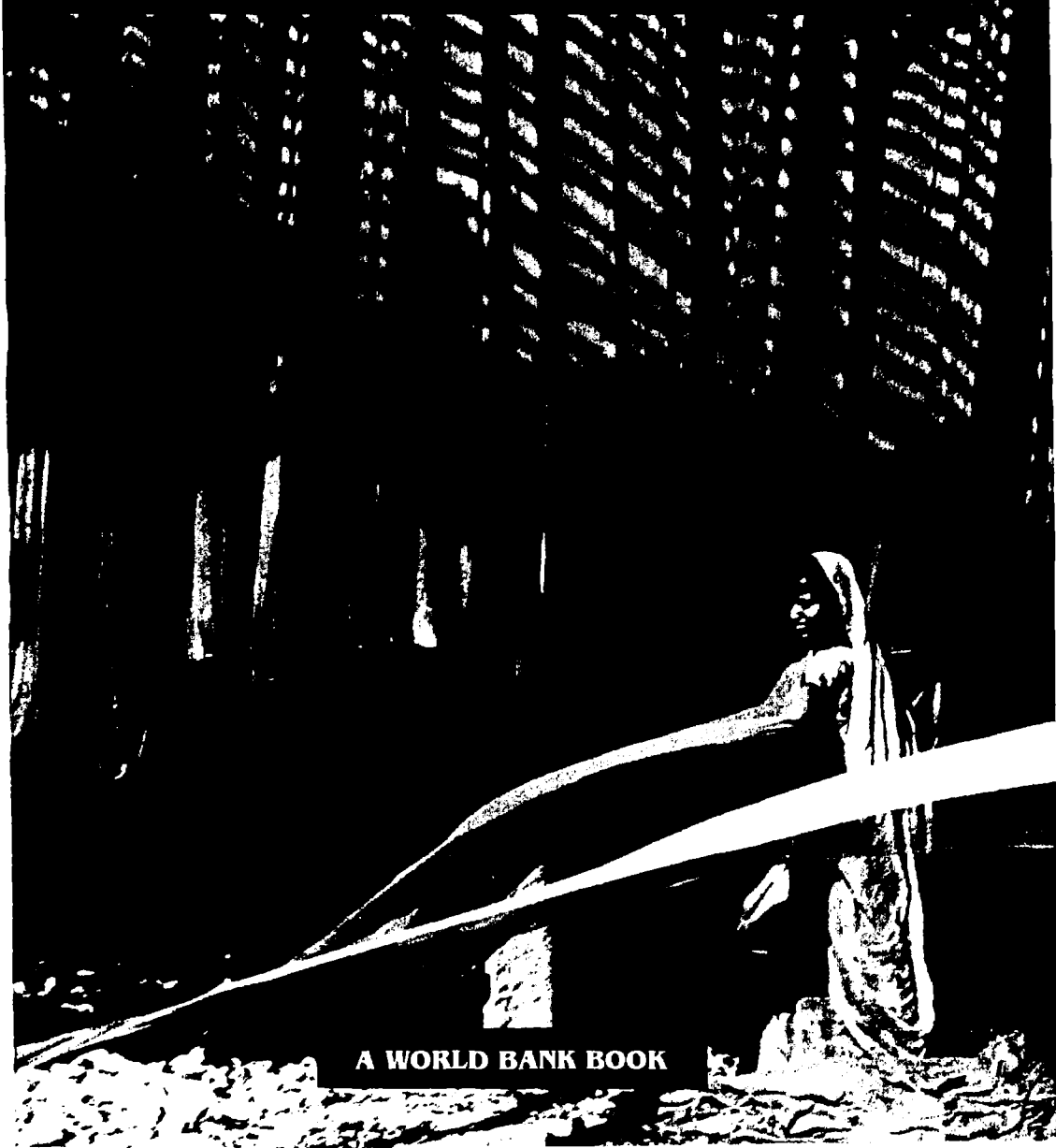


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**THE ECONOMICS OF RURAL ORGANIZATION**  
*Theory, Practice, and Policy*

Edited by Karla Hoff, Avishay Braverman, and Joseph E. Stiglitz



A WORLD BANK BOOK



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*The Economics of  
Rural Organization*

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*Cover photograph:* The cover shows a scene from the village of Pali in Rajasthan, India, where the main nonagricultural economic activity is cloth dyeing and printing. After the cloths are removed from a dye bath, they are hung from tall wooden frames to dry, in preparation for printing with stencils.

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*Published for the World Bank  
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## Preface

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By exploring problems of information and incentives that give rise to market failures, economists in the past twenty years have made strides in explaining aspects of rural organization that had been difficult to fit into the traditional neoclassical model. But less progress has been made in empirically testing competing hypotheses from this literature, and in drawing out its implications for development policy. The objective of this book is to narrow the gaps between economic theory and empirical work, and between academic research and policy evaluation, with respect to the rural sector of developing countries.

The premise of this book is that in order to design effective policies to remedy a market failure, one has to understand its underlying source. One needs also to recognize that the interactions among markets are not limited to ones of price and income, as modeled in general equilibrium theory. What happens in one sector or market can have repercussions on the nature of transaction costs, risks, and enforcement mechanisms used in other markets.

To design effective development policies, one therefore needs a theory of rural organization. This book attempts to set out the main elements and themes of that theory and to contribute to the fund of empirical knowledge on which the theory is based. Each of the four parts of the book covers one area where governments of developing countries have intervened heavily: rural credit markets, rural land markets, agricultural taxation and transfers, and technological change in agriculture. Each part of the book, in turn, consists of an overview chapter, one or more theoretical chapters, and case studies.

In choosing the title for this book, we initially hesitated to treat the Economics of Rural Organization as a separate area of specialization within economics. One could argue that there is a general theory of information and missing markets applicable to all economies. But in the rural sectors of developing countries (which, according to United Nations projections, will

account for more than 60 percent of those countries' populations through the end of this century), the problems of imperfect information and missing markets are especially acute. There the obstacles to perfect markets arising from imperfect information are compounded by rudimentary transportation and communication infrastructure, weak legal systems, and conflicts between statutory and customary property rights systems.

A long tradition of work by anthropologists and, more recently, by economists documents the mechanisms for overcoming these disadvantages. These mechanisms include sharecropping, interlinked contracts over several markets, village moneylenders ("thick on the ground" in the parts of Thailand surveyed in chapter 8), and loans in which the lender obtains the usufruct of the land as collateral. Some of these institutions have no formal counterparts in nonrural and nondeveloping country settings. (But some do. Sharecropping contracts, for example, are similar to the incentive contracts ubiquitous in labor and credit markets in industrial countries, and to revenue-sharing arrangements between franchisors and franchisees in the U.S. service sector.) The chapters in this book suggest that formal models of the institutions in the rural sector provide a key to explaining why some rural development policies have succeeded and others have failed. This is ultimately the justification for treating the Economics of Rural Organization as a separate field.

This book emphasizes information constraints and transaction costs, rather than political constraints on the development of the rural sector. We do not mean to suggest that political impediments to development are not important in many places. We hope, however, that the book will help clarify those situations where the *potential* benefits of government intervention are greatest. Several of the chapters also suggest mechanisms to alleviate political obstacles to welfare-increasing policies in credit markets, land reforms, and water rights systems.

Many of the case studies present new primary sources of information—for example, on rural credit markets in Nigeria and China, on moneylenders' transaction costs, and on patterns of landholding in an Indian village over nearly three decades. New theoretical results demonstrate, among other things, that (a) cosigning, a device widely used in lending, can be Pareto-improving; (b) on efficiency grounds, a government may prefer a portfolio of taxes, including output taxes, to a land tax only; (c) tax revenues, net of administrative costs, may go up if tax administrators are "overpaid" relative to their alternative employment opportunities; and (d) a discriminating tax based on farmers' choice of irrigation technology can improve the allocation of groundwater.

While some of the theoretical chapters are quite technical, the overview chapters and most of the case studies are not. These chapters should be accessible to a wide audience of policymakers, academics from many disciplines, and university students.

Scholars, including some noneconomists, have refereed each of the chapters in this book, generally on an anonymous basis. We are indebted to them for valuable corrections, suggested reorganizations, and references to the literature. Goddard Winterbottom, former Editorial and Production Division Chief in the Office of the Publisher at the World Bank, organized the referee process for the book as a whole. Ravi Kanbur, former editor of *The World Bank Economic Review*, organized the referee process for those chapters that were published (in slightly different form) in the September 1990 and January 1991 issues of that journal.

The preparation of this book was financed by the World Bank. Karla Hoff also gratefully acknowledges support from the project on Institutional Reform and the Informal Sector (IRIS) at the University of Maryland, College Park. The World Bank's Agricultural Policies Division organized the conference in June 1989, in Annapolis, Maryland, where many of the chapters were presented in preliminary form. The book covers areas of past and ongoing work undertaken by that division. Participants in the Annapolis conference, other than the authors, were Franklin Allen, Kaushik Basu, Hans Binswanger, John Bruce, Michael Carter, Christophe Chamley, M. Datta-Chaudhuri, Angus Deaton, Robert Evenson, Michael Lipton, Pradeep Mitra, Jim Poterba, and Vernon Ruttan, whom we thank.

KARLA HOFF  
AVISHAY BRAVERMAN  
JOSEPH E. STIGLITZ



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## *Notation in This Book*

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WE USE PARENTHESES to denote arguments of a function, and square and curly brackets to denote expressions to be multiplied. This enables us to suppress arguments of a function without confusion. Thus, a function  $f(x)$  evaluated at the value  $x = k[b + c]$  is written as  $f(k[b + c])$ .





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# 1

## *Introduction*

*Karla Hoff, Avishay Braverman, and Joseph E. Stiglitz*

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THIS BOOK REPRESENTS A COMING OF AGE of the Economics of Rural Organization—a branch of economics devoted to understanding market and nonmarket institutions within the rural sector, primarily of developing countries. It is concerned with how these institutions affect the allocation and distribution of resources, how they have evolved, and how they will adapt to changing circumstances. The field, which has grown slowly but steadily over the past twenty years, had blossomed to the point where, as we began planning this book in 1987, we could draw upon the work of dozens of scholars in industrial countries and the developing world.

Institutional economists of an older generation argued, quite rightly, that economic analysis needed to take account of institutions. But they often failed to explain the origins of those institutions and therefore were not in a position to predict how the institutions might change in response to new economic conditions—as change they did over the course of time.

The Economics of Rural Organization takes as its objective *explaining* the economic institutions of the rural sector. By an economic institution we mean a public system of rules that define the kinds of exchanges that can occur among individuals and that structure their incentives in exchange. Economic institutions include markets and property rights, systems of land and animal tenure, obligations of mutual insurance within lineage groups, and other systems of exchange that are determined by implicit contracts or social norms.

This branch of economics shares with other branches of economics the belief that many aspects of institutions reflect “rational” responses to economic problems. By rationality we mean that individuals act in a way that

advances their objectives, given the information and opportunities that they have.<sup>1</sup> The chapters in this book largely investigate rational, *noncooperative* behavior. There is, however, a large gap between “individual rationality” and “collective rationality,” as Arrow (1951) emphasized. Recent work, discussed below, has argued that with incomplete markets, imperfect information, or mutually sustaining networks of social sanctions, outcomes are not, in general, Pareto-efficient and in this sense do not exhibit “collective rationality.”

## The Origins of the Economics of Rural Organization

Over the past thirty years the neoclassical model formalized by Arrow and Debreu (1954) has become the “standard” model, the benchmark against which other models may easily be compared, both with respect to their assumptions and conclusions. In that model all individuals have the same information, and there are no transaction costs. While individuals may not be perfectly informed, the model does not admit to the possibility that individuals can use resources to acquire more information, or that individuals’ beliefs can be affected either by the actions of others or the consequences of those actions—such as the prices that emerge in a market or the quantities of goods that are traded.<sup>2</sup> An implication of these assumptions is that markets for all goods will exist, including markets for future goods and for all risks.<sup>3</sup> Economic relations can be reduced to price relations. One party delivers goods or services to the other in exchange for money; that is the end of the relationship. *There is thus no place in this model for institutions other than markets and property rights.*

The standard neoclassical model is a powerful tool to analyze the allocation of resources where markets work reasonably well, but it is not equipped to handle missing markets, quantity constraints that arise when prices do not adjust to market clearing levels, and nonmarket exchanges. Formal models to explain (a) the absence in actual economies of many markets, especially for risk, and (b) the fact that many transactions are based on more than price, have been developed only since the late 1960s (and are still the subject of vigorous research). This work has involved extensions of the neoclassical model to allow for differences among individuals in the information they have and for transaction costs. The insights on which these extensions are based have been understood intuitively at least since the time of Adam Smith.<sup>4</sup> But by incorporating them into formal models, this work changed the conceptual framework of neoclassical economics.

The old conceptual framework of neoclassical economics recognized that the exchange of goods, credit, and labor often does not occur through the impersonal mechanism of the price system. But its claim was that the basic

economic forces that it had identified—such as the law of supply and demand and property rights—were all that mattered. The only aspect of institutional analysis that was relevant was the legal structure that enforced property rights and contracts.

In contrast, the new conceptual framework, based on work beginning in the 1960s, is one that claims that the price system is *intrinsically* limited by our inability to make the distinctions on which perfect markets depend. Because of transaction costs and, more fundamentally, information and enforcement costs, some markets will not exist and other markets will not be even approximately competitive. In the new conceptual framework, institutions have at least two major roles. First, they are a response to missing markets. Second, they may help to overcome (or, possibly, they may aggravate) the information problems that preclude complete markets.<sup>5</sup> In the process, institutions are likely to limit the competitiveness of many markets.

The need to explain particular anomalies in the rural sector of developing countries helped shape this new conceptual framework and can be viewed as giving rise to a new field, the Economics of Rural Organization. At the cost of oversimplifying, we will trace the origins of this field to three papers: Cheung (1969), Akerlof (1970), and Stiglitz (1974). The Cheung and Stiglitz papers were concerned with explaining the institution of sharecropping—an institution that was pervasive and yet appeared to be inefficient since workers seemingly received less than the full marginal return to their efforts. Akerlof's paper was concerned with demonstrating how uncertainty about quality might either destroy a market or render it very imperfect.

### ***The Disadvantages of the Price System: Transaction Costs***

Cheung (1969) argued that sharecropping arose because it provided the advantage of risk dispersion while entailing lower transaction costs than either insurance contracts or fixed rental agreements with escape clauses—clauses specifying conditions under which the rent could be deferred or reduced.<sup>6</sup> He argued that sharecropping contracts would specify the amount of labor effort to be expended and, hence, there would be no inefficiencies associated with sharecropping. The contracts were sufficiently flexible that workers were, in effect, fully compensated for any extra effort they expended.

Cheung's paper can be thought of as one of the modern forerunners of the vast literature on the *transaction cost* approach to economics pioneered by Coase's (1937) theory of the firm. This approach stresses the importance of contracting costs in shaping the institutional arrangements in an economy.<sup>7</sup> It emphasizes the particular (often nonprice) form in which market exchanges occur as a result of transaction costs and takes as its unit of analysis the transaction rather than the market. Bardhan (1989, p. 4) named

the transaction cost approach the Coase-Demsetz-Alchian-Williamson-North (CDAWN) school, after its major contributors.<sup>8</sup>

### ***The Intrinsic Limitations of the Price System: Adverse Selection***

The second paper that shaped the development of the Economics of Rural Organization was George Akerlof's 1970 article on the theory of "lemons" and quality uncertainty. He described the article as "a struggling attempt to give structure to the statement: Business in underdeveloped countries is difficult" (Akerlof 1970, p. 488).

He argued that business was difficult because of *adverse selection*. Adverse selection arises when commodities are distinguished on one side of the market (usually, the sellers') but are treated as identical by the other side (the buyers').<sup>9</sup> The sellers of the best quality products will withdraw them from the market because their products cannot be distinguished and therefore are priced according to the average quality. More generally, the presence of people in the market who seek to pawn bad wares as good will tend to drive honest dealers out of the market. Akerlof's paper illustrated one possible, albeit extreme, consequence of adverse selection—zero trade. His paper also described numerous problems in developing countries that arose from such information problems, such as the practice of deliberately mixing stones with rice and selling the mixture as (pure) rice, and the very limited scope of credit markets in developing countries. Akerlof's paper provided perhaps the first theoretical model within which one could interpret these phenomena.

Akerlof's (1970) paper and those by Arrow (1963), Spence (1973), Stiglitz (1975), and Rothschild and Stiglitz (1976) are the forerunners of a vast literature on adverse selection. This literature concerns the problem of sorting commodities whose quality is unknown (workers, land, investment projects, or managers). It stresses the difficulty—and importance from both a social and private perspective—of ascertaining which are more productive, efficient, or better in some other respect and how markets respond to these informational problems.<sup>10</sup> That literature exposes the fact that once we extend the neoclassical model to include informational asymmetries between buyers and sellers, the extended model implies that some markets, especially for risks, will be missing, and many other markets will be thin and thus imperfectly competitive.

### ***The Intrinsic Limitations of the Price System: Moral Hazard***

In addition to adverse selection, there is another reason, which had been formalized somewhat earlier, that market systems are intrinsically limited by

informational problems. This second reason is *moral hazard*. Moral hazard arises when an individual takes an action to maximize his own welfare that is to the detriment of others in situations where informational problems prevent the assignment to the individual of the full damage caused by his action. The problem of moral hazard was originally formalized by Arrow (1963) and Pauly (1968, 1974) in their work on the medical care and insurance markets. In the insurance context, the moral hazard problem is that the insured party takes less care when he has insurance: some of the cost of an accident is borne by the insurance company, and in deciding on the level of care, the insured does not take into account the insurer's costs. It was shown that in the presence of moral hazard, markets for some forms of insurance might not exist, but that government intervention may cause more problems than it solves. Attempts to supplement deficient insurance markets run into the same moral hazard problems that impede private markets.<sup>11</sup>

### ***Nonprice Controls as a Response to Missing Markets: Principal-Agent Relations***

Given that adverse selection and moral hazard impede transactions in many markets, other institutions are likely to arise to address these problems. This viewpoint has provided many explanations for sharecropping that are quite different from Cheung's and that have quite different implications for efficiency.

If it is impossible (or very costly) to monitor workers, then it is not realistic to suppose, as Cheung did, that an employer can perfectly regulate the actions of his workers. On the contrary, the high costs of monitoring workers will preclude contracts based on effort. An effective way of motivating the tenant is an incentive contract. Stiglitz (1974) explained sharecropping as a response to missing markets for tenants' effort and for risk. Reversing the standard dictum that sharecropping attenuated incentives, this paper suggested instead that the function of sharecropping (like piece-rate systems in industrial economies) was actually to enhance incentives relative to what they would be under a conventional wage contract.<sup>12</sup> Sharecropping was advantageous to landlords and tenants because of (a) the savings in landlords' monitoring costs compared to a wage system with costly monitoring; (b) the increases in output compared to a wage system with imperfect monitoring; and (c) the reduction in risk borne by tenants compared to a system where workers had to pay land rent but did not have access to risk markets.

Thus, while Stiglitz agreed with Cheung in arguing that sharecropping might be efficient, he disagreed with Cheung's conclusion that output was the same as it would have been in the absence of sharecropping. Alfred Marshall and other earlier writers were correct in arguing that sharecropping

attenuated incentives. But given the costs of monitoring, sharecropping was better than the alternatives. Cheung, in Stiglitz's view, had ignored one of the most important "transaction" costs, that associated with monitoring worker effort.<sup>13</sup>

Other work in the Akerlof-Stiglitz tradition of imperfect information explains the institution of sharecropping as arising from the conjunction of missing markets in tenants' effort and in credit,<sup>14</sup> or in the effort of both tenants and landlords (Eswaran and Kotwal 1985). In the latter model, sharecropping is a partnership between a landlord and tenant in which the landlord supplies management expertise and the tenant supervises his own and his family's labor. A share contract provides both parties with incentives to exert effort, yielding a better outcome than a rental or wage contract that provides incentives to only one party. Since economic development tends to equalize access to know-how across agents by diffusing information, this model provides an explanation for the fact that sharecropping typically gives way to fixed rental contracts as agrarian economies develop.

Stiglitz's (1974) paper on sharecropping and the contemporaneously written paper by Ross (1973) are forerunners of a vast literature on the theory of principal-agent relations. This literature stresses that the kind of incentive problem that arises in insurance markets and in sharecropping also occurs in a wide variety of economic relations in capital, labor, land, and product markets.<sup>15</sup> This literature explains many observed institutional arrangements as responses to incentive problems that are pervasive in the economy. To illustrate the power of agency theory in another context, we will consider here how it has been used to explain the interlinking of contracts in the rural sector of developing countries.

*Interlinking* describes the simultaneous fixing of transactions between two parties over several markets, with the terms of one transaction contingent on the terms of another. There is evidence of extensive interlinkage practices in the rural sector of developing countries.<sup>16</sup> A simple interpretation of interlinkage practices is that they are barter transactions that save on transaction costs. But other reasons for interlinking are to circumvent incomplete markets and to reduce problems of adverse selection and moral hazard.<sup>17</sup> This is not surprising since adverse selection and moral hazard are basically forms of externality (see Greenwald and Stiglitz 1986). Interlinkages of contracts across markets can internalize some or all of those externalities.

For example, a landlord may tie a subsidized sale of fertilizer to a sharecropping contract. The induced increase in the use of fertilizer will, in general, raise the marginal productivity of effort, which in turn will increase the worker's incentives to work, thus partially offsetting the reduction in work incentives under sharecropping compared with a system where farmers rent their land.

Another common form of interlinkage is between credit and marketing.

A lender may require a prospective borrower to use the lender as his exclusive wholesaler for his output for several periods before a significant loan is made, as well as during the period of the loan itself (see chapters 7 and 8). This improves the potential lender's ability to judge the farmer's capacity and willingness to repay (thus reducing adverse selection problems), and thereby may improve the farmer's opportunities to borrow. In these ways, interlinkages *can* induce Pareto-improving changes in the allocation of resources—that is, they can make both parties to the transaction better off. Whether or not they do make both parties better off will depend, however, on general equilibrium effects (in the case of perfectly competitive agents) or on the effect that interlinking has on each party's bargaining power (in the noncompetitive case), an issue that we will come back to later in this chapter.

### *Nonprice Controls as a Support to Market Exchanges*

In the Arrow-Debreu model, complete reliance on price incentives leads to a Pareto-efficient allocation of resources. That is why there is no role for institutions except property rights systems. Allowing for information asymmetries makes the price system insufficient for efficiency and creates incentives for a variety of institutions. Contractual arrangements, such as sharecropping and interlinking, that work through more than just a price may mitigate moral hazard and adverse selection. Institutions that link transactions in each period with transactions in other periods may also mitigate moral hazard and adverse selection.

An illustration of the power of intertemporal linkage is given by Heal (1976). Heal considered an agrarian economy in which neighboring peasant villages exchange some fraction of their crops each period. The crops are of heterogeneous quality. The quality of any item is known to the producer, but it is not known to the buyer at the time of exchange. The one-period model for this situation is the one developed by Akerlof's (1970) paper on lemons, but Heal showed that there existed an equilibrium in the many-period case in which no adverse selection would occur. The externalities across buyer and seller that existed in the one-period model were internalized in the many-period model. More generally, in repeated relationships, it is harder to get away with cheating—either on effort (moral hazard) or on quality (adverse selection) than in a single-period relationship.<sup>18</sup>

In every society, some nonmarket controls are internalized as moral principles. The extent of moral hazard and adverse selection depends on those principles. In a suggestive debate, Arrow (1968) insisted to Pauly (1968) that moral hazard was, in part, a question of morality. The studies of rural credit markets in this book bear witness to the dependence of the scope of exchanges on kinship groups and on nonmarket institutions.

## The Place of the Economics of Rural Organization in Modern Development Economics

In the preceding section, we traced the origins of the Economics of Rural Organization back to the emergence of a new neoclassical paradigm based on transaction costs and imperfect information. In this section, we put the Economics of Rural Organization in the context of other work in development economics. During the past four decades, there have been marked shifts in emphasis in development policies and corresponding shifts in the direction of research. Three major elements in these shifts are (a) planning, (b) the Institutionalist tradition, and (c) the Chicago school. We view the Economics of Rural Organization as a unification of the Institutionalist tradition with the rationalist approach of the Chicago school.

### *Planning*

In the 1950s and 1960s, economic development was generally modeled as a sequence of well-defined stages through which an economy must pass (just as the maturation of an individual requires his passing through a set of well-defined stages).<sup>19</sup> What the economy produced and what role the government ought to play differed according to the stage of development. An essential part of the early stages of development was a high rate of capital accumulation to finance expansion into heavy industry.

The market failures approach to public policy provided a rationale for government's role in the economy. Government needed to intervene to correct a well-defined set of market failures—that is, public goods, externalities, monopolies, and missing markets. The planning literature assumed that the most important set of missing markets were futures markets—markets for goods and services at future dates. In that view, government planning of investments was required to correct this market failure. A particularly strong need was perceived for government involvement in heavy industry where high fixed, sunk costs precluded effective competition within the domestic market. Most of the planning literature did not sufficiently take into account the possibility of international competition.

The optimization techniques of linear and dynamic programming gave the planner an analytic alternative to markets. The 1960s saw the adoption of development plans and development planning processes by country after country.

In the past fifteen years, there has been a shift away from planning. Like many shifts in intellectual fashion, it was motivated partly by events and partly by ideas. Those countries in which planning had played a particularly prominent role were not notably successful in their development efforts. In none of the major development success stories, the newly industrialized



countries (NICs), did planning play an important role. A further factor contributing to the downgrading of the importance of planning was the opening up of the world economy: with international trade, concerns about the absence of competition in heavy industry, and about the material balances that were the focus of much of the planning exercise, became largely irrelevant. A case might be made for industrial policies, but not for general planning exercises.

The shift away from planning coincided with an increased emphasis on microeconomics within the economics profession, particularly on the micro-foundations of macroeconomics. Within development economics, it became increasingly recognized that macroeconomic planning models had paid insufficient attention to urban-rural migration and problems of incentives and selection. As or more important than the sector or product in which investment occurred were microeconomic questions such as the choice of project and management team. What was required was entrepreneurship. Government bureaucracies not only were, by their structure, not conducive to entrepreneurship, but they diverted scarce talent from the risk-taking associated with entrepreneurship to the safety of civil service positions, and they made life more difficult for entrepreneurs by the regulations that they imposed.

There have thus been several distinct criticisms of the planning approach to development. First, it underestimated the opportunities provided by international trade, and it assumed that government could control all aspects of allocation. Advocates of planning have an easy response to such criticisms: they simply would have to build *better* planning models to incorporate the international trading environment, government's limited control, and behavioral assumptions about the actions of households and firms that government cannot control.

A second criticism was that the central barriers to development do not arise from a lack of planning, but from a lack of entrepreneurship. Planning processes may not only have little to contribute, but may actually interfere with development.

A final source of the critique of planning was a growing appreciation of the political economy problems associated with government intervention. Economists could not afford to ignore the problems of public choice and incentives within government. The best economic plans could be undone by lax procedures of accountability and enforcement, or by the emergence of vested interests for continued protection from market forces.

### ***The Institutional Tradition***

The Institutional tradition in development economics stressed the economic role of nonmarket institutions. Most important among these institutions were those that used the power of the community to resolve disputes.

In the view of John Commons, the leader of the American Institutional school,

If transactions are to go on peaceably without resort to violence between the parties, there must always have been a[n additional] party to the transaction, namely a judge, priest, chieftain . . . who would be able to decide and settle the dispute, with the aid of the combined power of the group to which the . . . parties belonged. (Commons 1924, p. 67)

Therefore economic problems could not be treated in isolation from the legal, social, and political system.

The Institutional tradition also emphasized the interdependence between economic and political conditions: a change in economic conditions may induce a change in the distribution of power, which in turn may induce further changes in economic conditions. "And there is generally no equilibrium in sight" (Myrdal 1982, p. 312).<sup>20</sup>

The Institutional tradition called attention to the highly selective specification of institutions in neoclassical economics and to the need to treat actual institutions and observable mores as part of the data to be used in economic analysis. But most Institutional writing was descriptive rather than theoretical. It did not provide a theory of economic behavior, and thus did not provide any alternative to the neoclassical theory. Moreover, it did not furnish a criterion of social welfare. It therefore did not provide a basis for explaining how government could speed up the development process. Institutional considerations had no role in the planning process on which macrodevelopment policy focused and could not easily be incorporated into that analysis: the planning process did not focus on the units, the households and firms, that comprised society, except in terms of the goods they produced and purchased and the inputs they supplied or used.

### ***The Chicago School***

A third major element in development economics is the Chicago school. Over a span of close to half a century, the great economists at the University of Chicago, including Ronald Coase, Milton Friedman, George Stigler, Gary Becker, Aaron Director, and Theodore Schultz, not only articulated more fully the implications of economic rationality and competitive markets, but showed that the reach of neoclassical economics could be extended well beyond the analysis of markets to a much broader context, including the interpretation of the behavior of government regulatory agencies and the relationships within families. Schultz and others established the power of the economic (as opposed to the anthropological) approach to economic behavior in poor countries. He provided convincing evidence that traditional farmers in poor countries were not only sensitive to prices and other market

factors, but allocated resources efficiently, given the information, institutions, and technology that were available to them (Schultz 1964).

What sets the Chicago school apart from other traditions is not its positive content—individuals privately optimize given their opportunities—but its normative content. (See Reder 1982 for a survey.) Many members of the Chicago school view private actions as ones that induce *globally* Pareto-efficient outcomes. A resource allocation is *globally* Pareto-efficient if no one can be made better off without making someone else worse off. In contrast, a resource allocation between two individuals is *pairwise* Pareto-efficient if there is no action that either could take that would make one of them better off without leaving the other person worse off. It is a general characteristic of models of principal-agent relations that they are pairwise Pareto-efficient, but that turns out to be a weaker criterion than global Pareto efficiency and to yield a less sanguine view of the “collective rationality” of individual actions than that held by the Chicago school (see, for example, Akerlof 1984).

In general, the Chicago school views information as a commodity like any other that would be acquired in the quantity that made its marginal cost equal to its marginal value. For example, Stigler in his analysis of credit markets held that “there is no ‘imperfection’ in a market possessing incomplete knowledge if it would not be remunerative to acquire (produce) complete knowledge” (1967, p. 291). Left out of this analysis are the effects of imperfect information on the competitive structure of the market and on whether the market will clear at all, questions that are examined in chapters 2 and 7 and Hoff and Stiglitz (1993).

The view of the Chicago school toward institutions is ambivalent. In the strand of the Chicago school pioneered by Becker, institutions can be explained by standard theory, and the fact that economists go to the trouble of explaining them suggests that the institutions might be of some relevance. However, there is another strong strand within the Chicago tradition that says that institutions are efficient. Therefore, the kinds of resource allocations that one obtains if one uses simple models focusing on efficient resource allocation provide good descriptions of market allocations. In this view, private sector institutions are only an interesting sideshow. These two strands are not as contradictory as they might seem. In the short run, the institutions that we have may not be those that ensure economic efficiency, particularly when government intervention suppresses their natural development. In these cases, institutions really do matter. An economic analysis of institutions can give us insight into the direction in which institutions may be evolving or would evolve in the absence of government intervention.

Perhaps Coase (1960) provided the clearest articulation of the view that if we want to study how societies (without government intervention) allocate resources, we need only study efficient resource allocation. He analyzed the

consequences of the assignment of property rights in the presence of externalities. He argued that—apart from transaction costs—it made no difference how these were assigned. So long as the parties were left to themselves, they would arrive at an efficient solution.<sup>21</sup> The assignment of property rights could make a difference for transaction costs, and this should therefore influence how they are assigned.

In the development context, Cheung (1969) provides an excellent illustration of the Chicago perspective. While he argued that transaction costs could explain the institution of sharecropping, he also argued that the outcomes (the levels of production) are exactly the same as one would have obtained had one ignored the sharecropping institution: there is no attenuation of incentives.

While the Coase view emphasizes the importance of the assignment of property rights, those too can be viewed as an institution, and, like other institutions, they can evolve in a way to promote economic efficiency. Chapter 14 of this book and recent studies of the treatment of property held in common provide some limited support for this view.<sup>22</sup> Traditionally, economists have bemoaned the “tragedy of the commons,” the excessive grazing of commons land and the excessive fishing of common fishing grounds (Hardin 1968). The enclosure movement in Great Britain—effectively, a change in property rights—was given credit for an enhancement of efficiency, even if its distributional consequences were not so commendable. In recent studies of local common property resources within developing countries (village ponds, pastures, river beds, sources of fuelwood, and so on), a variety of restrictions on the use of local commons have been observed, based either on deliberate allocation of use or on implicit norms, and enforced through sometimes elaborate patterns of monitoring and sanctions. These restrictions greatly limited the efficiency losses that are normally associated with property held in common. The key elements in these success stories were that the commons were open only to members of the same small community, and there was a mutual dependence on the commons by members of the community.

These findings illustrate that local institutions can solve the problem of efficient use of local common property resources. Conversely, privatization need not yield efficient outcomes. In the Amazon Basin, privatization of some of the commons land, supported by ill-advised tax policies, led to its degradation. Those hurt by the deforestation caused by cattle farmers were too weak, economically and politically, and too dispersed geographically to reach a negotiated agreement with the cattle farmers.<sup>23</sup>

### ***The Economics of Rural Organization***

The Economics of Rural Organization fills a gap between the competing approaches—planning, the Institutionalist tradition, and the Chicago school. Like the Institutionalists, it emphasizes the importance of institu-

tions in explaining economic behavior. Like the Chicago school, it retains the methodological individualism of neoclassical economics. But by modeling the effects of a set of individual-specific information constraints, it reaches a very different conclusion from that of the Chicago school: *it argues that individual rationality or optimization will not, in general, coincide with social rationality.* Even if “binary” relations—the relations between any two parties—are pairwise Pareto-efficient and cannot be improved on holding all other economic relations constant, the global market equilibrium can be improved on. Government may be able to make some individuals better off without making anyone else worse off—for example, by establishing group lending programs or promoting diversification of crops within a region so as to reduce aggregate swings in income. Such measures might be socially profitable even if they would not be privately profitable if undertaken by a single individual.<sup>24</sup>

Regarding institutions, Akerlof (1984) has shown formally that economically unprofitable institutions may persist as a result of a mutually sustaining network of social sanctions. Arnott and Stiglitz (1991) show how institutional arrangements for the provision of insurance—arising out of a perceived failure of markets to provide insurance, itself a consequence of moral hazard—may actually make society worse off; these institutions are, nonetheless, part of an equilibrium.

The theory of rural organization shares with the planning approach the belief that some forms of government intervention may be desirable, but it differs from that approach in the kind of market failures that it emphasizes. It believes that the market can solve most problems of coordination of investment with future demand. Discrepancies between market and shadow prices surely exist, and where the government can easily correct those discrepancies, it surely should. But such problems are not at the heart of the failure of so many countries to develop. Like the Institutionalists, the theory of rural organization looks to the institutions that constitute a society for at least part of the failure of some societies to develop, but unlike the Institutionalists, this theory develops formal models to explain the origin and evolution of those institutions. It is part of the research agenda of the Economics of Rural Organization to design policies and institutions that improve on the performance of institutions.

Thus, while sharing the Chicago school's assumption that individuals are rational and respond to economic incentives, the Economics of Rural Organization denies the Chicago school's three major propositions: (a) that institutions are necessarily efficient in the absence of government interference; (b) that accordingly, to study market resource allocations one need only study patterns of efficient resource allocation—one can ignore institutions; and (c) that, apart from transaction costs, the distribution of property rights (wealth) also makes no difference to the achievement of an efficient allocation of resources.

There is another reason for government intervention: even if evolutionary processes work in the long run to weed out inefficient social institutions, they work slowly. If Keynes's dictum in the context of short-run macroeconomic fluctuations—"in the long run we are all dead"—has any validity, it surely must here: institutions often take generations to evolve.

In a sense, there is a curious affinity between the Chicago and the planning schools: they both believe that resource allocation processes can be studied independently of institutions. Yet we should remember that feudalism and traditional societies persisted for centuries. The Industrial Revolution and modern capitalism occurred in particular locations, at a particular time. They did not spring up everywhere, of their own accord. From our current perspective it is clear that they were not, and are not, inevitable. Whether or not Max Weber was correct in identifying the social arrangements that were necessary for their origins, one conclusion surely is correct: the social context in which individuals act out their maximizing behavior has a profound effect on both the short-run equilibrium and the evolution of society.

The theory of rural organization, it should by now be clear, has a close affinity to the earlier market failures approach out of which it grew, but it differs from it in several key respects. First, it does not focus on the same market failures—the coordination failure of investment with future demand—that underly the planning approach, or the standard externalities across sectors,<sup>25</sup> or the provision of public goods. All of these are indeed important and by now well understood. The market failures on which the *Economics of Rural Organization* focuses are rather those that reflect the myriad problems facing households and firms as a result of imperfect information and incomplete markets. These include information asymmetries about the characteristics of workers, land, and products, and problems arising from the absence of risk markets. Second, because these market failures are pervasive in the economy, correcting them, both in principle and in practice, is a far more difficult task than correcting the market failures upon which earlier analyses focused.

### ***Income Distribution, Economic Efficiency, and the Theory of Rural Organization***

Both the Chicago school and the theory of rural organization have been criticized for a seemingly inordinate focus on questions of efficiency at the expense of distribution. For the Chicago school, there is a good reason for this: as we noted, Coase contended that at least the essential properties of equilibrium could be studied independently of the distribution of property rights.<sup>26</sup> But Bardhan (1989, p. 238), in discussing recent developments in the theory of rural organization, has commented:

If the [old Institutionalists] erred in ignoring the micro[-]foundations of institutions, we in our turn should be careful that our theories of principal-agent games and moral hazard do not cover up the basic, often ugly, power relations involved in the phenomena we are studying.<sup>27</sup>

Not all questions of distribution can be adequately modeled in a neoclassical framework, but many can be, as Bardhan goes on to show.<sup>28</sup>

There is a second and entirely different response to the criticism that modern theorists have focused on efficiency to the exclusion of distribution. Recently economists have constructed models in which *allocational efficiency itself depends on the distribution of wealth*. Hoff (forthcoming) and Hoff and Lyon (1992) emphasize that the inseparability of efficiency and distribution considerations is a general result for economies with imperfect information and missing markets.<sup>29</sup> For example, if individuals have private information, the ability of an economy to take advantage of exogenous investment opportunities can be shown to be sensitive to even small changes in the distribution of wealth. This result undermines the traditional view of the efficiency properties of the market. A complete set of markets, as Arrow and Debreu proved, obtains the largest possible output from any given set of scarce resources and exhausts all gains from trade. But a realizable set of market and nonmarket institutions, being limited by asymmetries of information between individuals, usually will not obtain (first-best) production or exchange efficiency. In general, the ability of individuals to get around information asymmetries depends on the distribution of wealth. Libecap (1989) and Kanbur (1992) emphasize a further reason that the efficiency of production will depend on the distribution of wealth. Their concern is with the management of local common property resources (especially fisheries and irrigation systems). If all individuals had identical abilities and endowments, then in comparing the allocation of resources that would occur under conditions of efficient common property management and of free access, all would be better off under the common property regime. But if individuals' endowments are sufficiently unequal, then their unanimous agreement to an efficient system of common property management will require sidepayments. Empirical studies suggest that while such payment mechanisms exist, they are at best incomplete. For this reason efficient cooperative agreements are less likely to arise when inequality is great, and existing agreements are likely to break down in the face of increased inequality.

### **Lessons of the Economics of Rural Organization: The Contribution of This Book**

Two questions are sometimes raised about this as well as other new branches of economics: Do we learn anything that we did not already know? What are

the general principles or the central messages that we can take away? In the remainder of this introduction, we will address these two concerns. Detailed treatments of each chapter appear later in the four overview chapters in this book.

### **Some Novel Results**

Academics have a penchant for looking for the unusual, the exceptions to the general principles, the contradictions to the prevailing conventional wisdom. Such exceptions, for example, Giffen goods with upward sloping demand curves, have played an important role in the development of microeconomics. But the question may well be asked whether *curiosa* have a role to play in a policy-oriented subject, such as development economics.

Several of the chapters in this book challenge much of the prevailing wisdom, but not by drawing attention to the exceptional case. Rather, they call attention to the central case where markets are missing and information is incomplete. *It is the traditional neoclassical model, with its assumptions of perfect information and complete markets, that should really be viewed as the exception.* Yet much of the prevailing wisdom is based on reasoning using the traditional neoclassical model. Indeed, it has only been in the last decade that the alternative paradigm has come even partially to replace the standard perfect markets model in the leading graduate schools.<sup>30</sup>

Here are three specific instances, each in a major policy arena, where this book makes an important contribution to the policy debate.

- In credit policy, it challenges the notion that government intervention offers remedies to the problems of informal rural credit markets in which interest rates far exceed the government's opportunity cost of funds. The challenge is based on administrative problems within government financial intermediaries (chapter 3), information costs within the informal sector (chapter 7), and the pattern of segmentation induced by differences in information costs among lenders (chapters 8 and 9).
- In taxation, it challenges the longstanding presumption in favor of land taxation and against output taxation. The inequities arising from errors in administration are markedly different for the two forms of taxation (chapter 19), as are the risk-bearing consequences. In the absence of perfect risk markets, the losses from the risk imposed on farmers by land taxation may more than offset the gains from the beneficial incentive effects. Henry George was wrong after all! The efficient tax system will be a portfolio of taxes, including output taxes (chapter 18).
- In welfare policy, the book reverses the presumption that in-kind transfers are always inferior to cash transfers in poverty alleviation pro-



grams. When it is difficult to identify who the poor are, distorting the prices faced by the poor may be worth the value of improved targeting of aid (chapter 20).

Institutional economists (and others) may say of each result, they knew it all along. And they are probably right. The problem is that other economists, using more fully articulated models, disagreed. The land tax was nondistortionary; it is only badly trained or reactionary economists who could possibly argue against the land tax! What the chapters in this book should help establish is that there are implicit and misleading assumptions in many standard economic models. By increasing the fund of knowledge of actual institutions in developing countries, and by building models that incorporate aspects of the institutional environment, we believe this book will make a major contribution to policy discussion.

### *Some General Lessons*

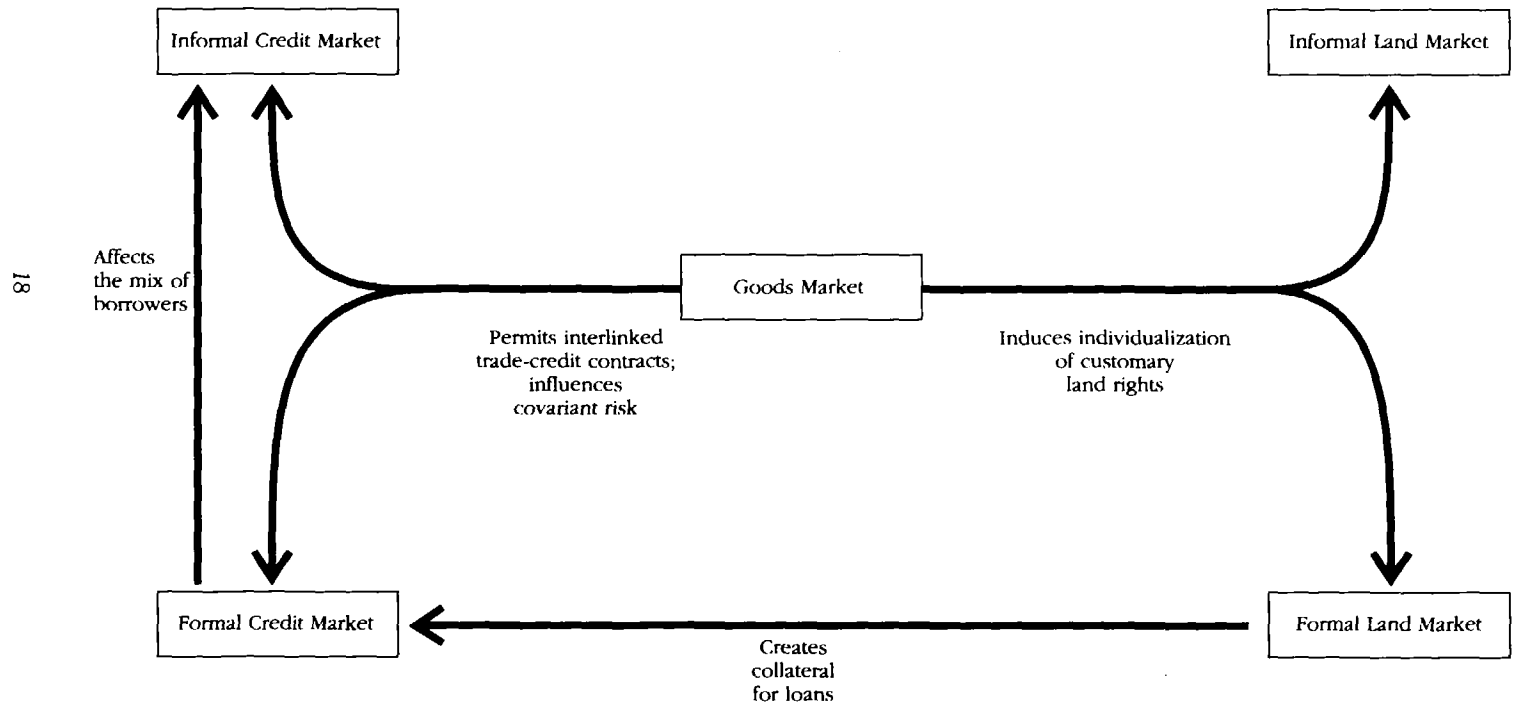
In the remainder of the introduction, we try to extract from the myriad of details that appear in the twenty-nine chapters of this book a small list of general lessons.

*Markets interact through many channels besides prices and incomes.* Traditional economic theory stresses the interactions among markets—but those interactions are always governed by, and limited to ones of, price and income. The Economics of Rural Organization provides an explanation for the much richer set of interactions that we actually observe.

Figure 1-1 illustrates some of the additional channels of interaction highlighted in this book. The figure represents an economy with a goods market and both formal and informal markets in credit and land. Although more precise definitions are useful in particular contexts, here we mean by the informal credit market one where individuals lend largely out of their own equity, and by the informal land market one in which transactions are based on customary law. Chapters 8 and 9 provide evidence that because formal lenders lend primarily to larger farmers, an important effect of government policies that operate through the formal credit market is to change the mix of borrowers in the informal sector, rather than (as general equilibrium theory would suggest) to reduce the market power of the informal moneylender and, hence, the interest rate he charges.

*Trader-moneylenders are a dominant source of informal credit in the commercialized areas surveyed in part I.* Chapters 7, 8, and 9 provide evidence that commercialization of production leads to interlinked trade-credit contracts in the informal sector that act as a substitute for collateral. Commercialization of production thereby promotes the growth of the informal

Figure 1-1. *Nonprice Market Interactions*



credit market.<sup>31</sup> Further growth of both formal and informal credit markets is made possible by diversification of production, which reduces the covariance of risks.

Chapter 14 provides evidence that commercialization of production, by creating a demand for new combinations of inputs, has induced changes in customary land rights systems in Sub-Saharan Africa that permit greater freedom to transfer and alienate land. The result is an expansion of both formal and informal land markets.

Bank loans to farmers typically require land collateral. Chapter 13 provides evidence that in areas where customary law permits exogamous land sales, titling of land increases farmers' access to the formal credit market. Thus the performance of the formal credit market depends partly on the scope of the formal land market.

*New sorts of market failures imply new sorts of policy solutions.* For example, chapters 18 and 19 point out that while with perfect information and perfect risk markets, heavy reliance on a land tax might be desirable, this may not be the case if information and risk markets are imperfect. A land tax imposes a greater social cost of risk-bearing than does an output tax, where the government effectively pools and spreads the risk. And in the presence of errors in administration, a land tax may give rise to greater inequities, and thereby result in lower social welfare, than an output tax.

When asymmetric information is at the core of market failures, better information and more transparency in markets and institutions will be at the core of the solution. This explains the success of some group lending programs that entail a role for peers in the monitoring and enforcement of credit (see chapters 3 and 4).<sup>32</sup>

*As a result of imperfect information, the justifications for market interventions grow in number but also in complexity and side effects.* Market imperfections naturally give rise to calls for government intervention. Sometimes these are based on an incomplete understanding of the underlying cause of the problem. For example, credit markets work imperfectly largely because of the screening, monitoring, and enforcement problems faced by lenders. The chapters in part I of this book, as well as in chapter 27, provide ample evidence that if governments intervene, they will face all of these problems as well, though sometimes in a slightly different form than would private lenders.

This is in marked contrast to the kinds of market interventions envisaged in the earlier market failures approach. Under perfect information, the market failure associated with pollution, for instance, can be easily corrected: all that is required is a pollution tax, and perhaps a franchise tax on firms in the polluting industry. The planning approach stressed the market failure associ-

ated with a particular information problem: coordination of investment with future demand. Planning—even indicative planning—was “all” that was required. But no central planning agency can ever hope to solve, or resolve, the information problems that are at the heart of the theory of rural organization.<sup>33</sup>

*“New” and “old” market failures interact in important ways.* The ability of government to correct some “standard” market failures may be impeded by the absence of information. This is illustrated in chapter 25. If information were costless, it would be easy to establish a market for water, which would ensure that water would be used efficiently. Many of the rules that were historically developed for the allocation of water can be understood as responses to limitations on information in an environment where water was in relatively plentiful supply. As development has occurred and population pressure has increased, the scarcity value of water in much of the world has risen, and the traditional rules are now very inefficient. Chapter 25 considers a variety of alternative institutions to rationalize the allocation of water among competing uses.

The public provision of agricultural extension services, discussed in chapter 28, can be thought of as an example of *both* the old and new market failures. Knowledge is in many ways a public good, a traditional market failure. The design of extension services raises the problem of monitoring and providing incentives to extension agents, a new market failure.

*Effective government intervention needs to take account of the foreseeable impact on local institutions, which should be conceptualized as endogenous and locally rational, not as irrational remnants of primitive social structures.* Three examples will illustrate what we have in mind. First, many governments have encouraged the spread of formal credit institutions in the rural sector. These formal credit institutions interact with informal credit markets (local moneylenders). Local moneylenders are at an informational advantage relative to the government-sponsored banks. Loans that a bank could not easily make to a villager might still be profitable to an informal lender whose proximity to the borrower reduces his monitoring and enforcement costs, or to a trader who can reduce his enforcement costs by interlinking credit with a marketing contract. The incidence of subsidies to formal credit will thus depend on the nature of competition in the informal market. If it is a monopoly, then the subsidies are not likely to benefit the borrower in the informal market (see chapter 9). If the informal credit market is characterized by Chamberlinian monopolistic competition, then all or part of the benefits of credit subsidies may be dissipated because they may induce an inefficient level of entry into the informal market (see chapter 2 and Hoff and Stiglitz 1993). Only if the informal credit market is perfectly competitive will the incidence of subsidies to formal credit normally be on the borrower in the

informal market, and even here one can derive conflicting results for special cases (see chapters 8 and 9).

Second, consider government efforts to stabilize agricultural prices by putting goods into storage when prices are low and taking them out when prices are high. Such price stabilization activities will tend to displace private storage. This displacement will, in turn, increase the cost of government stabilization programs and, if public storage is more expensive than private, result in inefficient resource allocation (see chapter 21).

Third, land-to-the-tiller programs can be undermined by arrangements that are subleases in disguise. The 1972 land reform in the Philippines redistributed property rights to the tillers and denied land reform beneficiaries the right to lease their land to share tenants. Chapter 15 documents the appearance of new forms of permanent labor contracts as substitutes for tenancy. The new forms of labor contract appear to be less efficient than the old and to have created a new class of landless agricultural laborers with few prospects of becoming landowners.

*Government interventions can change the balance of economic or political power in ways that undermine the original purpose of the intervention.* This is illustrated by the case study of Colombian land reform in chapter 16. Initial phases of the land reform in the 1930s sought to modernize large farms under the threat of expropriation. The policy increased the wealth and political power of those landlords who modernized. They used their increased power to obtain substantial public subsidies biased toward large-scale farming operations. The resulting increase in the property values of large farms relative to small farms blocked the possibility of equalizing land redistribution with full compensation, and has perpetuated a size distribution of farms that is economically inefficient as well as socially explosive.

*With economic development come important changes in the kinds of transactions that are feasible and the transaction costs they entail.* This is seen dramatically with respect to contract enforcement. In traditional societies, social pressures may suffice to ensure the enforcement of contracts under normal conditions. Established forums exist for handling disputes, and the sanctions for not complying with the outcome of such adjudication processes are often effective (chapters 5, 6, and 12). Customary law may also obviate the enforcement of statutory law where the two are inconsistent (see chapter 14 regarding land statutes).

At a later stage of development, some countries may be in the worst of all possible situations with respect to contract enforcement: traditional enforcement mechanisms have weakened but have not been supplanted by effective formal legal structures. Chapter 7 documents the very high transaction costs of moneylenders in Pakistan, and chapter 10 documents the breakdown of lending controls in the cooperative agricultural sector in Israel.

Reputation mechanisms are an alternative to both customary and formal legal systems for contract enforcement. But they may not be effective at the high rates of interest prevailing in the early stages of development. In the transitional stages of development, increased mobility and uncertainty may inhibit the workings of both customary law and reputation mechanisms.

*While government may play a central role in correcting market failures, of both the old and the new type, it has a potential role beyond that—the role of social innovation.* The theory of public goods provides a rationale for why, left to itself, markets might generate too little social innovation: a large part of the benefits accrue to persons other than the innovators. The market may be at an inefficient Nash equilibrium; that is, there is no private coordinating mechanism to “switch” the economy to a more efficient equilibrium.<sup>34</sup> It is this form of coordination—coordination for institutional change, rather than the kind of coordination upon which the planning models focused—that in our view is of paramount importance.

Government intervention to create group lending programs can be thought of as one such innovation (see chapters 2 through 4). Group incentive schemes can substitute for collateralizable wealth since each member suffers a penalty for contract nonperformance by other members of the group, and in this way the group enhances prudence in the use of borrowed funds. It is difficult to know without extensive local experimentation how best to organize a group lending program in a given area. Since no single individual, group, or lender can capture a large portion of the social product of improved group lending programs, the rational response is to wait for someone else to bear the costs of experimentation and then to imitate those procedures, should they prove successful. Too little experimentation may therefore be undertaken, unless the government acts as a catalyst and helps organize group lending programs.

## Concluding Remarks

To many development economists, much of the foregoing discussion may appear simply as common sense. Why, then, a new “Economics of Rural Organization”? It has long been remarked how uncommon common sense is, and perhaps nowhere is this more true than in economics. Much of the development literature of the past quarter-century has ignored the kinds of considerations that are emphasized here. This is partly because it has seemed hard to incorporate these considerations into formal development and planning models. And it is partly because the institutional literature emphasizing these considerations seemed to be out of keeping with recent advances in economics; it was atheoretical or even antitheoretical. We hope that the

chapters in this book address these problems by showing that actual rural institutions can be analyzed from a solid theoretical basis and subjected to rigorous hypothesis-testing, and that simple mathematical models of institutions can be usefully incorporated into formal development models.

## Notes

1. There are at least two other ways that the concept of rationality has been used in economics. For some, it means little more than that individuals act in a consistent way. For others, it means that they act in a way that, to an outside observer, indicates a “rational” pursuit of their objectives. Thus, if the subjective probabilities of individuals differ markedly from objective frequencies, then they may act in a consistent way (satisfying rationality in the first sense) but not in a way that reasonably conforms to the pursuit of their actual objectives. The recent literature in experimental psychology provides evidence that individuals often do not act rationally in the second sense.

2. While the Arrow-Debreu model can accommodate some kinds of information imperfections—individuals don't need to know whether it will rain tomorrow or not—other kinds of information imperfections have to be ruled out: when tomorrow comes around, for instance, we have to be able to ascertain whether or not it has rained. The “commodities” that are traded are taken as primitives in the analysis.

There have been attempts to extend the Arrow-Debreu framework to incorporate endogenous beliefs (for example, Radner 1968), transaction costs (for example, Foley 1970 and Hahn 1973), or incomplete markets (for example, Borch 1968 or Diamond 1967). It is now recognized that those early attempts were not particularly successful. They employed highly restrictive assumptions. When those assumptions were dropped, all of the basic propositions of the Arrow-Debreu model were shown not to be robust. For instance, as we note below, only under very restrictive conditions is the economy Pareto-efficient—even taking into account the costs of information or the transaction costs associated with establishing markets. See Greenwald and Stiglitz (1986, 1988) and for a survey of results, Stiglitz (1985).

3. This result requires, in addition, the assumption of convexity—there are no fixed costs of production. This is an assumption that underlies all of the Arrow-Debreu model.

4. See Smith (1976 [1776], p. 379), regarding adverse selection; and Keynes (1936, p. 144), regarding moral hazard.

5. See Arnott and Stiglitz (1991) and chapter 4.

6. Cheung wrote (1969, p. 32) that “with increasing transaction costs associated with additional escape clauses—in particular the cost of defining different levels of ‘famine’ in the market place and the cost of negotiating the rental reduction for each—the incremental gains of having them may be so small that no further ‘custom’ [of escape clauses] is developed by the market. Instead, an alternative device chosen is a share contract, under which multiple ‘escape’ provisions for the tenant will be implicit, and within which the rental payment is no longer fixed.”

7. This approach also provides explanations of sharecropping that are not based

on risk. For example, Murrell (1983) demonstrates the transactional efficiency of share rents relative to fixed rents where land quality and future prices are unknown and the tenancy relation persists over many periods. Share rents, by rising and falling in value along with changes in prices, save on contract renegotiation costs.

8. See Williamson (1979) and the survey of this school in Eggertsson (1990). A set of references to empirical studies that take the transaction cost approach to economics is in Williamson (1985). That approach is also taken in chapter 27 below.

9. As stated in note 2, the notion of a commodity was taken as a primitive in the Arrow-Debreu framework. There was no ambiguity about what was meant by a commodity, and beliefs about the quality of a commodity being sold were, accordingly, not affected by anything that went on in the market, including the price at which the commodity was sold. It was this assumption, in particular, to which Akerlof took exception.

For a still earlier discussion of the adverse selection problem and its implications for market failure, see Arrow (1963). For case studies of adverse selection in markets in several developing countries, see Klitgaard (1991, chapters 3–5).

10. Much of the literature emphasizes the importance of informational asymmetries, the fact that some individuals may know more about the quality of a commodity than others. A more recent literature has been concerned with the problems that arise when all participants are uninformed; there must be some process of *learning*.

11. Insurance markets are also impeded by adverse selection problems, as shown formally by Rothschild and Stiglitz (1976). Hazell, Pomareda, and Valdés (1986) document some of the information and incentive problems encountered by developing countries in crop insurance programs.

12. See chapter 15 below. For a brief survey of the sharecropping literature, see Stiglitz (1987).

13. Cheung was correct, however, in emphasizing the transaction costs associated with writing complicated contingency contracts. The economies in writing a contract that is linear in output are significant. Curiously enough, much of the more formal principal-agent literature seems to have missed this basic lesson: that literature frequently involves highly nonlinear, complicated contracts.

14. This line of reasoning can be traced to Adam Smith and Alfred Marshall (Binswanger and Rosenzweig 1984, p. 644).

15. Arnott and Stiglitz (1988) show how the same formal model can be applied to sharecropping, employment, and credit contracts.

16. For interlinking lenders, see chapters 7, 8, 9, and 10.

17. There is a very large theoretical literature on interlinking. See Braverman and Stiglitz (1982, 1986) and Braverman and Guasch (1984). A concise summary treatment is Bardhan (1989, chapter 12), while Bell (1988) provides an extensive survey.

18. With no discounting and an *infinite* number of periods, one can obtain efficient outcomes. With discounting, matters are more delicate: if the discount rate is low enough one can obtain efficient outcomes, though to do so may require quite complicated strategies. See Abreu (1988).

19. Perhaps the classic study in this tradition is Walt Rostow (1960). The sequence of stages perspective is an old one: Marx thought of the development process as involving an inevitable sequence from feudalism to bourgeois capitalism to socialism, and eventually to communism.



20. Myrdal's work is generally thought to be the most successful Institutional writing, and somewhat apart from the American Institutional tradition, surveyed in Brofenbrenner (1985). In chapter 16 below, the analysis of land reform policies in Colombia tries to capture the interdependence Myrdal describes.

21. This is sometimes referred to as the Coase theorem, though it might more appropriately be called the Coase conjecture. The result is valid only under highly stringent assumptions—including the absence of free-rider (public good) problems and the possession of perfect information by all parties to the negotiations concerning the preferences of the other parties. For a critique, see Farrell (1987) or Stiglitz (1985).

22. See the citations in Ostrom (1990) and Dasgupta and Maler (1991). These authors do not adopt the Coasian-Chicago perspective, but rather seek to establish the conditions under which individuals are more or less likely to be able to efficiently exploit common property resources.

23. See Dasgupta and Maler (1991, p. 116).

24. The argument can be put more formally. Moral hazard and adverse selection give rise to pervasive externalities that cannot, in general, be completely internalized through pairwise arrangements such as sharecropping or interlinking. Moreover, in the absence of a complete set of risk markets, the distribution of prices is a public good (Greenwald and Stiglitz 1986).

25. Or the less formal theories underlying the "Big Push" (Rosenstein-Rodan 1943) or sectoral interlinkages (Hirschman 1958).

26. This is, of course, also the major message of the fundamental theorems of welfare economics.

27. Carter (1985) elaborates on this criticism from the perspective of a participant-observer of the Institutional tradition.

28. Braverman and Srinivasan (1981) describe the ambiguous distribution effects of interlinking, and Basu (1986) constructs a model where interlinking in three-way relations (for example, among a shopkeeper, landlord-employer, and tenant) can enable the landlord to press the tenant below the utility level he would have obtained absent three-way interlinking.

29. This can be put formally as follows: imperfect information gives rise to incentive compatibility constraints and participation constraints. These make the economy second best, and they shift with even small changes in the distribution of wealth. There are thus real consequences to the distribution of property rights—consequences that go well beyond the transaction costs on which Coase focused.

30. The new paradigm is sometimes called the Economics of Information. It is neoclassical under the broad definition of neoclassical theory as the systematic exploration of the implications of rational, individualistic behavior subject to constraints.

31. Further evidence is provided for the Philippines in Floro and Yotopoulos (1991).

32. Klitgaard (1991, chapters 4 and 5) provides further examples of public interventions that can overcome asymmetries of information and incentives to mislead and can help create opportunities and enforcement mechanisms for contracts. A particularly successful intervention was that of the Indian Dairy Development Board, which made widely available a hand-operated machine for testing the butter-fat content of milk. By removing milk traders' incentive to dilute the milk with water,

this innovation contributed to a large increase in the urban milk market and in the incomes of rural farmers.

33. The distinction here should be a familiar one: Lange thought that market socialism or planning could be used to obtain a more efficient allocation of resources that would resolve some of the information deficiencies of market processes (arising in part, to use modern terminology, out of the incompleteness of futures markets). Hayek and von Mises saw the information problem as being much more complex, one that market socialism or planning could never resolve. See Stiglitz (forthcoming).

34. A similar perspective is adopted in North (1990) to explain the persistence of institutions that are not good approximations of optimal behavior. North distinguishes institutions (the "rules of the game") from organizations (firms, political parties, family farms, and so forth). He argues that the free play of competition cannot, in general, occur at the level of institutions because of the high fixed cost of changing institutions, their public good characteristics, network externalities, and pervasive information problems. But without perfect competition, there is no reason that efficient institutions need eliminate inefficient ones. North's views are briefly summarized and related to those of game theorists in Hoff (1992).

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*Part I*

***Rural Credit Markets  
and Policies***

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## 2

# *Imperfect Information and Rural Credit Markets: Puzzles and Policy Perspectives*

*Karla Hoff and Joseph E. Stiglitz*

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RURAL CREDIT MARKETS have been at the center of policy intervention in developing countries over the past forty years. Many governments, supported by multilateral and bilateral aid agencies, have devoted considerable resources to supplying cheap credit to farmers in a myriad of institutional settings. The results of many of these interventions have been disappointing. Despite high levels of subsidy to rural credit in the Asian countries surveyed in this part of the book, many farmers—especially small farmers—depend for credit on moneylenders whose interest rates remain extremely high. (See table 2-1.) One explanation for the failure of public credit institutions to drive out the traditional moneylender or drive down the interest rates charged must be that public policies were based on an inadequate understanding of the workings of rural credit markets.

There typically exists a dual rural credit market in developing countries. In the formal credit market, institutions provide intermediation between depositors (or the government) and lenders and charge relatively low rates of interest that usually are government-subsidized. In informal credit markets, money is lent by private individuals—professional moneylenders, traders, commission agents, landlords, friends, and relatives—generally out of their own equity. The objective of this chapter is to provide a framework for assessing the relationship between the formal and informal sectors of rural credit markets and the consequences of government interventions in formal credit markets.

Table 2-1. *Characteristics of Selected Rural Credit Markets Surveyed in This Volume*

Survey region/period	Share of formal sector in total credit (percent)	Mean interest rate <sup>a</sup> (percent)		Average transaction (dollars)	
		Formal sector	Informal sector	Formal sector	Informal sector
Zaria, Nigeria, 1987-88	8	-3.6	-7.5	266	51
Nakhon Rachasima Province, Thailand, 1984-85	44	12-14	90 <sup>b</sup>	440	254
India					
1951	7	3.5-12.5	7-35	400 <sup>c</sup>	200 <sup>c</sup>
1961	17	n.a.	n.a.	n.a.	n.a.
1971	30	n.a.	n.a.	n.a.	n.a.
1981	61 <sup>d</sup>	10-12	22	n.a.	80-345 <sup>e</sup>
Chambar, Pakistan, 1980-81	25	12	79 <sup>b</sup>	n.a.	284

n.a. Not applicable.

a. Interest rates for Nigeria are real realized monthly rates. Interest rates for Thailand and India are nominal and annual. Interest rates for Pakistan are real annual rates charged. See chapters in part I for details on the calculation of these rates.

b. Figures include only commercial lending; they exclude loans from friends and relatives.

c. Annual borrowings per borrowing household.

d. Based on official sources, but much higher than more plausible estimates from unofficial sources. See chapter 9.

e. Low figure for Bihar; high figure for Punjab.

Sources: Nigeria: chapter 5; Thailand: chapter 8; India: chapter 9 (table 9-1), plus additional data provided by Bell drawn from the RBI (1954, vol. 1, part 2, chapter 21, "Regional Data" tables), Bell and Srinivasan (1989, table 2) and Bell, Srinivasan, and Udry (1990); Pakistan: chapter 7.

This chapter also provides an overview, based on the case studies in part I, of the modus operandi of informal credit markets in five developing countries and Israel. Contracts and institutions that appear to be pervasive are usufruct loans, kinship- and village-based credit systems, trade-credit interlinkages, and rotating savings and credit associations. These contracts and institutions help to solve the information and enforcement problems in lending. The fact that they are available to some potential lenders and borrowers and not to others helps to explain why informal credit markets are segmented, and why financial intermediation between formal and informal sectors is very imperfect, so that low formal interest rates coexist with high informal interest rates.<sup>1</sup>

The body of this chapter presents four competing theories of rural credit markets: (a) the view that the village moneylender is a usurious monopolist;

(b) the view that credit markets are (approximately) perfectly competitive and characterized by market clearing, with high interest rates reflecting only high risks of default and high costs of information; (c) the view that emphasizes the use of indirect screening mechanisms, such as the interest rate, with the result that there may be credit rationing; and (d) the view that emphasizes the use of direct mechanisms to solve the problems of information and enforcement, with the result that credit markets may be monopolistically competitive. Evidence from the case studies suggests that the last view is the most useful in understanding the informal sector of rural credit markets. We will therefore describe these direct mechanisms in some detail.

The end of this chapter considers policy implications. Our principal conclusion is that the most successful government interventions in the formal credit markets are those that draw on the ability of the informal sector to solve the selection, monitoring, and enforcement problems of lending.

## Traditional Views and Puzzles

There are two early views of rural credit markets, each providing a different explanation for the typically high interest rates in the informal sector.

### *The Monopolistic Moneylender*

In this view, the village moneylender is a monopolist. Without competition, he is free to charge a “usurious” interest rate. The traditional view is captured in India’s landmark study of the rural credit system in the early 1950s: agricultural credit presented a “two-fold problem of inadequacy and unsuitability” (RBI 1954, vol. 2, p. 151, cited by Bell in chapter 9). Introduction of government lending agencies and promotion of rural cooperatives were needed to “provide a positive institutional alternative to the moneylender himself, something which will compete with him, remove him from the forefront and put him in his place” (RBI, pp. 481–82).

From the perspective of recent research, that official view overstates the problems of rural capital markets because it ignores the thriving informal credit markets that often exist. It seems to assume that there is no competition among moneylenders. But in another way it understates the problems. The past forty years’ experience of government intervention in India, Pakistan, Thailand, and other developing countries shows that the creation of a positive institutional alternative—rural banks and credit cooperatives—has failed to drive the traditional moneylender out of the market (“to put him in his place”). The case study of Thailand (chapter 8) goes further—it suggests that government intervention has not even lowered interest rates charged by moneylenders.

### ***Perfect Markets***

A second view of credit markets, which is associated with George Stigler of the Chicago school, is that imperfections in credit markets are not likely to be important. In general, high interest rates reflect not monopoly power but high default rates and high information costs. Moreover, Stigler argued in his 1967 paper on credit markets (p. 291) that “there is no ‘imperfection’ in a market possessing incomplete knowledge if it would not be [privately] remunerative to acquire (produce) complete knowledge.” But this statement is true only if private and social benefits from increasing information are the same. In general they are not the same, either for information about technology (see Hirschliefer 1971, regarding inventions), or for information in labor markets (see Spence 1974 and Stiglitz 1975), or, as we will argue in this chapter, for information in credit markets. This view also fails to take into consideration the fact that imperfect information may limit the effective degree of competition within a market, a point to which we return in a later section.

In the “perfect markets” view, there is a presumption that credit markets are approximately Pareto-efficient. The only ground for government intervention in credit markets is to redistribute income to the poor (at some cost in efficiency).

### ***The Inadequacy of the “Monopoly” and “Perfect Markets” Views of Rural Credit Markets***

Neither the traditional “monopoly” nor the “perfect markets” view can explain other features of rural credit markets that are at least as important and equally puzzling as high interest rates:

- The formal and informal sectors coexist, despite the fact that formal interest rates are substantially below those charged in the informal sector.
- Interest rates may not equilibrate credit supply and demand: there may be credit rationing, and in periods of bad harvests lending may be unavailable at any price.
- Credit markets are segmented. Interest rates of lenders in different areas vary by more than can plausibly be accounted for by differences in the likelihood of default. Local events—a failure of a harvest in one area—seem to have significant impacts on the availability of credit in local markets.
- There are a limited number of commercial lenders in the informal sector, despite the high rates charged.
- In the informal sector, interlinkages between credit transactions and transactions in other markets are common.

- Formal lenders tend to specialize in areas where farmers have land titles.

Neither the monopoly view nor the perfect markets view can account for these features taken as a whole. An alternative approach is required—one that is better able to help us understand the workings of rural credit markets and, thus, help us design appropriate policy interventions.

## The “Imperfect Information” Paradigm

In the past decade there have been major advances in our theoretical understanding of the workings of credit markets. These advances have evolved from a paradigm that emphasizes the problems of imperfect information and imperfect enforcement. Lenders exchange money today for a promise of money in the future and take actions to make it more likely that those promises are fulfilled. *Lending activity* thus entails (a) the exchange of consumption today for consumption in a later period, (b) insurance against default risk, (c) information acquisition regarding the characteristics of loan applicants (this is the *screening* problem); (d) measures to ensure that borrowers take those actions that make repayment most likely (this is the *incentives* problem); and (e) enforcement actions to increase the likelihood of repayment by borrowers who are able to do so.

It is this broadening of the perspective of what is entailed by lending activity that provides the background for the new theories of rural credit markets. This framework guides the case studies in part I and the theoretical analysis of peer monitoring in chapter 4.

It is useful to distinguish two types of mechanisms for resolving the problems of screening, incentives, and enforcement. *Indirect mechanisms* rely on the design of contracts by lenders such that, when a borrower responds to these contracts in his own best interests, the lender obtains information about the riskiness of the borrower, and induces him to take actions to reduce the likelihood of default and to repay the loan whenever he has the resources to do so. These mechanisms may be in the credit market itself (in loan terms such as the interest rate and loan size), or they may rely on contracts in related markets (in rental agreements, for example) that will influence a borrower’s behavior in credit markets. In the first case, the interest rate serves the *dual* function of a price and an indirect screening or incentive mechanism. As we discuss further below, this means that the equilibrium interest rate need not clear the market—there may be credit rationing. Notice, however, that these indirect mechanisms are equally applicable whether there is competition or monopoly in the market.

*Direct mechanisms* entail lenders’ (a) expending resources in actively

screening applicants and enforcing loans and (b) limiting the range of their lending activity to members of a particular kinship group, residents of a given region, or individuals with whom they trade. These direct mechanisms (through personal relationship, trade-credit linkages, usufruct loans, and other means) tend to lead to a monopolistically competitive structure with interest rate spreads between different segments of the rural credit markets. We will argue that the entry of institutional credit into a rural credit market is unlikely to break the power of moneylenders unless the new institutions themselves find substitutes for the direct mechanisms used by moneylenders to overcome the problems of screening, incentives, and enforcement.

## The Theory of Indirect Mechanisms

### *Interest Rates as an Indirect Screening Mechanism*

For any loan there is a possibility that the project for which it is used will perform so badly that the borrower defaults. In that contingency, the lender cannot recover his total outlay, and in fact there are legal provisions in many societies that severely limit the amount that he can recover. The probability of default on a loan thus depends on the probability that the gross return on the project financed by the debt is less than the principal and interest due. It follows that as projects become riskier, in the sense that the probability of both very high and very low gross returns increases relative to the probability of moderate returns, the likelihood of default increases. The lender is hurt by an increase in the riskiness of projects that will be undertaken with his loans. In contrast, the borrower's expected profits from the project will rise.

To see how the interest rate can be used as an indirect screen of the riskiness of projects, it is simplest (but not necessary) to suppose that borrowers are risk neutral. Risk-neutral borrowers will submit loan applications for projects with a positive expected net return, taking into account default provisions. For any class of projects with the same mean gross return but differing risk, the interest rate will determine a *marginal* project that has an expected net return to the borrower that is just barely positive. By the above argument, all projects in this class that give the borrower a higher expected net return entail a higher probability of default. An increase in the rate of interest will mean that the old marginal project now gives a negative expected net return. The new marginal project will be riskier than the marginal project under the initial, lower interest rate, so that the pool of projects coming from this class will on average be riskier than it was at the lower interest rate. The same argument applies for projects with differing

risks at any level of mean gross return. Thus as the interest rate increases, the mix of prospective projects tilts in favor of riskier projects. As Adam Smith put it some two hundred years ago: "If the legal rate of interest . . . was fixed so high . . . , the greater part of the money which was to be lent would be lent to prodigals and projectors, who alone would be willing to give this high interest" (Smith 1976 [1776], p. 379).

A lender can never fully discern the extent of risk of a particular loan, and the pool of applicants for loans at any given interest rate will consist of borrowers with projects in different risk categories. But the lender knows, by the above reasoning, that the mix of projects to finance changes with the rate of interest. The interest rate takes on the dual function of rationing credit and regulating the risk composition of the lender's portfolio. This can lead to unexpected outcomes (explored in formal models in Stiglitz and Weiss 1981 and forthcoming, and Stiglitz 1987). For example, when there is an excess demand for loans at a given interest rate, classical economic analysis would suggest that this price would rise to choke off the excess demand. Higher interest rates would raise the lender's returns if they did not greatly increase his risk by increasing the probability of defaults. But at some higher interest rate, the greater risk and thus the higher incidence of default will offset the increased interest income from the loan portfolio. In that case, the lender will choose to keep the interest rate low enough to obtain a favorable risk composition of projects, and to ration the available loanable funds through other means. Thus, contrary to the operation of markets as they are supposed to work, demand may exceed supply, with no tendency for the interest rate to rise.

The situation would be even more extreme if lenders did not recognize the effect of interest rates on the risk of their portfolios. Then we might get a process whereby, at a given rate of interest, the default rate was so high that returns to the lender did not cover opportunity costs of funds. This would put upward pressure on the interest rate, but the increase in the interest rate would only worsen the risk mix. The process would go on until the interest rate was so high that only the riskiest projects—those with the highest probability of default—would be undertaken. It has been argued by some writers that processes such as these account for the thinness of many markets (including some types of credit markets) in which the quality (default risk) of the commodity exchanged depends on the price (interest rate) and there is asymmetric information between buyers and sellers (Akerlof 1970).

This would suggest that lenders, even in situations of limited competition, cannot raise interest rates so high as to extract all of the surplus associated with a particular loan. But the limited competition resulting from imperfect and costly information may nonetheless allow lenders to charge interest rates far higher than competitive levels.

### ***Incentive Effects of Terminations and Market Interlinkages***

A lender may employ two other indirect mechanisms to enhance the likelihood that borrowers undertake the actions desired by lenders. First, the lender may use the threat of cutting off credit to induce desired borrower behavior (see Stiglitz and Weiss 1983). For this incentive to be effective, of course, borrowers must enjoy some surplus from obtaining the loans. This provides another way in which markets with imperfect information are fundamentally different from markets with perfect information: competition does not drive rents to zero. Those who are lucky enough to get loans get a consumer surplus, and that consumer surplus, being denied to the unlucky, is in effect a rent.

Second, lenders who are landlords or merchants may use the contractual terms in these other exchanges to affect the probability of default. They may interlink the terms of transactions in the credit market with those of transactions in the product or rental markets (see Braverman and Stiglitz 1982, 1986). For example, a trader-lender may offer a farmer who borrows from him lower prices on fertilizers and pesticides, since the probability of default is reduced when such inputs are used. We shall consider the use of interlinkages as a direct mechanism for solving information and enforcement problems below.

### **Direct Screening Mechanisms**

In addition to indirect screening mechanisms, most lenders will also use direct screening mechanisms and may monitor borrowers' behavior, withdrawing credit if the terms of the loan appear to be violated. In developing countries potential lenders vary greatly in their costs of direct screening, monitoring, and enforcing loan repayment. For some lenders, such costs are low. For example, information may be a by-product of living near the borrower or being part of the same kinship group or a party to some other transaction with him. Thus, village lenders often do considerable monitoring, while banks may find it virtually impossible to do so. Differences across lenders in the costs of screening, monitoring, and enforcement may lead to the segmentation of markets.

### ***Geography and Kinship***

In the area of northern Nigeria surveyed in chapter 5, credit markets are almost completely segmented along geographic and kinship lines, and information asymmetries between borrower and lender within these markets appear to be negligible. In this case study the rural credit market was very



active, but loans between individuals in the same village or kinship group accounted for 97 percent of the value of those transactions (see chapter 5, table 5-3). Collateral was seldom used, and credit terms implicitly provided for direct risk pooling between creditor and debtor. That in three of the four villages surveyed, virtually no loans were observed to cross the boundaries of an extremely small social and geographic space, in an environment characterized by highly correlated risk and seasonal demands for finance, points to the high information costs of such transactions and the reliance on kinship and village sanctions as a mechanism for contract enforcement. Similar evidence for the informal credit market is reported in the case study of rural China (chapter 6).

Even in areas where nonresident lenders and institutions provide a large share of total credit, market segmentation by village and kinship group remains pronounced with respect to consumption loans. Thus chapter 8 reports on the temporary collapse of local Thai credit markets in the face of a severe regional shortfall of rain. In such periods, resident lenders' own equity is depleted, but nonresident lenders and institutions appear not to be able to form a sufficiently accurate judgment of households' ability to repay to permit them to operate in the consumption loans market.

### *Interlinkages with Other Markets*

For a given lender, loan applicants with the same wealth and productive capacity may differ in their ability to assure potential lenders of their creditworthiness. Similarly, for a given applicant, lenders may differ in their cost of screening and enforcing loan performance. Besides geography and kinship group, a critical source of these differences is the scope of individuals' participation in other markets. Such participation makes possible the interlinking of loans with transactions in those markets. Interlinked credit contracts may provide means to alleviate screening, incentive, and enforcement problems. Interlinkages may also enable the reputation mechanism to work more effectively. What affects behavior is the total benefits (rent) from a relationship. When an economic relationship entails transactions in several markets, there is scope for greater surplus.

The most widespread form of interlinkage is provided by traders. Lenders who are also nonresident traders and commission agents generally require that their clients sell all their crops to, or through, them (see chapters 7, 8, and 9). This trade-credit linkage "makes information on the size of the borrower's operations . . . available to the creditor and to no one else. This . . . thus closes the borrower's access to other lenders" (chapter 8). The trader-lender can easily enforce his claim by deducting it from the value of the crops sold to, or through, him. In towns with well-organized commodity markets, there may sometimes be cooperation among traders in enforcement. In chapter 9, Bell reports that:

In Chittoor . . . a commission agent who dealt in *gur* (a sugar product) told me that agents frequently know one another's clients. If a farmer attempted to sell through an agent other than the one with whom he normally dealt, the former would deduct principal and interest on the loan, basing his calculations on the usual rule of thumb relating the size of the loan to the quantity to be delivered, and would hand over the said sum to the latter.

Under some circumstances, however, such trader-provided credit turns out to be limited. Cassava, unlike most other crops, has no fixed harvest period. This makes loan enforcement difficult. Generally, cassava growers in Thailand obtain funds only by selling outright the standing crop (chapter 8). For this crop, a spot sale to a trader serves as a substitute for trader-financed credit.

Chapters 8 and 9 argue that trade-credit interlinkages go a long way to resolving the information asymmetry between borrower and lender and the enforcement problem, while they create asymmetries of information *across* lenders. Lenders who do not serve as traders for a borrower will know less about his productivity and will be in a less favorable position to enforce a loan. In a later section we will discuss the implications of such asymmetries for market structure.

### ***Devices That Limit the Consequences of Information Asymmetries and Enforcement Problems***

Three devices commonly used in rural credit markets in developing countries—collateral requirements, usufruct loans, and rotating savings and credit associations—may be viewed as methods to limit the consequences of information asymmetries and enforcement problems. Like geography, kinship, and market participation, these devices are available to some borrowers and lenders and not to others. Hence, they also have consequences for the sorting of borrowers across lenders and for segmentation in rural credit markets.

*Collateral.* In developing countries, banks have found it difficult to screen and monitor borrowers directly. Banks, but not informal lenders, therefore rely heavily on collateral, generally in the form of land. For this reason, in Thailand, “the sphere of operation of commercial banks and cooperatives . . . has been almost exclusively in villages where land titles have been issued” (chapter 8). Because land wealth is correlated with income in rural areas, this finding helps to explain why borrowers with above-average income have been found to have greater access to formal sector sources than those who do not. Chapter 8 reports that average per capita income of Thai households borrowing from the formal sector was more than 30 percent

above the mean, while those borrowing only from the informal sector had average per capita income close to the survey area's mean.

*Usufruct loans.* In one form of a usufruct loan, a lender occupies and uses the borrower's land until the principal is repaid. Such loans are transacted in Thailand to finance migration for work abroad. They are viewed as low-risk loans. As the saying goes, "Possession is nine-tenths of the law."

A similar practice that is widespread in Nigeria is procuring loans by transferring to the lender the right to harvest the borrower's trees. The harvest provides the lender the interest on his loan. Such transactions are called tree "pledging" and occur with cocoa, oil palm, and rubber trees (Adegboye 1983).

*Rotating savings and credit associations.* Rotating savings and credit associations (ROSCAs) have a long history in developing countries, even predating monetization (Bouman 1983), and they continue to be a major source of credit in African countries (where they are often called tontines). In the usual case, a small group is formed from a village or family group where enforcement costs are low because of powerful social sanctions. Each member agrees to pay periodically into a common pool a small sum so that each, in rotation, can receive one large sum. If the formal credit market is characterized by a gap between the savings and borrowing rates of interest, ROSCAs may be preferred to participation in the formal market (see Edwards 1989, Besley, Coate, and Loury, 1991). ROSCAs are thus an example of a credit exchange that improves upon opportunities in the market by drawing on preestablished social ties. Highly successful tontines in Cameroon were recently described as follows:

Tontines, built on trust, are generally made up of homogeneous groups—people from the same ethnic background, the same workplace or the same neighborhood.

[One Cameroonian reported that] "if you don't make your payment to the tontine, you are rejected by the community. If you are banned from one group, you are banned from the others."

Indeed, several years ago, several Bamileke traders committed suicide because they realized that they could not make their tontine payments. (*New York Times*, November 30, 1987)

But in Latin America, ROSCAs have been adapted to a situation where individuals do not know each other (Edwards 1989). The initiative for forming the group typically comes from a retailer of durable goods—for example, a car dealer. Suppose the group is of size  $N$  and the durable has a price  $P$ . The group members are required to come together for  $N$  monthly meetings to contribute their share of the price,  $P/N$ , into a common pool. At each

meeting, the individuals draw lots. The winner takes the pool, buys the car, and becomes ineligible for future drawings, though he must complete his  $N$  monthly payments. If he misses a payment, he loses the car. The same would, of course, hold true in a conventional car loan market. But by creating a group of individuals whom the borrower comes to know, and who would be hurt if he defaulted and (at the least) imposed transaction costs on them, the borrower performs more reliably than if the cost were borne only by the lender, with whom the relationship is brief and impersonal.

### ***Direct Screening and Enforcement Costs as the Basis for Monopolistic Competition***

The most important way of limiting information asymmetries is buying information. In his remarkable survey of the operations of moneylenders in South Pakistan (chapter 7), Aleem estimates the transaction costs incurred by moneylenders. He finds, for example, that they devoted an average of one day per applicant to obtaining information and rejected one applicant out of every two screened.

The screening process creates relationship-specific capital between lender and creditor. At any one time, a borrower is likely to have built up such capital with only one lender. If a borrower tries to shift to another lender, Aleem found that he needs on average one year to build up creditworthiness with the new lender.

Chapter 8 reports findings consistent with this view of the lender-creditor relationship. More than 80 percent of borrowers in a ten-province household survey of Thailand reported that they borrowed from only one informal source. Furthermore:

Seventy-two percent of the informal sector borrowers . . . reported that they had not attempted to borrow from other informal lenders during the past three years . . . ; the average period of contact involving credit transactions reported by these 72 percent was close to seven years!

Of course, more evidence is needed before we can infer that lenders exercise monopoly power over their borrowers. This evidence can be found in chapter 7. First, the total average costs of surveyed lenders, as a fraction of the amount of funds recovered, were roughly comparable to the average interest rate charged in the survey area. Second, mean marginal costs as a fraction of the amount recovered were *much less* than the average interest rate charged.

These findings strongly suggest that the informal credit market surveyed in chapter 7 is characterized by monopolistic competition. Each lender faces a downward-sloping demand curve from borrowers tied to him, so that he can price at above marginal cost, but entry of new moneylenders keeps pure

profits close to zero by driving price down to average cost. Thus, in the usual way of monopolistically competitive markets, each lender operates at too small a scale, spreading his fixed costs over too small a clientele. This view of the market can lead to dramatic policy conclusions about the effects of cheap institutional credit on rural interest rates, as we shall see in the next section.

To conclude, we should emphasize the difference between the screening process in the informal credit market described above and the use of the interest rate as an indirect screening mechanism, as discussed earlier. The first is active and may cost resources; the second is passive and works through a process of self-selection. These two types of screening have entirely different effects on interest rates and on the structure of the credit market. Passive screening is consistent with perfect competition and can reduce interest rates below the level that would exist if information were perfect.<sup>2</sup> The evidence presented in chapters 7 and 8 suggests that active screening through investment in information raises the interest rate above the level that would exist under perfect information by increasing the costs of the lender. More important, active screening makes the credit market imperfectly competitive.

## Policy Perspectives

### *Economic Development and the Evolution of Rural Credit Markets*

We have argued that observed features of rural credit markets in developing countries can be understood as responses to the problems of screening, incentives, and enforcement. Of course, these are problems that arise not just in developing countries. However, it can be argued that these problems are more severe for countries at an early stage of development because of more extensive asymmetries of information and the more limited scope for legal enforcement (in particular, more limited collateral). We may therefore ask, Will development by itself remove or reduce the imperfections of rural credit markets?

Several studies have suggested that as development proceeds and average income levels increase, the imperfections of rural credit markets should diminish. This argument is supported by evidence from India that rural areas with higher-than-average incomes seem to face lower interest rates from moneylenders:

A high  $r$  is the effect of the high-risk premium that the village moneylenders usually charge for lending to the peasants, who are frequently without sound collateral. The lack of creditworthiness is really a reflection

of the peasants' poor income and meager savings. Hence, the growth of real income . . . should reduce the probability of default and the risk premium, which in turn will reduce  $r$ . (Ghatak 1983, pp. 21–22)<sup>3</sup>

In a relatively more prosperous district like Burdwan in West Bengal . . . , the average rural interest rate for different classes (such as casual laborers, tenants, and agricultural laborers) varied between 36 to 84 percent per annum, while in a relatively poorer district like Nadia . . . the average rural interest rates varied between 72 and 120 percent per annum. . . . [I]n West Bengal during 1975–1976, moneylenders still remained a major source of agricultural credit. (Ghatak 1983, p. 32)

Agricultural technical change does influence the supply of loans. . . . Farmers residing in areas characterized by the use and/or provision of new technology appear to benefit in that they face lower moneylender interest rates. This result provides an additional point of leverage for policy-makers: Interest rates can be lowered indirectly through the provision of technical change and investment opportunities and need not be lowered directly through costly subsidies to some borrowers in the formal credit market. (Iqbal 1988, p. 375)

The argument above relies on the observation that as incomes and productivity increase, the risk of default decreases. But the chapters in part I of this book suggest additional critical links between development and credit markets.

Screening, incentive, and enforcement problems in credit markets are often mitigated through interlinkages between the credit market and other markets—for example, for land and for commodities. The creation of a dense network of market interactions, which we would expect as development proceeds, lowers screening and enforcement costs. Legal developments such as land titling, in conjunction with the individualization of land rights as commercialization proceeds, allow land to be used as collateral, and that in turn expands the scope of credit markets.

However, as technological change disrupts traditional ties in a developing economy, the strength of social sanctions in enforcing credit repayments may decrease. This role of social ties is documented by case studies in chapters 5–10, in Adams and Fitchett (1992), and elsewhere. Thus, as social ties break down in the wake of development, but before a dense network of interactions across markets has been built up, the imperfections in rural credit markets may well get worse before they get better.

Since development by itself is unlikely to take care of the imperfections in rural credit markets in the short and medium run, policy intervention may be called for. In fact, the argument has been that the imperfections in rural

credit markets, particularly their characteristically high interest rates, may themselves be an impediment to development. We will now discuss and evaluate the policy responses to this problem.

### ***Government Intervention and Credit Subsidies***

Enforcement (or lack of it) is one of the problems in rural credit markets. Thus it might be argued that the government as a lender has advantages the private sector does not—it has the ability to extend or cut off credit subsidies (using general revenue), and it has at least a legal monopoly on the use of force. The experience of many developing countries (and some industrial ones) suggests that the government is often politically unable to use these advantages. Thus chapter 9 notes that a widespread view in rural India is that institutional loans are really grants: “Politicians regularly vie with one another in promising, if elected, to impose a moratorium on the repayment of informal and institutional debts alike.” Harriss (1983, p. 239) reports that “during the election campaign of 1972 [in North Arcot] farmers were ‘promised’ that a vote cast in the right direction would write off a loan.” In Thailand, Farmers’ Associations, groups of 50–100 farmers formed hurriedly in 1975 by the Department of Agricultural Extension, have the worst repayment record: “Because their formation was politically motivated, their members tend to be rich and influential and, precisely for that reason, their repayment rate was poor” (chapter 8).

In Pakistan the political cost of foreclosing on debtors with collateral is significant. These costs may be part of the explanation for Aleem’s finding in chapter 7 that while default rates in the formal sector were 30 percent, for the informal lenders the mean delinquency rate (the percentage of loans repaid after the due date) was 15 percent and the mean cumulative rate of nonrepayment was only 2.7 percent. The latter figure is the percentage of due loans that had not been recovered since the moneylender’s inception of lending operations (table 7-3).

In view of this accumulated evidence, the argument for direct credit supply by the government as a means of relieving enforcement problems must be questioned. What is left, then, is the fact that the government can supply *cheap* credit. What is likely to be the effect of this on the rural informal credit market? The available evidence, as documented in the case studies in this part of the book, certainly does not suggest that cheap credit will drive out informal sector moneylenders, and it may not even drive down interest rates charged by them. The theoretical framework of the “imperfect information” paradigm allows us to understand this policy failure.

If some borrowers have direct access to cheap funds from government institutions and can satisfy all their borrowing needs from this source, there will of course be less demand for credit in the informal sector. If rural credit

markets behaved as classical markets are supposed to behave, this would exert downward pressure on interest rates. But we know that rural credit markets do not behave in this fashion. If the interest rate plays a screening role and this leads to credit rationing, it is unlikely that the interest rate will fall following a small infusion of credit. Conversely, if moneylenders engage in direct screening, those moneylenders with the highest screening costs may drop out of the market, and interest rates may be expected to fall.

If borrowers cannot fully satisfy their needs from government institutions, so that they get only part of their credit needs from that sector, then it matters whether formal sector loans are treated as senior or junior debt relative to informal sector loans. If the formal sector has seniority, the informal sector loans become, in effect, riskier, which may lead to an increase in the informal sector interest rate. To make matters worse, in monopolistically competitive settings where there is active screening, the screening costs have to be allocated among smaller loan sizes, raising average costs and interest rates (as discussed in chapter 8). By contrast, if the formal sector loans are treated as junior debt, the effect on informal sector credit is ambiguous. The greater borrowing that results from access to lower rates increases (at any given level of informal sector loans and interest rates) the default risk, but a disproportionate fraction of the default risk is borne by the formal sector. Unequal access to formal sector funds may have further implications for the informal sector. If formal sector loans go to larger borrowers with more collateral, and the evidence suggests that is so, then the mix of applicants among whom the informal sector has to screen changes adversely, and this might increase the interest rates charged there.

If formal sector loans do not go directly to borrowers, but instead to moneylenders who act as financial intermediaries, the effects depend on (a) how the costs of informal lenders change, and (b) how the level of competition in the informal sector changes. If privileged access to government funds increases entry, and therefore increases average costs of moneylending because the costs of screening borrowers are now spread over each moneylender's smaller clientele, then interest rates in the informal sector need not decline at all. This is another implication of monopolistic competition in rural credit markets, and we pursue it in a formal model in Hoff and Stiglitz (1993).

More generally, the "imperfect information" framework alerts us to the difficulty of relying on financial intermediation to solve the problems in rural credit markets. Although the case studies in part I present evidence that moneylenders do borrow from each other in the same village and across villages, screening, incentive, and enforcement problems place limits on the extent of these transactions. Formal sector institutions face the same information and enforcement problems in relation to moneylenders. The case



studies in chapters 7, 8, and 9 provide evidence of the limited extent of financial intermediation between the formal and informal sectors.

### ***Institutional Innovation and the Role of Public Policy***

We have seen that the “imperfect information”/“costly enforcement” paradigm stands apart from the traditional “monopoly” versus “perfect markets” debate. It argues that rural credit markets do not behave as classical competitive markets are supposed to, so there is no presumption that they are efficient. However, both theory and evidence suggest that high interest rates are not necessarily, or even primarily, a reflection of the monopoly power of the village moneylender. Rather, rural credit markets behave the way they do because of the problems of screening, incentives, and enforcement.

Government credit institutions face these same problems relative to borrowers. In fact, they may be in a worse position in terms of informational asymmetry, monitoring, and enforcement.

Is there, then, any role at all for public policy? Greenwald and Stiglitz (1986) have shown that markets with imperfect information give rise to externality-like effects, and it is here that government intervention may be most successful. In the context of credit markets, one externality that we have identified is the reduction of enforcement and information costs brought about by development in other markets. Land titling, to the extent it increases the value of land as collateral, and the introduction of cash crops, which makes possible interlinked trade-credit contracts, will reduce lenders’ costs of enforcement. Government investment in infrastructure that makes agriculture less risky will reduce the importance of informational asymmetries between borrower and lender. See figure 1-1 on page 18.

Another type of externality may reside in institutions that directly address informational problems in rural credit markets. One such institution is that of small-scale peer monitoring. In chapter 4 Stiglitz analyzes a model of this activity. Individuals form a small group that is jointly liable for the debts of each member. The group thus has incentives to undertake the burden of selection, monitoring, and enforcement that would otherwise fall on the lender. Of course, this entails an inefficiency, since a small group has a lesser ability to bear risk than a lender with a large and diversified portfolio. Stiglitz shows that under certain circumstances the benefits more than outweigh the costs. However, there is an externality in this institutional innovation. An individual who bears the initial cost of organizing such an institution is providing a form of social capital from which *all* members of the group will benefit. As is well known, when this type of externality arises there will be an undersupply of the socially beneficial service, and there is therefore a role for the government to help organize and act as a catalyst in

the formation of such institutions. As Huppi and Feder (1990) have noted in their review of group lending, and as Braverman and Guasch report in chapter 3, there are notable successes in the provision of rural credit when the government has acted in this way.

## Conclusions

The chapters in part I and the theoretical literature out of which they have grown show that we can look into the black box that was once referred to simply as “imperfect credit markets.” We can assess the nature and sources of those imperfections, and we have a framework for assessing the consequences of alternative government policies. A rich research agenda lies ahead of us: investigating the extent to which the findings of these studies generalize to other countries, exploring the effectiveness of the institutions and mechanisms for screening and monitoring loan applicants that we have touched on in this chapter, and evaluating the consequences of a variety of government interventions in credit markets, taking into account the information asymmetries and enforcement problems endemic in developing countries.

## Notes

1. Floro and Yotopoulos's 1991 study of informal credit markets in the Philippines provides further evidence, consistent with much of the data reported here, of the segmentation in rural credit markets. See also the collection of case studies in Adams and Fitchett (1992).

2. This result depends sensitively on the nature of the information asymmetry. As we argued above, a *decrease* in the interest rate improves the mix of prospective projects that a lender finances if the expected return of a project is public information but its riskiness is not; only the borrower knows it. De Meza and Webb (1987) consider a different information structure—one in which the set of possible returns of a project is public information, but its expected return is not. De Meza and Webb also assume that a prospective borrower has private wealth to invest in the project. Under these assumptions, an *increase* in the interest rate improves the mix of projects that a lender finances by making borrowers more cautious about risking their own funds in low-return projects. In this case, indirect screening will not reduce interest rates below the level that would exist under symmetric information.

3. Later in his paper Ghatak qualifies the argument that the growth of income will lead to a fall in interest rates. He notes, in particular, the independent and complex role of caste and other social and legal factors.

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### 3

## *Administrative Failures in Government Credit Programs*

*Avishay Braverman and J. Luis Guasch*

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*Most government interventions in rural credit markets have been unsuccessful as measured by the targeting of funds to small farmers, the susceptibility to political pressures, repayment rates, and the ability of financial institutions to survive the withdrawal of external funding. This chapter argues that these problems are related to the poor design of incentive systems within lending institutions and to government-imposed interest rate ceilings. It considers how to improve the administrative performance of banks and cooperatives, and the advantages (and shortcomings) of group lending. The apparently large influence of social and cultural factors on the performance of financial institutions, an area in which our predictive power is limited, suggests the need for experimentation among alternative modes of organization in lending and savings mobilization.*

AGRICULTURAL LENDING BY FINANCIAL organizations in developing countries is much more difficult than commercial lending for many reasons:

- The more seasonal nature of the activity and the consequent peak-load demands that are made on the organization for speedy disbursements
- The convention that repayment for working capital can be required only once at harvest season
- The fact that adversities often affect a large number of loan recipients simultaneously, making it very difficult for local institutions to diversify their portfolios to cushion against economic shocks
- The high cost of serving geographically dispersed customers
- The lack of trained and motivated personnel in the rural sector

- The frequent absence of collateral
- The common conflicts between customary law and statutory law, which contribute to the difficulty in enforcing contracts.

This formidable list of hostile factors has discouraged lending by private banks in the rural sector of developing countries. These factors also impede government credit programs in the rural sector. They help to explain the poor performance of many of the financial institutions that governments in developing countries have created to channel subsidized credit to the rural sector. However, overwhelming evidence suggests that there are additional causes of the poor performance of government financial institutions. Subsidized credit has encouraged corruption, capital flight, and unproductive investment, while discouraging savings. Many of the financial institutions created to channel and allocate credit to the rural sector lack accountability, foster arbitrary practices, and allocate credit more on political than economic grounds.<sup>1</sup> Most credit programs have been unsuccessful as measured by the targeting of funds to small farmers, repayment rates, facilitating the development of private commercial lending, and the ability of financial institutions to survive the withdrawal of external funding.

This chapter argues that the failure of policymakers to account for the inevitable multiple agency problems in lending institutions bears responsibility for a large part of the poor performance of government rural credit programs in developing countries in the last three decades. The first two sections of this paper present evidence on the performance of government financial intermediaries; the third section analyzes group lending programs. It is impossible to explain the performance of lending programs solely on the basis of economic models; therefore, the fourth section considers the effect of social and cultural factors. The last section considers practical reforms to government lending programs.

## **Effects of Government Lending Programs on Rural Income Distribution**

A standard justification for government intervention in rural credit markets has been to improve the distribution of rural incomes. However, intervention has proven quite often to be regressive. It has been estimated that only 5 percent of farmers in Africa and about 15 percent in Asia and Latin America have had access to formal credit; on average across developing countries, 5 percent of borrowers have received 80 percent of the credit.<sup>2</sup> In general, government intervention in rural credit markets has failed to have a significant positive impact on rural income distribution and poverty.

To understand how these problems have arisen, consider the typical pro-

cess by which those institutions allocate credit. They have secured a loanable amount, most often from government sources, and usually they have been given restrictions and guidelines by which to allocate the funds. Their market is, generically, single farmer borrowers and collectives, such as cooperatives and credit groups. A common restriction imposed on the lending institutions is a ceiling on interest rates below market rates, while a common guideline is the targeting of small-scale farmers, or the earmarking of credit for productive purposes rather than consumption. Interest rate restrictions result in income transfers to loan recipients. They induce excess demand from all types of applicants. Increasing returns to scale in loan processing costs, as well as the collateral offered by larger landholders, biases loan allocation in favor of the larger landholders. In theory, higher transaction costs would be reflected in higher interest charged on small loans, but interest rate restrictions often prevent that outcome. Influence and patronage also bias the distribution of the subsidized credit in favor of the larger landholders.<sup>3</sup> The larger the subsidy (the difference between the market interest rate and the credit program interest rate), the stronger the pressure exerted by the larger landholders on the financial institutions to receive a larger loan allocation.

For example, Mosley and Dahal's (1987) Nepal study reports that in credit programs designed just for the small-scale farmers, at least 30 percent of loan recipients owned more land or had more income than the ceilings stipulated for the program. In general, there seems to be a high correlation between credit recipients and size of landholdings (Lipton 1981; Braverman and Guasch 1986). When larger landholders receive greater income transfers, income inequality increases and the policy becomes regressive (see also chapter 8, table 8-3).<sup>4</sup>

The administrative cost of loans is consistently reported to be very high. Most of the studies assess processing and administration costs at over 20 percent of the value of the loan made, particularly for small loans. In many cases, this is well in excess of the intermediary interest income.<sup>5</sup>

### **Financial Viability of Credit Institutions**

Many governments in developing countries have created financial institutions for the purpose of making agricultural loans. They are started with an infusion of government funds, and their sustainability has been a running concern.<sup>6</sup> Although a number of the institutions were originally conceived as comprehensive financial intermediaries offering credit and deposit services, this latter function is virtually absent in many of them.

Here again, interest rate restrictions conflict with the objectives of the financial institutions. A survey of eighteen credit cooperatives in Honduras

showed that the financial viability of those organizations was very closely linked to interest rate policies. Credit cooperatives offering higher rates enjoyed higher deposits and lower loan delinquency problems (Poyo 1983). Also, in a cooperative pilot project in the Dominican Republic, an increased emphasis on savings mobilization and provision of positive real interest rates, education, and technical assistance dramatically raised participation in the cooperative, along with the volume of savings and loans, while default rates dropped from 50 percent to below 10 percent (Poyo 1988).

The damage done by interest rate restrictions is of course greatest in periods of high inflation. When the interest rate is fixed in nominal terms and a country experiences inflation rates well over 100 percent, as Brazil did in the 1980s, to expect institutions to achieve financial viability is to expect miracles. Indexation of credit loans in those environments is only a matter of common sense.

Because most rural financial institutions created under government auspices have access to concessionary discount lines from central banks, they have no strong incentives for mobilizing voluntary deposits. They find it easier and cheaper to take large loans from the central bank than to undertake the difficult task of securing small amounts of funds through a large number of private deposits.

Given the proper incentives, the potential for cost-effectively mobilizing voluntary savings from rural households exists. The best examples of induced rural savings behavior and successful savings mobilization are in China and the Republic of Korea, where average propensities to save among farmers in both countries were remarkably high during the 1960s and 1970s as high real rates of return provided savers with strong incentives to save. Kenya's cooperative movement and a number of credit unions in Burundi, Cameroon, Côte d'Ivoire, Lesotho, and Zambia have also been successful recently in mobilizing voluntary savings, as have savings clubs in Zimbabwe and rural unit cooperative banks in Rwanda. But overall they have been the exceptions (see Adams 1983).

The advantages of successful savings mobilization are multiple. Besides the obvious benefits to the depositors, it can strengthen the financial intermediaries and reduce their dependence on government and donors, diminishing political interference, and can induce financial institutions to be more responsive to the local market.

An insidious effect of financial institutions' reliance on outside funds is that it tends to weaken enforcement procedures in the pursuit of default cases. Usually the bad loans are transferred to the central bank or the originating government institution. This reinforces bad business practices and makes borrowers more reluctant to repay or comply with the terms of their loans. Most financial intermediaries have accumulated substantial



arrears and bad loans. There is evidence that large farmers tend to default more often than small farmers (Lipton 1981; Basu 1990).

While the objectives of the rural financial institutions are described as the pursuit of the social good, based on economic principles and good business practices, the employees' objectives are often the use of their leverage, as a result of their positions, for their personal benefit. Governments have rarely created incentives to align the objectives of the former with those of the latter. Governments have overlooked careless screening, ignored lax enforcement procedures and corruption, and have failed to adapt to informational problems and changes in the environment. When governments did impose regulations to correct errors in management, financial intermediaries and borrowers were often able to circumvent the intent of regulations that were not in their private interests (Kane 1983).

### Group Lending

A significant percentage of the disbursed formal credit in rural areas in the last few decades has gone to cooperatives and other groups.<sup>7</sup> The potential of group lending, and its success relative to individual lending, demands closer attention and understanding of that form of lending, in particular of the role the government should play.

The advantages of group lending and groups are multiple. Group borrowing improves the group's bargaining position in relation to external lending sources, and it reduces the loan transaction costs of both lenders and borrowers. This enables the group to offer strong economic incentives to its members, such as lower interest rates, price discounts on inputs, and relief from individual processing of loans. Groups also promote scale economies in technical assistance. From the lenders' perspective, they may reduce the risk of loan default because of the common practice of some form of joint liability among group members (although that practice in itself does not guarantee success, as we discuss next). Group borrowing enables small-scale farmers to gain access to credit where they are discriminated against as single borrowers.

In addition, groups, and particularly credit unions, can play a critical role in mobilizing rural savings. Savings mobilization is not only critical for the long-term financial viability of the institution, but groups that rely extensively on members' voluntary savings as the source for their loanable funds fare much better in terms of loan recovery, as examples from Cameroon, the Dominican Republic, Guatemala, Honduras, the Republic of Korea, Rwanda, Taiwan (China), and Togo suggest (Cuevas 1988; Poyo 1983, 1988; Yun 1987).

While group borrowing provides many advantages, it can also cause severe inefficiencies and has many of the same problems that are associated with common ownership and team production. Noncooperative behavior usually yields an inefficient outcome if joint output or liability is fully shared among the agents. Everyone's welfare can be improved when each individual increases his effort or productive activity beyond the noncooperative equilibrium level. The noncooperative equilibrium outcome usually entails overborrowing and undersupplying of effort or of other individually costly production activities. To control these problems, a system of incentives and allocation or sharing rules needs to be imposed (Holmstrom 1982; Mirrlees 1976; Braverman and Guasch 1989). The mixed performance of credit groups and cooperatives in the last three decades reflects the existing trade-offs of benefits and costs in group arrangements. Most of the successful cases have accounted for the incentive problems, while most of those that have failed have not.

Crucial elements of any group lending activity are (a) the precise form of joint liability, (b) the extent to which the lender interacts only with the group as a whole or with the members on an individual basis, (c) the consequences of noncompliance, (d) the organization of the group, and (e) the covariance of the returns of the members' projects. Several other factors also affect the performance of credit groups and cooperatives. When the group emerges in response to the felt needs of the members and through their own initiative (bottom-up) with little government interference, there is a greater prospect of success than when formation of the group is imposed from above (top-down).<sup>8</sup> In addition, there is abundant and consistent evidence that the size of the group and its homogeneity have a significant impact on the behavior and performance of the members and thus, ultimately, on the success or failure of the organization.<sup>9</sup> When a loan is made directly to a member of the group, liability can take three forms. First, there is *individual liability*, where the member bears sole responsibility for the repayment of the loan. Second, there is *joint voluntary liability*, where individuals are also responsible for the repayment of the loan, but all group members are denied access to future loans if any of them defaults. Third, there is *mandatory joint liability*, where all members are responsible for any loan made to a single member, and access to future loans is denied as long as any loan is in arrears. When the loan is made to the group as a whole, mandatory joint liability prevails.

The evidence yields mixed results as to whether lending to the group or directly to the members induces better performance. This reflects the two sides of joint liability. It can be effective if enough peer pressure is present; however, its inherent free-rider effects may render it ineffective. Some form of joint liability appears in many of the successful programs. In Thailand, the Thai Bank for Agriculture and Agricultural Cooperatives' (BAAC's) programs

lending to individuals with mandatory joint liability have obtained repayment rates of 82 percent. That compares favorably to the average of 62 percent repayment rates for comparable loans with just individual liability (Huppi and Feder 1990). Similarly, in Bangladesh and Malawi, repayment rates of 98 and 97 percent, respectively, have been obtained under mandatory joint liability (Hossain 1988; Schaefer-Kehnert 1983). Finally, a comparative study of lending schemes with different forms of joint liability, undertaken in Zimbabwe by Bratton (1986), shows that in normal years, repayment rates were 92, 73, and 53 percent for loans made, respectively, to a group, to individuals with joint liability, and to individuals. However, the opposite ranking of repayment rates occurred in a year of a very poor harvest. The explanation appears to be that under the group lending scheme, if members do not expect the others members to comply, then they will not comply either.

Another important factor affecting the performance of groups is the level of managerial and financial skills in the organization. Groups that have emphasized proper accounting, record keeping, and educational training of managers have had many success stories—for example, the cooperatives in the Republic of Korea, the Comilla Projects in Bangladesh, and some credit cooperatives in Cameroon (Huppi and Feder 1990; Von Pischke, Adams, and Donald 1983). However, it appears that those skills have been missing in other cooperatives and credit groups. Cuevas and Graham (1988) report that a survey of credit cooperatives in Niger found that less than half of the local leaders were in possession of a record indicating who was eligible for a loan, and less than a quarter had records indicating the amount received by each farmer. Not surprisingly, the repayment rates were quite low.

Finally, exogenous variables, such as weather or macroeconomic shocks affecting the financial environment, can adversely affect the performance of credit cooperatives. Inflation can be the most damaging to a cooperative (and credit program) structure—see the case study of Israeli cooperatives in chapter 10.

Since members' defaulting on their obligations of debt repayment is the direct primary cause of failure of credit cooperatives (and other financial institutions), the implementation of credible enforcement mechanisms, such as denial of future credit to a defaulter or to the whole group of which he is a member, is necessary for any cooperative to succeed.<sup>10</sup> Credibility needs to be established from the outset. From the history of past credit programs, the credibility of that threat can be questioned. Where groups receive external funds, borrowers may perceive those funds to be more like income transfers than loanable funds, and they do not expect the institution to actively pursue default cases. The opposite is true of institutions whose loanable funds are collected via savings mobilization.

A measure that has proven quite effective for enforcement purposes is to

transfer control over some or all of the members' assets to the organization. This measure, coupled with some form of joint liability, renders credibility to threats of punishment and also creates a common interest that increases the incentives to comply.<sup>11</sup> However, preventive measures to diminish the likelihood of a member's default can also be quite effective. One of these measures is monitoring the actions of the members. It can be undertaken by the organization in the form of vertical monitoring where particular employees are assigned to monitor the actions of borrowers, or it can take the form of peer or horizontal monitoring where the members monitor each other. Both types are costly to implement, and since the benefits and monitoring costs vary from environment to environment, the choice, which also includes no officially sanctioned monitoring at all, should be made on a case-by-case basis.<sup>12</sup>

Overall, credit cooperatives that started as local bottom-up organizations, structured into small homogeneous units, and that emphasized institutional and human development with some form of joint liability or control over members' assets, have been the most successful cooperative financial intermediaries.

### Social Interaction Effects

Even though applying agency and organizational theory in institutional design can provide significant efficiency gains, field experience has demonstrated that, in themselves, these theories do not suffice to consistently elicit success in rural financial programs. Seemingly identical incentive and organizational structures have produced obviously different outcomes in different environments (see Von Pischke, Adams, and Donald 1983, especially chapter 39; Huppi and Feder 1990). It seems as though there is not a single institutional form providing superior performance for all countries. It might, therefore, prove fruitful to integrate social factors—norms, cultural patterns, and political structures—into our economic analyses.

While economic analysis sees individuals and organizations atomistically striving for profit constrained by market characteristics and policies, cultural theorists use holistic modes of explanation, probing the nonrational and subjective aspects of organizational life. Comparative sociological studies have taught us the impact of cultural modes in economic relations. We think of culture, in part, as the socially learned way of life of a group of individuals and the set of unwritten rules and means by which orderliness and patterned relations are maintained in a society. Culture includes norms, values, shared meanings, and cognitive structures. In the process of designing institutions, one should take into account the cultural environment. In attempting to transfer successful designs across sites or countries, care should be exercised to take into account differences in culture.

The following examples may illustrate the case. Korea's strong and successful cooperative movement can be traced to practical Confucian philosophy and ancient organizational and social forms and rules of conduct, such as Hyangyack and Kye. Essential elements in cooperatives, such as mutual help, had already appeared in the Kye as early as A.D. 742, an early historical precedent of today's Korean cooperatives (Yun 1987). Hamilton and Biggart (1988) report the following: Nakane's (1970) classic study combines cultural and structural analysis to show how the group relations of the Japanese family serve larger social institutions, including Japanese enterprise. Pre-World War II Swedish shop floor democracy can be traced to strong socialist sentiment in the country (Blumberg 1973). Worker self-management in the former Yugoslavia is linked to an ideology of social ownership (Tannenbaum and others 1974). American values emphasizing individualism and free enterprise lead to segmented organizations (Kanter 1983) and fear of central planning (Miles 1980).<sup>13</sup> In the Anglo-Saxon world, the Protestant ethic celebrates effort and individualism at the expense of social relations; it rewards accomplishments and downgrades individual experiences of pleasure not directly linked with productive activities. In each case, values will produce conforming social and individual norms and expectations about behavior that will be reflected in and dictate the boundaries of economic mediation, contracting, and economic organizations.

The examples above are highly suggestive of the impact of the environment on organizations. In some societies, individual incentives are molded by a view congruent with the Aristotelian doctrine that good citizenship entails a moral commitment to the welfare of the society as a whole. In institutional design, perhaps, to pretend an absolute preponderance of social responsibility over the individual one, would be highly misleading, but to abandon any social coherence not derived from individually self-serving actions is also inadvisable. The concept of sharing and moral commitment has been successfully implemented in a number of environments, including Korea, with substantial gains to welfare (Yun 1987).

What motivates individuals to consider and perhaps put other people's interests on an equal basis or even ahead of their own? To design an environment that will encourage and increase individuals' propensity to cooperate is a most challenging task. A fair amount of work has recently been devoted to that subject, both from a theoretical and empirical standpoint (see, for example, Axelrod 1984; Friedman and Hoggat 1980; Harsanyi 1977; Schelling 1960; Zusman 1988). Among the key lessons is the importance of fostering closer personal ties among the participants or members. In a sense, that has been the Japanese strategy. There the worker "is a member of the company in a way resembling that in which persons are members of families, fraternal organizations, and other intimate and personal organizations in the U.S." (Abegglen 1973, p. 62). Given that the activities in which we seek to promote cooperation are often to be undertaken over and over, any policy

or arrangement that increases the relative importance of the future will have a positive impact on the propensity to cooperate.<sup>14</sup> Critical to the success of cooperation is the opportunity cost of failing to belong to the program, group, cooperative, or organization. If that opportunity cost is not large, the incentives for compliance will be undermined.<sup>15</sup>

When considering establishing and promoting group activities, one should be aware of the clear advantages in letting the group form itself when joint liability on any member's loan is vested in the group. It shifts the costs of association efficiently to the lower-cost party, the agents. Since joint liability puts the onus of debt repayment on all the members of the group, members and leaders will be very careful in the selection of their associates in forming the group and adding new members. An individual or group would risk its earned surplus or social capital by modifying its size or structure only when it expects positive net benefits from the change. The intangible character of borrowers, which is difficult for the market to capture or trade, is then internalized by the group and turned into a marketable asset. That internal and prior screening should increase the seriousness and creditworthiness of the group.

One aspect of screening is to match individuals with similar views regarding exchange-orientation. That concept is defined as follows. The stronger one feels about the following sentence, "Every positive or negative action by one individual should be met by a similar weighted action by the recipient," the more exchange-oriented one is (Murstein, Cerreto, and MacDonald 1977, p. 543). Homogeneity of characteristics or attitudes within the group or cooperative has been shown, in both theoretical and empirical work, to affect significantly the success of the organization.<sup>16</sup> The characteristics of the individuals in any association will influence the nature of the internal transactions, the actions not subject to contracting, and the devices to mediate conflicts. This conforms with the behavioral view of social institutions, as described by Menger (1963) and Hayek (1973), where social institutions are regarded not as sets of predesigned rules, but rather as dynamic and somehow unplanned and unintended regularities of social behavior that emerge organically. This view is consistent with and can help explain the significant performance discrepancies in different places of seemingly identical programs and institutions.

Having said that, we should note that there are costs to matching, screening, and maintaining homogeneity, which of course should be taken into account when designing credit policies. In associations among individuals, we do not expect the costs to be too high, since in rural areas or villages, because of the small numbers and social stability, the information that individuals have about each other is fairly extensive. In the interaction between financial institutions and borrowers, however, we would expect those costs to be much higher. The institution may be remote and detached

from the village and may lack that inside information or local common knowledge.

## Reforms and Conclusions

The evidence of the failures in government rural credit programs, at least of the kind we have seen in the last few decades, argues against them. A policy of no preferential government credit programs would, in many cases, most likely be an improvement over the status quo. If public intervention in rural credit is believed to be an essential instrument for fostering development, or if it is not politically feasible to dismantle public financial institutions in the rural sector, then a critical task is to improve their internal administration. *The effort should focus on appropriate institution building, the mobilization of savings, adequate accounting, and financial reporting and auditing procedures.*

There have been a small number of successful cases of credit groups and cooperatives. We have argued that their limited success has been mostly due to shortcomings in their design and implementation, rather than inadequacy of the approach itself. We still maintain that, in an appropriate socio-political context, and insofar as they match the features most likely to induce success, cooperatives can be effective and may be one of the only means to guarantee small-scale farmers access to financial services. Since organizational forms, such as cooperatives, have a significantly higher chance of failure when imposed on farmers than the same organizational form when initiated by farmers themselves, the role of government here should be limited to facilitating the formation of voluntary bottom-up associations rather than forcing the individuals into groups, and it should make use of existing self-help groups and grassroots organizations that perform well. Given the nature of education as a public good and given the benefits that cooperatives and groups can derive from it, government intervention should be considered for (a) providing or facilitating management training, (b) introducing accounting systems and loan evaluation procedures, (c) educating the members on the implications of joint liability, homogeneity, size, control of members' assets, and loan recovery practices, and (d) providing extension services.

Beyond the implementation of sound business procedures, the design of correct incentive systems, strong enforcement of rules, and periodic accountability of the institutions, we know little of what else is needed to guarantee the success of an institutional lending and credit program. A number of factors appear to transcend market explanations and belong to the realm of cultural and behavioral studies in which our predictive knowledge is at best tentative. What has worked in one place or might not work in another. To

put the puzzle together, it seems sensible and cost effective to experiment. In the process of social experimentation, there is little to lose and much to gain. It should be understood that we are advocating educated experimentation to search for important residuals. By analyzing the environment, history, and social norms, we expect to find the modes of organization most likely to induce success.

## Notes

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1. See Adams and Vogel (1986), Ladman and Tinnermeier (1981), Sicat (1983), Robert (1983), Braverman and Guasch (1986), and Basu (1990).

2. See, for example, Gonzalez-Vega (1983), Adams and Vogel (1986), Braverman and Guasch (1986), and Sayad (1983).

3. The politically dominant role of large farmers has been documented in Apthorpe (1970), Borda (1969), Robert (1983), and UNRISD (1974).

4. It is even possible that interest rate restrictions can hurt small farmers by raising interest rates in the informal credit market. A subsidized credit policy will increase the demand for formal credit from all agents. If, as a result of common loan allocation practices, the share of formal credit going to the larger landholders increases, the absolute amount of lending to small farmers may decrease relative to what it would have been absent interest rate restrictions. In that case there will be a larger unfulfilled demand from the small farmers, which is transferred to the informal market, pushing informal market rates higher. (See Braverman and Guasch 1990.)

5. See, for example, Braverman and Guasch (1986) for a generic analysis, Adams and Romero (1981) for the Dominican Republic, Singh (1983) for North India, and Owusu and Tetteh (1982) for Ghana. As an example of how high those transaction costs can get, Singh (1983) reports that the average cost of lending for seven north Indian village moneylenders was 134 percent, while the average annual rate of interest they charged was 142 percent. On the other hand, Udry's case study of the informal credit market in Nigeria (chapter 5) shows very low transaction costs. The main reason for Udry's observation is that the credit sources there were family and friends. See also Nisbet's 1967 study of Chile.

6. A question arises regarding the financial viability of those lending institutions. Should viability be understood in terms of economic profitability of the institutions, or should it be understood as social profitability to the country? These are two very different concepts. The difference comes from a number of factors. First, there is usually a discrepancy between the institution's opportunity cost of funds and the marginal social rate of time preference. Second, the planned horizon and the relevance of the long-term impact of the high-priority sectors in the economy may not be included in the computations of the financial institution. Third, the evaluation of the risk and creditworthiness of the high-priority sectors, targets, and individuals



may be at least different if not distorted by the institution as a result of tradition and conservative investment policies. Fourth, the social, but not the financial, profitability depends on the weight and value placed on improvements in the income distribution. Given the decision to intervene, it is natural that from a social welfare standpoint, the criterion for viability should be social profitability to the country.

7. For this section we have benefited from and made liberal use of Huppi and Feder (1990).

8. The evidence of malfunctioning cooperatives subject to top-down organization and other government interference in decisionmaking is abundant. FAO (1986) indicates that as the reason for the failure of many cooperatives in India, Thailand and the Philippines. Likewise, Jordan's experience with cooperatives, where the managers are appointed by the government, has been disappointing. In Pakistan, where government workers rather than cooperative managers appraise and collect the loans, credit cooperatives have performed very poorly (Huppi and Feder 1990).

9. A few examples may suffice. In Ghana groups of around a hundred performed significantly worse than groups of ten to twenty. In the Dominican Republic loan recovery rates declined markedly with group size (see Huppi and Feder 1990). Those effects are strongly suggested by theory (see for example, Braverman and Guasch 1989): as groups and cooperatives increase in membership size, they reach a point where they are "too big" for peer monitoring and pressure to become effective. Successful group lending in Malawi and in some areas of Bangladesh and by the Thai BAAC has been linked to a policy of lending to relatively small and highly homogeneous groups (see chapter 8). Homogeneity has meant linkage by kinship or same village and same crop.

10. For some examples of the successful implementation of these policies, see Schaefer-Kehnert (1983) on Malawi, Bratton (1986) on Zimbabwe, and Hossain (1988) on Bangladesh.

11. For example, high repayment rates have been obtained in Bangladesh, Malawi, and Nepal, where between 5 and 10 percent of the total value of the group loan is retained as a deposit. Part or all of the deposit plus interest is returned to the group upon full repayment of the loan (Schaefer-Kehnert 1983). Also, repayment rates of 99 percent have been obtained in a group lending program in the Philippines where a group of small producers of grain pledged their cooperative against the group loan (Huppi and Feder 1990). Also, the cooperative's control over the marketing and proceeds of members' output was perhaps the main reason behind the success of Kenya's coffee cooperatives (Von Pischke 1983).

12. Attempts to explicitly model the monitoring problem in groups and cooperative organizations include Bradley and Gelb (1981), FitzRoy and Kraft (1984), Ireland and Law (1985), Putterman (1986), Braverman and Guasch (1989), and Stiglitz (chapter 4).

13. See also Ouchi's 1981 work linking cultural studies and economic traditions. While Williamson (1975) describes organizational structures or governance structures as emerging from market transactions, Ouchi claims that cultural values such as trust will influence whether individuals will resort to contracts and other devices of control to mediate transactions.

14. See Leibenstein (1987) for an insightful analysis of how the Japanese organizations deal with the free-rider problem inherent in group activities.

15. Many of these principles have been successfully applied in the case of the Grameen Bank of Bangladesh. See Hossain (1988).

16. Not surprisingly, exchange-orientation itself may harm organizations that depend heavily on cooperation. In his study of married couples, Murstein, Cerreto, and MacDonald (1977) found a significantly negative correlation coefficient ( $-0.67$  for men and  $-0.27$  for women) between the degree of exchange-orientation and marital satisfaction.

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## 4

# Peer Monitoring and Credit Markets

Joseph E. Stiglitz

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*A major problem for institutional lenders is ensuring that borrowers exercise prudence in the use of the funds so that the likelihood of repayment is enhanced. One partial solution is peer monitoring: requiring others in the village to monitor the borrower and pay a penalty if the borrower goes bankrupt. Peer monitoring is largely responsible for the successful financial performance of the Grameen Bank of Bangladesh and of similar group lending programs elsewhere. But peer monitoring has a cost. It transfers risk from the bank, which is in a better position to bear risk, to the cosigner. In a simple model of peer monitoring in a competitive credit market, this chapter demonstrates that the transfer of risk leads to an improvement in borrowers' welfare.*

DIFFICULTIES IN OBTAINING CAPITAL, and the high cost of capital when it can be obtained, may act as important impediments to improvements in productivity. Capital markets in the rural sector often appear to be underdeveloped. There are traditional moneylenders, but they are often reviled for charging usurious rates. The reason for these high rates remains a subject of controversy. There are widespread popular views that the rates are exploitative. These views implicitly assume that competition is limited. Local moneylenders make use of local knowledge, and this local knowledge may explain why competition is so limited. More recent views have questioned the extent of exploitation, suggesting that the high rates are a result of three factors: the high rates of default, the high correlations among defaults, and the high cost of screening loan applicants and pursuing delinquent borrowers (chapters 7 and 8). Because of the importance of local information,

moneylenders' loans are generally concentrated within a single geographical area; the inability to diversify means that the risks lenders must bear are large.

Both in the rates charged and the institutional arrangements by which loans are extended, traditional moneylending appears markedly different from modern banking institutions of the form found in more developed economies. As a result, many governments have encouraged formal banking institutions to go into the rural sector (chapters 8 and 9). These institutions would serve to increase both economic efficiency (by making credit more widely available) and equality (by lowering the interest rate that poor farmers have to pay). This, it was believed, would be true whether the high interest rates reflected exploitation as a result of limited competition, or whether they reflected compensation for the undiversified risks that local moneylenders had to bear. Presumably, these more efficient modern institutions would drive out the less efficient local moneylenders.

As it has turned out—as shown in chapters 7, 8, and 9—the two groups have not only managed to coexist, but the local moneylenders seem able to continue to lend at high interest rates. Although the formal lending institutions often have suffered large losses, the local moneylenders have not only survived, in some cases they have actually thrived. Part of the reason for the survival of local moneylenders is that the formal institutions have not made loans available to all farmers who would like them (or have not provided them with as much credit as they would like). But another part of the reason may be that the local moneylenders have one important advantage over the formal institutions: they have more detailed knowledge of the borrowers. They therefore can separate out high-risk and low-risk borrowers and charge them appropriate interest rates; and they can monitor the borrowers more effectively, making sure that the funds are used productively and thus lowering the default rate.<sup>1</sup> (See chapter 7 for a dramatic contrast between default rates of formal institutions and those of some moneylenders.)

Of the banking institutions that have been set up to provide credit in the rural sector of developing countries, one institution, the Grameen Bank in Bangladesh, appears to be a model success. It makes small loans—the average size is approximately US\$70—to the landless and near landless. It makes about 475,000 loans a month. Its default rate is approximately 2 percent in contrast to some other lenders, which have default rates of between 60 and 70 percent (Lurie 1988). There are a number of distinctive characteristics of the Grameen Bank, but the one I wish to focus on here is that the loans are made to self-formed groups of five individuals who live in the same village and who are jointly responsible for repaying the loans. Noncompliance with bank rules by any member of the group curtails the borrowing opportunities of the other group members.<sup>2</sup>

Thus, the Grameen Bank is able to exploit the local knowledge of the

members of the group. It has devised an incentive structure whereby others within the village do the monitoring for it (peer monitoring). Elsewhere it is argued that peer monitoring may be an effective way of designing an incentive-monitoring system in a variety of settings with costly information (Arnott and Stiglitz 1991).<sup>3</sup>

Peer monitoring is not without its cost. The members of the borrowing groups in the Grameen Bank bear risks that, in the absence of the monitoring problem, could much better be absorbed by the bank. Indeed, in the case of borrower groups, the interdependence among the members of the group is artificially created. They have been induced to bear more risks than they otherwise would.

This poses an analytical problem: are the gains from improved monitoring worth the costs of increased interdependence? This is the problem that this chapter sets out to model and answer. The chapter should be viewed as a first attempt at developing a general theory of peer monitoring.<sup>4</sup> Thus the borrowing group consists of only two individuals. Moreover, the interdependence is limited—they have to pay only a limited amount in the event of default. But even this limited amount raises the risk that they must bear. I assume, moreover, that the information each member of the group has about the other is essentially costless; it is a by-product of living near each other. (In more general cases, the amount of monitoring will depend on the extent of interdependence, so that with only a little interdependence, one may obtain only limited monitoring.) Finally, I assume that the risks of default are independent. In practice, they are correlated. The existence of correlation would only strengthen the results of this analysis.

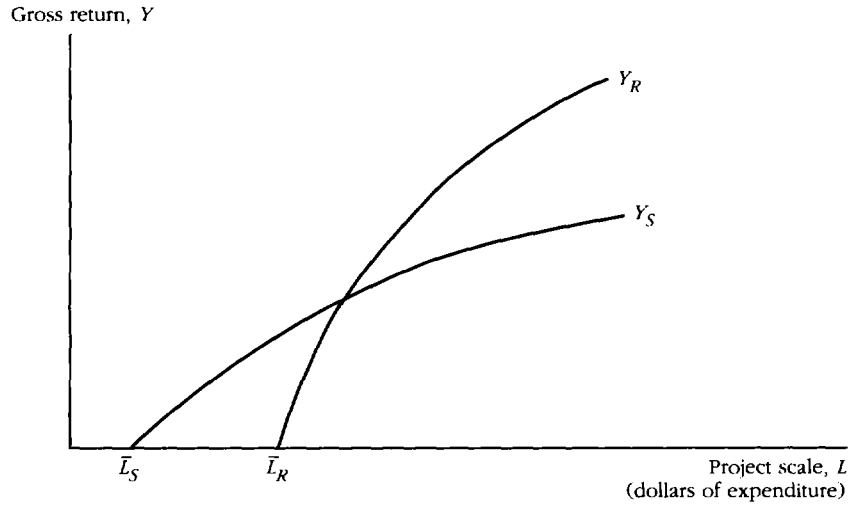
The next section presents the basic model describing the equilibrium that would emerge in the absence of peer monitoring. The following section shows how peer monitoring works and explains why it will be adopted.

## The Basic Model

I assume all individuals have two projects that they can undertake: a relatively safe project yielding, if successful, a return of  $Y_S(L)$  when undertaken at scale  $L$  (measured in dollars of expenditure), and a relatively risky project yielding, if successful, a return of  $Y_R(L)$ . If a project fails, returns are zero. The probability of success for each project is  $p_S$  and  $p_R$ , with  $p_S > p_R$ . I assume that the return is an increasing function of scale and that the fixed cost,  $\bar{L}$ , associated with the risky project is larger than for the safe project:  $\bar{L}_R > \bar{L}_S$ . Accordingly, in the relevant region,  $Y'_R$  is greater than  $Y'_S$ , as depicted in figure 4-1.



Figure 4-1. Relationship between Gross Returns and Investment (Assuming Success) for Safe and Risky Projects



Note:  $\bar{L}$  = fixed costs;  $R$  = risky project;  $S$  = safe project.

Assume that, taking into account the probability of success, the safe project always yields a higher return than the risky project:

$$(4-1) \quad Y_S(L)p_S - [1 + r]L > Y_R(L)p_R - [1 + r]L \quad \forall L$$

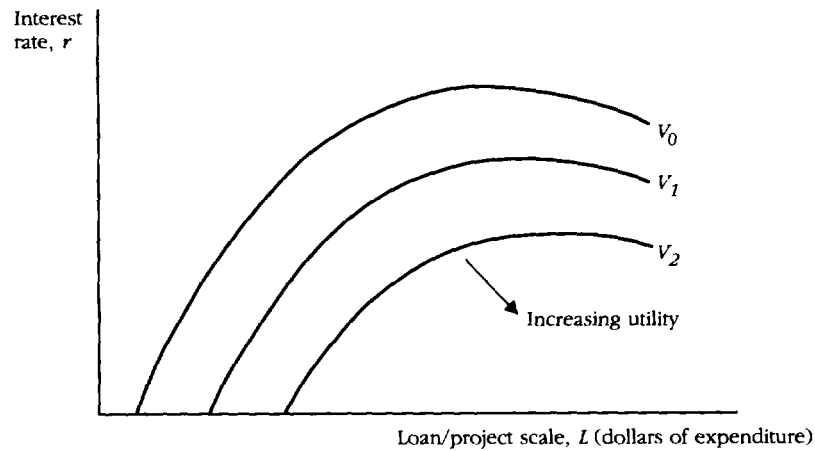
where  $r$  is the rate of interest. An individual who invests his own funds, therefore, will always choose the safe project. An individual who invests borrowed funds and declares bankruptcy if the project fails, however, will discount the cost of funds to reflect the probability of bankruptcy.

In order to focus on the incentive program, I assume all individuals are identical and, for simplicity, that the level of effort required by the two projects at any given size is identical.<sup>5</sup> Expected utility from undertaking project  $i$  is<sup>6</sup>

$$(4-2) \quad V_i(L, r) = U(Y_i(L) - [1 + r]L)p_i - v(e(L))$$

where  $U(Y)$  is the utility of income,  $U' > 0$ ,  $U'' < 0$ , and the utility function is normalized so that  $U(0) = 0$ .<sup>7</sup> The term  $v(e(L))$  is the disutility of effort  $e$ ;  $v' > 0$ ,  $v'' > 0$ . It is assumed that the level of effort required goes up as project size increases:  $e'(L) > 0$ . The individual's indifference curve for a

Figure 4-2. *Indifference Curves between Loan Size and Interest Rate Charged for a Single Project*



Note:  $V_i$  = expected utility from project  $i$ , where  $V_0 < V_1 < V_2$ .

given project (risky or safe) is given in figure 4-2. This curve gives all the contracts  $(L, r)$  that yield the borrower the same utility.<sup>8</sup>

The slope of the indifference curve if the individual undertakes project  $i$  is<sup>9</sup>

$$(4-3) \quad \frac{dr}{dL} = \frac{Y'_i - [1 + r] - v'e'/U'p_i}{L}.$$

The "switch line" can be defined as those combinations of  $(L, r)$  for which the individual is indifferent between the two projects; that is, where

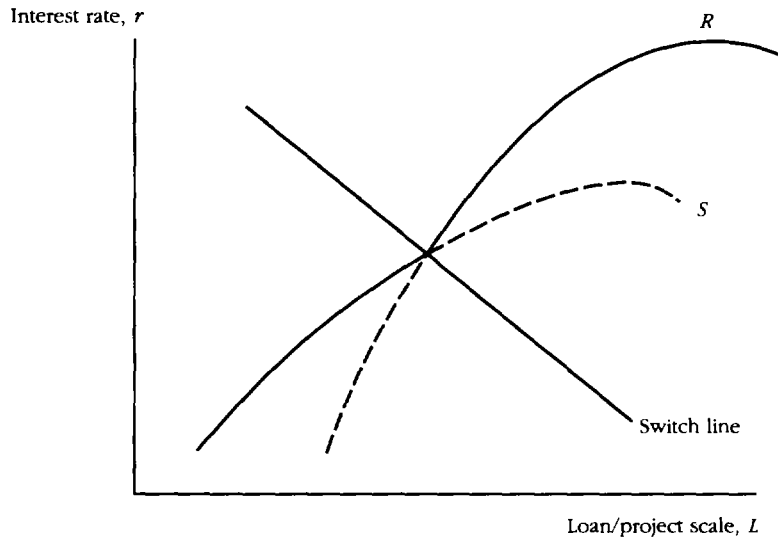
$$(4-4) \quad V_S(L, r) = V_R(L, r).$$

The switch line is negatively sloped under the plausible condition that because returns to scale are more important for the risky project than for the safe, an increase in  $L$ , keeping  $r$  fixed, makes the risky project more attractive. In the relevant region, that is, where  $(L > \bar{L}_R)$ , we have

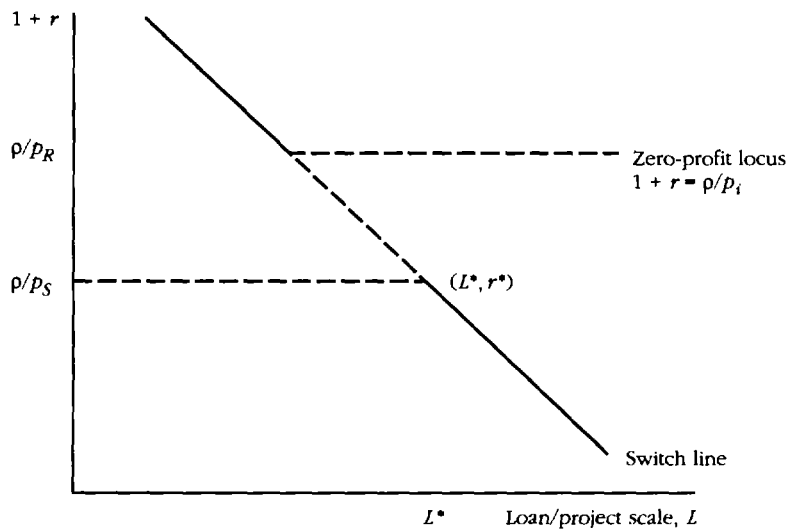
$$(4-5) \quad \frac{\partial V_S}{\partial L} < \frac{\partial V_R}{\partial L}.$$

Note that the indifference curves, letting the choice of project vary with the terms of the loan contract, have the scalloped shape shown in the top part of figure 4-3. Above the switch line (at high levels of  $L$ ) the individual undertakes the risky project.

Figure 4-3. Influence of Loan Size and Interest Rate in Selection of Safe and Risky Projects



Note:  $R$  = risky project;  $S$  = project. Because at larger loan sizes individuals undertake the risky project, the indifference curve—letting the technique employed vary with the contract—has a scalloped shape.



Note: Market equilibrium occurs at the contract  $(L^*, r^*)$ , where profits are zero. It is the largest loan size along the zero-profit locus for which individuals are willing to undertake the safe project. The parameter  $\rho$  = cost of capital;  $p_i$  = probability of success of project  $i$  ( $i = R, S$ ).

To see that the switch line is downward-sloping, fix the loan size and note that utility decreases with increases in  $r$  by the amount  $LU'p_i$ . Since for the risky project  $U'$  is lower and  $p_i$  is lower, the decrease in utility for each increase in  $r$  is smaller for the risky project. Hence, starting from a value of  $(L, r)$  at which the borrower is indifferent between undertaking the safe or risky project, such as point  $E$  in figure 4-4, an increase in  $r$  causes the risky project to dominate the safe project. But it was assumed in equation 4-5 that an increase in  $L$  at a fixed  $r$  increases the expected utility from the risky project more than that from the safe project. Therefore, an increase in  $L$  must be accompanied by a fall in  $r$  to leave the borrower indifferent between the two projects, which proves that the switch line is negatively sloped.

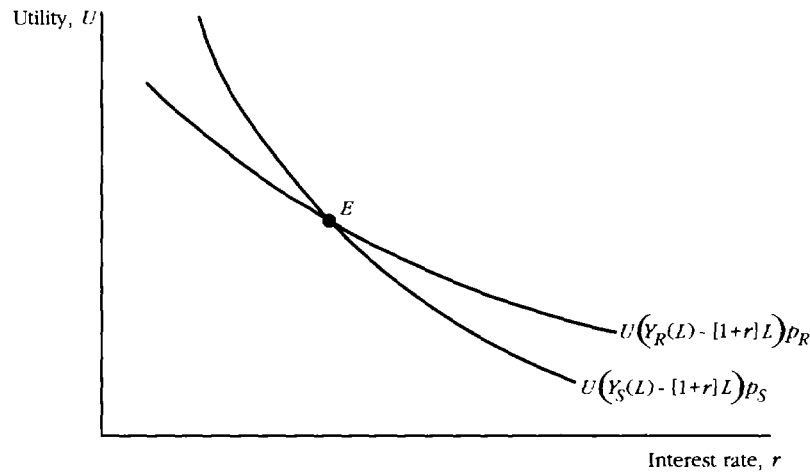
The borrower is compensated for the extra risk associated with the risky project by a higher return when the project is successful, but the bank is not. The risky project has a lower probability of success, and hence the bank has a lower chance of being repaid. Clearly, if the bank could directly control the actions of the borrower, it would specify that the borrower undertake the safe project. It cannot, and this is the incentive problem with which I am concerned. By controlling the terms of the loan contract, the bank can induce the borrower to undertake the safe project. That is, the bank must offer a contract that lies on or below the switch line.

To analyze the market equilibrium, one additional set of curves is needed—the zero-profit locus. The zero-profit locus can be constructed simply as follows. If the borrower undertakes the safe project, the expected return to the bank is  $p_s[1 + r]$ . If the cost of capital is  $\rho$ , then profits are zero provided  $1 + r = \rho/p_s$ . Similarly, if the borrower undertakes the risky project, expected profits are zero provided  $1 + r = \rho/p_R$ . The zero-profit locus is thus the peculiarly shaped dashed line in the bottom part of figure 4-3.

The market equilibrium is the point on the zero-profit locus that maximizes the borrower's expected utility. (It is assumed that the borrower does not have alternative sources of credit or, equivalently, that the lender can monitor the total amount borrowed by an individual.) In the bottom part of figure 4-3, the equilibrium loan contract is  $(L^*, r^*)$ . Clearly, the borrower would like to borrow more at the market rate of interest; and if the borrower could credibly commit himself to not undertaking the risky project, the lender would be willing to lend him a larger amount at that rate. But given that the borrower cannot commit himself, and the lender cannot enforce such a promise even were it made (and the borrower and lender both know that), the lender must limit his loan size to  $L^*$ .

This is only one of the two forms that credit rationing may take in somewhat more general models. It also may take the form that of a group of identical borrowers, some get loans and some do not. The usual argument for why this kind of credit rationing cannot occur is that those who have

Figure 4-4. *Effect of Interest Rates on Utility in Selection of Risky or Safe Projects at a Given Loan Size*



Note:  $L$  = loan/project size;  $p_i$  = probability of success of project  $i$  ( $i = R, S$ );  
 $Y_i$  = gross return of project  $i$  if it succeeds.

been rationed out of the market offer to pay higher interest rates. As they do so, the interest rate is bid up until demand for funds equals supply. It is easy to see in this model why this argument does not apply. Lenders know that at any interest rate above the switch line, borrowers will undertake the risky project. Though the amount borrowers promise to pay is higher, the amount they actually pay (on average) is lower.<sup>10</sup>

## Peer Monitoring

Now assume that every borrower has one (and only one) neighbor who is also a borrower. The success of their projects is independent. The two borrowers can monitor each other. The lender would like each to report if his neighbor is undertaking the risky project. The lender wants to create an environment in which it is in the self-interest of each borrower to monitor the other and report any cheating.

The following is a simple way of doing so. The lender offers a contract providing that if the neighbor agrees to cosign—in a specific sense to be

described below—the borrower can obtain a lower interest rate and additional funds. The cosigner agrees to pay  $qL$  dollars to the lender in the event that the loan he has cosigned goes into default—provided, of course, that he himself does not go into default.

Now, the cosigner's expected utility depends on whether his neighbor undertakes the risky or the safe project. Given their interdependence and the symmetry we have imposed on the problem, it is reasonable to assume that they cooperate. That is, they decide jointly on whether to undertake the safe or the risky project, and if they undertake the risky project, they agree not to report it.<sup>11</sup>

Having the individual cosign his neighbor's loan imposes on him an additional risk. Since the zero-profit condition ensures that the interest rate will adjust to leave the expected return to the bank unchanged—taking into account the payment from the cosignee—the effect of the cosignatory provision is to induce a mean-preserving spread in the borrower's income at any given level of his loan  $L$ . If both borrowers are successful, their incomes and utilities are higher, but if one is successful and the other is not, the first borrower's income and utility are lower. To compensate him for undertaking this additional risk, he would have to be able to obtain a larger loan. The relationship between the minimum-size loan required to attain a given level of expected utility and the magnitude of the cosignee's payment rate,  $q$ , is depicted in figure 4-5. Equation 4-13 in the appendix to this chapter shows that, given the banks' zero-profit condition, at  $q = 0$  we have

$$(4-6) \quad \left. \frac{dL}{dq} \right|_{V_s} = 0.$$

This means that (at low levels of  $q$ ) the risk burden imposed on the borrower by cosigning is exactly compensated by the reduction in the competitive interest rate charged.

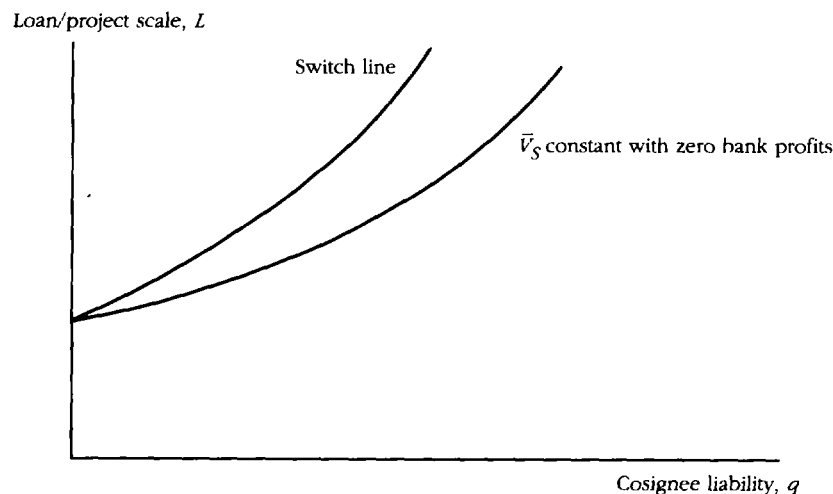
The only remaining question is to ascertain what happens to the switch line. If the two parties act cooperatively, the switch line is now given by the equation

$$(4-7) \quad \begin{aligned} & (U(Y_S[L] - [1 + r]L)p_S^2 + U(Y_S(L) - [1 + r - q]L)p_S[1 - p_S]) \\ & = U(Y_R(L) - [1 + r]L)p_R^2 + U(Y_R(L) - [1 + r - q]L)p_R[1 - p_R] \end{aligned}$$

Equation 4-15 in the appendix to this chapter shows that so long as the assumption of equation 4-5 is satisfied and the interest rate adjusts as  $q$  increases to maintain zero profits for the lender, the maximum  $L$  at which the individual undertakes the safe project increases with  $q$ . That is,

$$(4-8) \quad \left. \frac{dL}{dq} \right|_{\text{switch line at } q=0} > 0.$$

Figure 4-5. *Relationship between Loan Size and Cosignee's Liability at a Fixed Level of Expected Utility*



Note:  $\bar{V}_S$  = fixed level of expected utility from safe project ( $S$ ). The switch line is the maximum loan size, for each  $q$ , that induces individuals to undertake the safe project.

As shown in figure 4-5, peer monitoring will be welfare-enhancing. For low levels of  $q$ , the increase in  $L$  that it allows (with borrowers undertaking the safe project) is greater than that required to compensate the individual for the increase in risk-bearing.

## Conclusions

This analysis of the value of peer monitoring suggests some of the ingredients in the design of successful peer monitoring systems. First, the members of the peer group must be provided with incentives to monitor the actions of their peers. In the Grameen Bank this is provided by stipulating that access to future loans by each member of the peer group depends on the repayment performance of all the members. The denial of access to further credit can be an effective incentive device, as the earlier study of Stiglitz and Weiss (1983) emphasized.

The Grameen Bank uses small groups. The small size increases the risk from a single member's default but increases the incentives for peer monitor-

ing. The gains from the latter are likely to exceed the losses from the former. With large groups there is a free-rider problem—each would prefer that others expend the energy required to monitor and incur the ill will that would result from reporting offenders who have misused the funds lent to them (see chapter 10). Moreover, the cost to each member as a result of a default by any member might be sufficiently small that incentives to monitor—even apart from the free-rider problem—are minimal.

There are strong incentives for groups with similar risk characteristics to form. Because the group acts as a cooperative, if some individual is more prone to default than others, he is being subsidized. When group members are identical, there is no subsidy (in the *ex ante* sense). Of course, those with high risks of default would like to join groups with a low risk of default. Assortative grouping (see note 5) comes about as those with the lowest risk of default recognize their mutual interest in grouping together. Then those with the lowest risk among the ones who remain will group together, and the process will continue until the individuals with the highest risk are forced to group together. Villagers have an informational advantage over formal credit institutions not only in monitoring but also in selection. Efficiency in selection has beneficial effects by eliminating some of the cross-subsidization that occurs in credit markets with imperfect screening. The peer monitoring will enhance the effectiveness of rural credit markets.<sup>12</sup>

Provisions for cosigning have traditionally been viewed as a way of increasing the effective collateral behind a loan. This chapter has provided an alternative interpretation. *Cosigning provides an incentive for the cosignee to monitor the actions of the person for whom he has cosigned the loan, and it changes the borrower's behavior.* Cosigning also increases risk. But in the kind of symmetric competitive equilibrium analyzed here, interest rates adjust to reflect the improved monitoring. My central result was that at low levels of  $q$ , the gains from peer monitoring more than offset the loss in expected utility from the increased risk-bearing.

In developing countries the inability of those outside a village to monitor loans has posed a major impediment to the development of effective capital markets. Within the village, risks are sufficiently highly correlated and there are sufficiently few individuals with wealth that the lending market is both imperfectly competitive and carries with it high risk premiums.

A question naturally arises at this juncture: if peer monitoring is so effective, why isn't it employed by private markets? In capital markets in developed countries, it may be extensively employed. As noted above, provisions for cosigning may be important not only for the increased effective collateral but also for the induced selection and peer monitoring effects.

In developing countries, informal lenders may not need peer monitoring because they can monitor borrowers directly. In the formal sector, a major impediment to the development of peer monitoring—as well as to the devel-



opment of other institutions—comes from inadequate legal systems that are unable to enforce contracts. Government has one advantage over private lenders, a difference that is particularly important in developing countries, where the judicial system is at best slow, at worst ineffective. Government may have powers of enforcing contracts that private lenders might not have.

This suggests an alternative policy reform to more extensive government provision of credit: legal reforms giving lenders more security for the recovery of their loans. It may, however, be difficult to isolate legal reforms directed at making the credit markets more effective from a broader range of legal reforms. And there may be serious impediments to undertaking this broader range of legal reforms. Although legal reforms can facilitate the use of peer monitoring in private markets, even short of such fundamental reforms, well-designed government lending programs that take advantage of the opportunities provided by peer monitoring may be an effective second-best policy.

## Appendix

### No Peer Monitoring

To simplify the notation, let  $\bar{r} \equiv 1 + r$ , the principal and interest charged by the bank; let  $U_i \equiv U(Y_i(L) - \bar{r}L)$ , the utility of a borrower who succeeds at project  $i$ ; and let  $i = R, S$ .<sup>13</sup>

Recall that  $V_i(r, L) = U_i p_i$ , the expected utility of a borrower who undertakes project  $i$ , and the switch line is the set of contractual terms  $(L, r)$  for a rationed borrower where

$$(4-9) \quad V_R = V_S.$$

We assume in equation 4-5 in the text that in the relevant region ( $L > \bar{L}_R$ ), the benefit of an extra dollar of credit is greater for the risky than for the safe project:

$$(4-10) \quad U'_R[Y'_R - \bar{r}]p_R = \frac{\partial V_R}{\partial L} > \frac{\partial V_S}{\partial L} = U'_S[Y'_S - \bar{r}]p_S.$$

Differentiating the switch line (4-9) completely yields

$$\left. \frac{dr}{dL} \right|_{\text{switch line}} = \frac{\left( \frac{\partial V_R}{\partial L} - \frac{\partial V_S}{\partial L} \right)}{L[U'_R p_R - U'_S p_S]} < 0$$

where the sign condition follows from equation 4-10 and the fact that  $p_R < p_S$  and  $U'_R < U'_S$ . Thus the switch line is downward-sloping, as illustrated in figure 4-3.

### Peer Monitoring

With peer monitoring, the borrower faces, in effect, three states of the world: (1) both his own and his neighbor's projects succeed; (2) his own succeeds but his neighbor's fails; and (3) his own fails. Utility in the three states is, respectively,

$$\begin{aligned} U_i &\equiv U(Y_i(L) - \bar{r}L) \\ U_{iq} &\equiv U(Y_i(L) - \bar{r}L - qL) \\ U(0) &= 0. \end{aligned}$$

Expected utility in a symmetric equilibrium—where both the borrower and his neighbor choose the same project,  $R$  or  $S$ —is

$$(4-11) \quad \bar{V} = U_i p_i^2 + U_{iq} p_i [1 - p_i] = V_i(r, L, q).$$

Assuming that equilibrium is characterized by credit rationing, the bank chooses a contract  $(r, L, q)$  that ensures the individual will choose the safe project. The bank's zero-profit condition is  $p_S[1 + r] + p_S[1 - p_S]q = \rho$  so

$$(4-12) \quad \frac{dr}{dq} = -[1 - p_S].$$

For any  $r$ , equations 4-11 and 4-12 define a relationship between the borrower's loan limit and the copayment that keeps the borrower's expected utility unchanged and is consistent with the bank's zero-profit condition. That relationship is characterized by

$$\begin{aligned} \frac{1}{L} \frac{dL}{dq} \Big|_{\bar{V} \text{ and the bank's zero-profit condition}} &= \frac{-U'_i p_i^2 [1 - p_S] + U'_{iq} p_i p_S [1 - p_i]}{U'_i [R_i - \bar{r}] p_i^2 + U'_{iq} [Y_i - \bar{r} - q] p_i [1 - p_i]} \\ (4-13) \quad &= \frac{-M_i}{\partial V_i / \partial L} \end{aligned}$$

$$(4-13') \quad = 0 \text{ if } q = 0 \text{ and } p_i = p_S$$

$$(4-13'') \quad > 0 \text{ if } q = 0 \text{ and } p_i = p_R$$

where

$$M_i \equiv \frac{\partial V_i}{\partial q} + \frac{\partial V_i}{\partial r} \frac{dr}{dq}.$$

Equation 4-13' yields the result that in an equilibrium in which the borrower undertakes the safe project and banks earn zero profits, imposition of a low cosigner liability rate  $q$  at a fixed loan limit  $L$  leaves borrower utility unchanged. See the lower curve in figure 4-5.

It is useful to write the switch line (equation 4-9 or equation 4-7 above) explicitly:

$$(4-14) \quad p_R^2 U_R + p_R[1 - p_R]U_{Rq} = p_S^2 U_S + p_S[1 - p_S]U_{Sq}$$

Differentiating equation 4-14 totally yields

$$\left. \frac{dL}{dq} \right|_{\text{switch line}} = - \frac{M_R - M_S}{\partial V_R / \partial L - \partial V_S / \partial L}$$

From the assumption stated as equation 4-10, the denominator is positive. Using equations 4-13' and 4-13'', respectively, we have that at  $q = 0$ :  $M_S = 0$  and  $M_R < 0$ . Thus,

$$(4-15) \quad \left. \frac{dL}{dq} \right|_{\text{switch line at } q=0} = \frac{-M_R}{\partial V_R / \partial L - \partial V_S / \partial L} > 0.$$

Equation 4-15 shows that peer monitoring shifts up the switch line. It relaxes the constraint on  $(L, \tau)$  required to ensure that the borrower undertakes the safe project. Comparing equations 4-13' and 4-15 indicates that at low levels of  $q$ , the shift up in the switch line *exceeds* the shift needed to maintain the borrower at constant expected utility, as illustrated in figure 4-5. Peer monitoring will thus increase the borrower's welfare.

## Notes

This chapter is based on earlier work on the general theory of moral hazard (Arnott and Stiglitz 1985, 1986, and 1988) and on joint work with Richard Arnott on the general theory of peer monitoring (Arnott and Stiglitz 1991). It also draws heavily upon earlier joint work with Andrew Weiss on the theory of credit markets (Stiglitz and Weiss 1981, 1983, 1986, 1987a, and 1987b). Financial support from the National Science Foundation, the Olin Foundation, and the Hoover Institution is gratefully acknowledged. I am greatly indebted to Richard Arnott and Karla Hoff for helpful comments.

1. The incentive (moral hazard) and selection problems are two of the central problems facing any credit market.

2. The Grameen Bank experimented with individual loans and with loans to groups of various sizes. Through trial and error, the Bank settled on a group size of five individuals. "The spatial and social closeness of being from the same village [also] emerged as a major premise of a well-functioning, cohesive group" (Fuglesang and Chandler 1988, p. 56).

3. For instance, in labor markets workers frequently have much better information about whether peers are shirking than do managers. In insurance markets, family members have a much better idea about what precautions each is taking against some insured event than does the insurance firm.

4. This model focuses on how group lending affects borrowers' choice of projects, and thus their ability to repay, and does not address the problem of enforcing repayment from borrowers who are able to repay. A further work (Besley and Coate 1991) addresses the role of group lending in solving the latter problem. See also Varian (1990).

5. If villagers know each other's characteristics, then in forming peer monitoring groups, in the absence of countervailing social forces, there will be "assortative mating"; that is, the least likely to default will group together, the next most likely to default will group together, and so on, leaving the most likely to default to form a group. Thus the assumption that all members of the peer monitoring group are identical can really be viewed as one of the equilibrium conditions, which can be derived in a more general setting.

To the extent that group formation is socially determined, peer monitoring may be an even more effective form of addressing moral hazard issues than the analysis of this chapter might suggest.

6. I assume that either the individual has no source of income other than that from the project, or that whatever the income is, it is constant and cannot be garnished by the bank if the project fails.

7. This normalization is a convenient one for the exposition of this chapter but is in no way essential and encounters difficulties, for instance, with constant absolute risk-aversion utility functions.

Implicit in this formulation is that the individual's investment in the project is equal to the amount that he can borrow,  $L$ . The results can be generalized to the case where the amount of his own funds that the individual is willing to invest depends on the amount that he can borrow.

8. I assume that the lender can monitor the borrowing activity of the borrower, ensuring that he does not obtain funds elsewhere, although the lender cannot monitor other actions of the borrower. This assumption is not entirely satisfactory. While the lender can limit the size of the loan he extends, formal lenders often have difficulty enforcing restrictions on loans taken out with other lenders. Thus several of the case studies in part I of this book suggest that while information and other transaction costs imply that the borrower has a credit relationship with only one (or at the most, very few) informal lenders, borrowers frequently borrow from both formal and informal credit institutions.

A full analysis of market equilibrium in which formal institutions could not restrict the amount of outside loans would take us beyond the scope of this chapter. (See Arnott and Stiglitz 1991 for an analysis of the analogous problem in the context of insurance markets with moral hazard.) Doing so, however, would strengthen the case for peer monitoring, because the inability to restrict outside loans will lower the level of expected utility attained by the borrower in formal credit markets without peer monitoring.

9. The indifference curve for a given project is "well-behaved" in the relevant region where  $Y'_i > [1 + r]$  provided  $Y''_i < 0$  and  $d^2(v'e')/dL^2 > 0$ .

10. This argument is set forth in greater detail in Stiglitz and Weiss (1981). In the simple model presented here, lenders are indifferent to lending any size loan below the switch line, at a given interest rate. But if the model is modified slightly to allow  $p$ , to increase slightly with loan size, then below the switch line the zero-profit locus is negatively sloped, and lowering the loan size below  $L^*$  actually lowers the expected return to the lender.

Other modifications to the model, to make it more realistic, provide further reasons why lenders will not wish to make small loans, to "underfund" projects. For instance, borrowers often have the discretion to take actions that put the lender in a position of choosing to ante up more money or risk the loss of everything previously lent. Borrowers thus can "force" lenders to lend them more. See Stiglitz and Weiss (1981) and Hellwig (1977).

11. The interactions among the individuals that result in this being an equilibrium are not modeled in detail. It is easy to construct a game for which this is an equilibrium. For instance, assume that at any date at which one side reports that his neighbor has undertaken the risky project, the other side has time to report the same information. Then it would not pay either party to renege on the agreement not to report.

More generally, it is reasonable to assume that social sanctions would ensure that they behave cooperatively when their incomes are interdependent. There are natural information assumptions that assure that they cannot cheat on each other.

Throughout, it is assumed that if the borrower cheats on the contract by undertaking the risky project, the cosignee can "force" the reversal of the action. For example, the loan contract might provide that in the event of such cheating, the loan is in default and the lender receives all returns from the project.

12. There still may be some cross-subsidization across groups if interest rates charged to different groups do not correspond to differences in group default rates. Successful peer monitoring, however, lowers group default rates to the point where this cross-subsidization may be relatively unimportant.

13. Throughout the appendix, the effort required to manage the project is ignored. Incorporating the effects of changes in effort induced by changes in loan size is straightforward.

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## 5

*Credit Markets in Northern Nigeria:  
Credit as Insurance in a Rural Economy*

Christopher Udry

*This chapter addresses the issues of incomplete markets and imperfect information in the context of credit markets in rural northern Nigeria. In much recent theoretical literature, the problems of moral hazard and adverse selection are assumed to be decisive for the organization of agrarian institutions. In contrast, it is found that these credit transactions take advantage of the free flow of information within rural communities. Information asymmetries are unimportant, and their institutional consequences—the use of collateral and interlinked contracts—are absent. Credit transactions play a direct role in pooling risk among households through the use of contracts in which the repayment owed by the borrower depends on the realization of random production shocks by both the borrower and the lender.*

THE ANALYSIS OF RURAL MARKETS and institutions in developing countries has been transformed through the application of the theory of economic behavior under conditions of incomplete markets and imperfect information. Nowhere is this more evident than in the literature on rural credit markets.<sup>1</sup> This literature emphasizes that because complete insurance markets are absent, credit transactions take on a special role in allowing individuals to smooth income shocks over time.<sup>2</sup> It also emphasizes that because moral hazard and adverse selection are especially prevalent in credit transactions, credit markets are likely to incorporate organizational features that serve to mitigate or accommodate the problems caused by these information asymmetries.

Two organizational features have received particular attention in the literature on credit markets. The first is the pledging of collateral.<sup>3</sup> Collateral pledged in exchange for the receipt of a loan directly reduces the cost to the lender of a default on a loan; it can reduce the moral hazard associated with lending by providing an added incentive for the borrower to repay; and it can alleviate the problem of adverse selection by screening out those borrowers most likely to default.

The second institution is contractual interlinkage between markets. An interlinkage exists if two parties engage in transactions in more than one market and the terms of each transaction are set in a single contract.<sup>4</sup> The literature concerning this contractual form has grown to the point at which "the ubiquity of interlocking transactions is now widely acknowledged" (Hart 1986, p. 177). An interlinked transaction may be a disguised form of collateral. For example, the forward sale of standing crops (a product-credit market interlinkage) is often most easily interpreted as the pledging of those crops as collateral. Alternatively, the interlinkage may serve to reduce moral hazard or adverse selection by permitting the use of the contractual terms in one transaction to alter an agent's behavior in another.<sup>5</sup>

This chapter extends contemporary research on credit markets to rural credit in Africa by reporting findings from a detailed survey of 198 households in northern Nigeria. The survey yields two major findings. First, nearly all loans are transacted within a village or kinship group. I present evidence that information asymmetries within such groups are unimportant. The quantitative unimportance of collateral and contractual interlinkages are evaluated in an upcoming section entitled "The Information Environment" as part of a broader description of the information environment surrounding credit transactions in the survey villages.

Second, in the "Risk Pooling" section in this chapter I establish that credit contracts play a direct role in pooling risk among households in the survey area: the repayment owed by a borrower depends on the realization of production and consumption shocks by both borrower and lender.

In preparation for the discussions of information asymmetries and risk management in "The Information Environment" and "Risk Pooling" sections, "The Geographical Setting" section describes the survey area and survey techniques. The section entitled "Credit Transactions" then outlines the procedure through which credit contracts are made and enforced in the study area and presents summary statistics on credit transactions among the sample households.

## **The Geographical Setting**

From February 1988 to February 1989, I undertook a survey designed to extend contemporary research on economic behavior in the absence of



perfect information and complete markets to the analysis of rural credit in Africa.<sup>6</sup> A two-stage random sampling procedure yielded fifty households in each of four randomly selected villages near the city of Zaria in a semiarid area of Kaduna State in northern Nigeria.<sup>7</sup> The size of the sample was kept small in an effort to reduce nonsampling error on matters that are notoriously sensitive.<sup>8</sup> The survey consisted of a series of monthly interviews with each of the household heads and (separately) his wives. The questionnaires were designed to yield a complete picture of each household's asset and debt position; an account of its credit, labor, product, asset, and asset-rental transactions over the previous month; and a range of demographic and background data. Consumption and income data were not collected. The demarcation of an appropriate unit of analysis is often difficult; this is particularly true in northern Nigeria.<sup>9</sup> I adopted the traditional approach of empirical researchers in northern Nigeria and defined the household as "those people eating from one pot" (Norman and others 1976, p. 7). To be a member of the household, an individual had to eat the household food for the six-month period between two demographic questionnaires included in the survey.

The Zaria area is in the heart of one of the most dynamic and promising agricultural regions of Africa. It receives an average of 1,100 millimeters of rain per year during a wet season that lasts approximately 160 days. Rain-fed agriculture predominates, though there is also dry-season irrigated farming on lowlands bordering streams (*fadama*). Over the past decade there have been significant changes in cropping patterns (in particular, a marked shift to the use of hybrid varieties of maize) and inputs (an expansion of the use of chemical fertilizers) (Balcet and Candler 1982). The use of bullock and tractor plowing has become more prevalent, though they are still used by a minority of farmers.<sup>10</sup>

There is a moderate degree of involvement in the market both for the purchase of agricultural inputs and the sale of output. Of the sample households, 73 percent produce vegetables and nonfood cash crops for the market, and 53 percent of all labor used on the sample household farms was wage labor. Of cultivated land, 95 percent was treated with modern chemical fertilizers.

The area has a diverse population, with agricultural systems ranging from farmers who keep no cattle to semi-settled herders. Every household in the research villages operates a farm, usually composed of multiple plots (an average of five plots per household) interspersed with those of other village residents. Two to five different crops are generally intercropped on each plot. A large variety of nonagricultural occupations also exists. These include trading, the provision of transport services (via vans, motorcycles, bicycles, or donkeys), and small-scale industries such as carpentry, house building, or tailoring. The settlements are nucleated rather than dispersed, and the four villages included in the study range in size from 138 to 916 households. See

table 5-1 for summary data concerning landholdings and household demographics.

A large majority of the population of the area is Moslem, as are 199 of the 200 sample households. This fact has particular importance for a study of rural credit because Islamic law prohibits the use of fixed interest charges on loans. Investment income is prohibited if the investor does not share in the

Table 5-1. *Summary Data for 198 Households Surveyed*

Characteristic of household	Mean	Standard deviation
Household size	8.5	4.1
Males aged 10-60	2.7	1.7
Household head	1.0	
Children over 10	1.0	1.4
Other males over 10	0.7	1.1
Females aged 10-60	2.0	1.3
Wives	1.7	0.9
Children over 10	0.3	0.7
Young children	3.4	2.4
Elderly	0.4	0.7
Age of household head	42	12.4
Land (hectares)		
Operational holdings	3.8	4.3
Uplands	3.3	4.0
Fadama	0.5	1.0
Owned land	3.6	5.1
Uplands	3.2	4.7
Fadama	0.4	1.0
Value of livestock (naira)		
July	4,154	14,922
Excluding two Fulani households	2,700	7,884
Value of grain holdings (naira)		
August	597	114
January	5,058	978
Daily male agricultural wage (naira)	19	47 <sup>a</sup>
Loans (naira)		
Size (average for 821 loans)	291	719
Gross borrowing per household over survey period	352	1,015
Gross lending per household over survey period	596	2,679

Note: The exchange rate ranged from US\$1 = ₦ 4 in February 1988 to US\$1 = ₦ 7 in February 1989.

a. The high variability results from seasonal changes in the wage rate.

Source: Survey data.

risks of the enterprise. Hence an equity investment is legal, while lending with a fixed interest rate is not.<sup>11</sup> Fixed repayment periods are also prohibited: "And if the debtor is in difficulty, then [there should be] postponement to a time of ease" (Koran 2:280). The vigor with which these prohibitions are enforced is not clear. As documented below, almost no loans between individuals are made with positive, explicit fixed interest rates. When asked to explain this pattern, all of the respondents referred to Shari'a law. However, individuals display no reluctance to accept loans from banks at low (but positive) fixed nominal interest rates.

## Credit Transactions

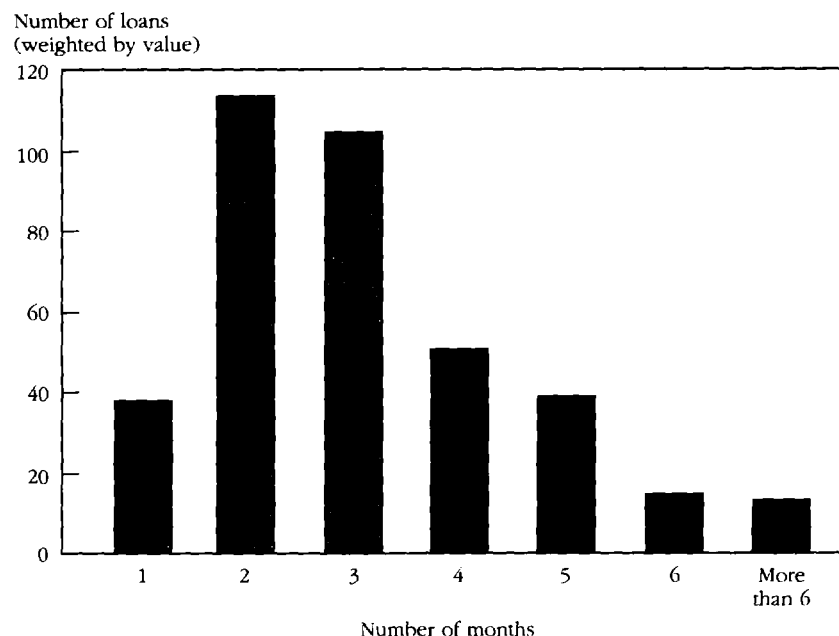
The survey data support the conventional wisdom concerning the scarcity of formal sector credit in rural Africa. Only 7.5 percent of all loans (by value) come from banks, companies, or projects. The most numerous of these were in-kind loans from the Nigerian Tobacco Company, which was promoting the cultivation of tobacco in one of the four villages. There is widespread participation, however, in both borrowing and lending in the informal credit market, as can be seen in these data for 198 households:

<i>Household</i>	<i>Did not borrow</i>	<i>Did borrow</i>
Did not lend	10 percent	15 percent
Did lend	25 percent	50 percent

On average, loans are held for just under three months (see figure 5-1). The peak borrowing period occurs near the start of the main growing season, and many loans are repaid after the first crops are harvested. The average amount of credit transacted per household over the sample year was approximately ₦1,000. This figure is of the same order of magnitude as the mean value of grain holdings when they reach their minimum just before harvest, ₦652. The loans, therefore, are of a scale and timing associated with short-term consumption and working capital needs. Both borrowing and lending tend to increase with wealth, as can be seen in figure 5-2.

The median (nominal) realized monthly rate of return on loans is zero, and the mean nominal monthly return (weighted by value) is  $-3.8$  percent.<sup>12</sup> After excluding those loans for which there is evidence that a default has occurred, the mean (nominal) rate of return rises to only  $-3.0$  percent. Average monthly inflation in Nigeria over the relevant period was  $3.7$  percent, so the average real monthly return on these loans was  $-7.5$  percent.<sup>13</sup>

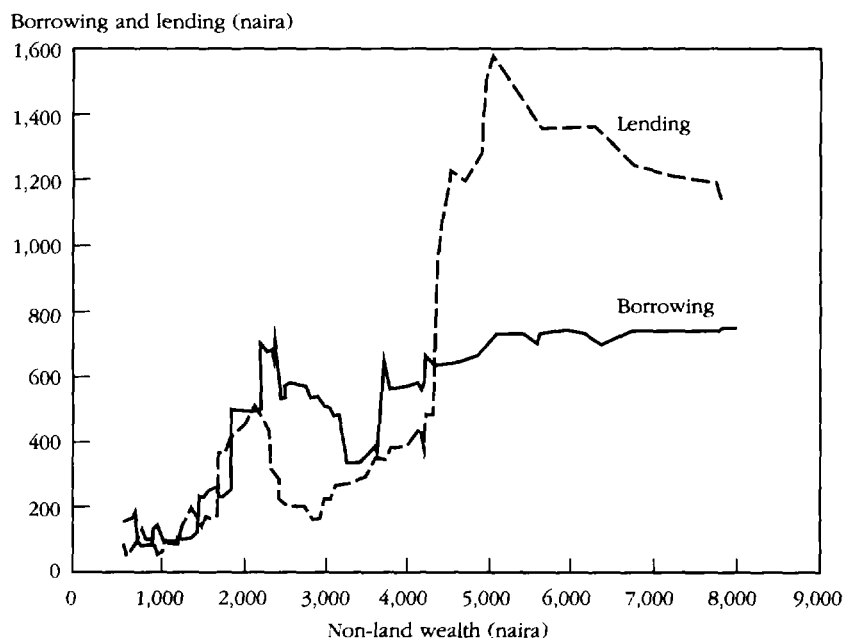
These figures, however, obscure large variation in realized interest rates.<sup>14</sup> Figure 5-3 reports the empirical distribution weighted by loan value and shows that on about one-fifth of the amount lent, realized nominal monthly interest rates exceeded  $7.5$  percent (or  $3.8$  percent in real terms). There is no

Figure 5-1. *Length of Loans*

statistically significant difference between the returns realized on loans between relatives and on other loans. There is no clear relationship between the length of time over which the loan was held and the monthly interest rate (see figure 5-4).

These loan transactions appear to be extreme in their informality. They generally occur in private, with no witnesses and no written record. They are almost always made and repaid in cash. Although the borrower and lender negotiate over the size of the loan, most transactions (84 percent) are made without setting an explicit (nominal) interest rate or repayment date. When an explicit interest rate is set (15 percent of loans), it is almost always set at zero. The realized rate of return on these putatively zero (nominal) interest loans, however, is no more likely to be zero than on other loans and is often quite high.<sup>15</sup> The borrower and lender, therefore, only implicitly agree on the terms of the loan.

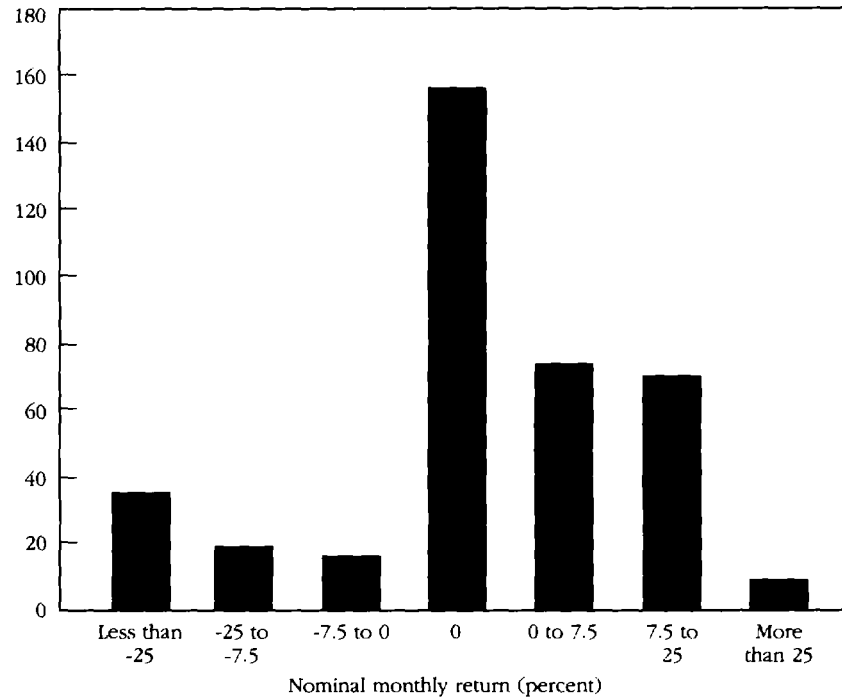
The fact that these transactions are loans is explicitly acknowledged, and mechanisms exist that serve to enforce the implicit obligations of both parties. The simplest and most direct penalty for a default is the exclusion of the

Figure 5-2. *Credit and Wealth*

defaulter from future opportunities to borrow from the lender. This type of mechanism has been analyzed extensively in the literature on repeated games<sup>16</sup> and is implemented in the case of defaults on these loan transactions. The fact that these transactions occur within families or villages, however, permits alternative mechanisms for enforcing credit obligations through appeal to community authorities. The respondents reported that the response to a perceived default was negotiation with the borrower's family, a religious leader, or the village head. Recall that the terms of the loan are only implicit, so the response to a default must consist of at least two stages. First, the lender must convince the authority that the borrower has not met his obligations; second, the authority must impose a penalty. Both steps depend heavily on the fact that for the vast majority of these loans, borrower and lender are members of the same small community. The authority's decision as to whether a breach of an implicit contract has occurred must rest on the statements of the two parties involved. He must take into account the possibility of deliberate deception as well as of misunderstandings over the terms of the contract.<sup>17</sup> As a member of the same

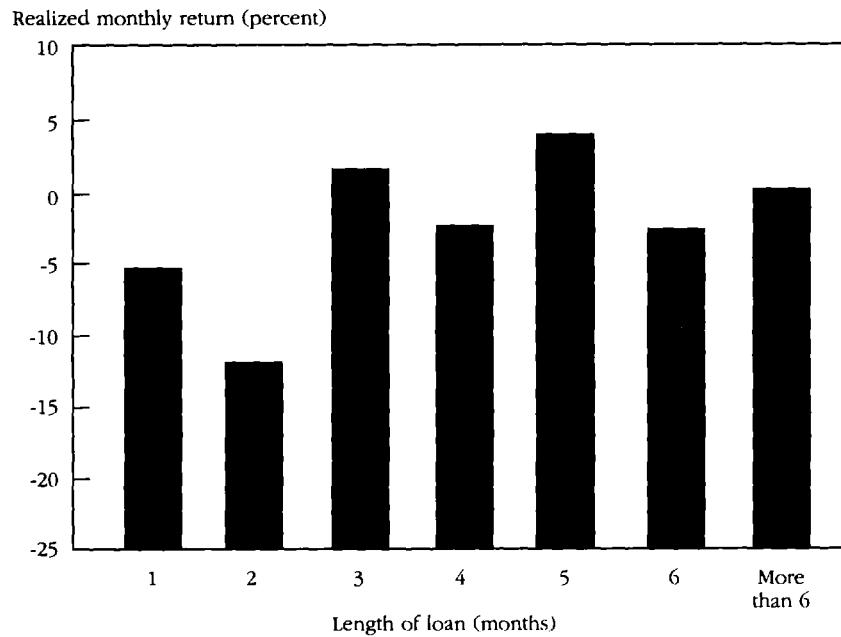
Figure 5-3. *Distribution of Returns*

Number of loans  
(weighted by value)



community, the authority is able to consider the reputations of both parties for honesty in previous activities in all markets and, more generally, in all types of social activity.

The penalties invoked by the authority also depend on his position as a respected figure in the community. In many cases, the possibility that he might disapprove of one's activities is sufficient to prompt a potential defaulter to meet his obligations. The possibility that he might make his finding public, either to other authority figures or to the community at large (through gossip), is a stronger incentive to meet obligations. Both of these penalties apparently impose a cost on the defaulting party. If his honesty is impugned, the defaulter may be excluded from future credit transactions and his ability to transact in other markets may be damaged as well. Private negotiation with (and admonishment from) an authority figure was the only penalty imposed on any of the sample households during the survey period; no dispute over loan repayments was made public.

Figure 5-4. *Term Structure of Returns*

## The Information Environment

Since formal sector lenders are almost completely absent from the study area, the information flows of concern are those between individuals who lend to each other. These parties are, with very few exceptions, well known to each other: as the data below show, 97 percent of 808 informal sector loans by value are either between residents of the same village or between relatives.<sup>18</sup>

<i>Borrower and lender</i>	<i>Related by kinship</i>	<i>Not related by kinship</i>
Residents of the same village	37 percent	55 percent
Residents of different villages	5 percent	3 percent

Of the remaining informal sector loans, 65 percent occur between individuals who share a long history of exchanging gifts or a long history of previous credit transactions.<sup>19</sup> The respondents claimed that they knew their transaction partners well. Respondents were asked to give an account of unexpected occurrences on their transaction partners' farms and of nonregu-

lar expenditures (such as ceremonies or medical expenses) by their partners. For 82 percent of the 808 private loan transactions, the respondents were able to provide such an accounting.

This direct evidence that information flows freely between borrowers and lenders is complemented by the lack of indirect evidence of information asymmetries. The special contractual forms that are used in other situations to ameliorate the problems of moral hazard and adverse selection are not common in northern Nigeria.

The first question I investigated was the possibility that collateral was used to secure these loans.<sup>20</sup> Almost all households own some land, and while land sales are prohibited by statutory law, each of the sample villages has active land sales markets. Of all land owned by sample households, 34 percent was acquired through market transactions. These were not limited to transactions within the village; one-fifth of the land purchased by sample households was acquired from individuals who were neither residents of the same village nor relatives. Land, therefore, is available to serve as a collateral asset.<sup>21</sup> However, collateral (usually land) is used in only 3 percent of the loans observed. The distinguishing feature of the few loans for which collateral is used is their size; the average size of a loan involving collateral is ₦634, as opposed to an average size of ₦276 for unsecured loans. Loans involving collateral are just as likely to be between members of the same family as are other loans, and respondents are even more likely to be able to provide an accounting of events on their transaction partner's farms when the loans involve collateral (96 percent of the cases) than when they are unsecured.

Contractual interlinkages, discussed above, have also been hypothesized to be common adaptations to the moral hazard implicit in many loan transactions, and empirical studies in chapters 8 and 9 document their high incidence in Asia.<sup>22</sup> In these data, however, there is no evidence of interlinkage of the credit market with the land, labor, or product markets. A necessary condition for the presence of interlinkages between the credit market and other markets is the coincidence of transaction partners across pairs of markets.<sup>23</sup> Product market transactions generally occur in markets in larger villages nearby. Out of 1,150 product market transactions recorded, 96 percent were made with traders in the market and with whom the household member had no other connection. Only 0.5 percent of the product market transactions occurred between parties who had engaged in a credit transaction previously.

Land and labor transactions occur mainly within the village, so some overlap with credit transactions is to be expected. The overlap that I found is no more than what would be expected given random assignments of transaction partners within the village. Each household had, on average, 3.65 credit transactions within the village during the sample year, while the average size



of the four villages is 366 households. Clearly, the proportion of the village with which an average household has ever engaged in a credit transaction is higher than 1 percent; unfortunately, no data are available concerning past loans that had been repaid before the start of the survey. Of 1,920 recorded labor transactions, only 1 percent occurred between individuals who had ever lent to or borrowed from each other. Of 323 land rentals, only 3 percent occurred between individuals who previously had shared a credit transaction.

The information asymmetries that may drive market interlinkage and collateral use in other contexts do not seem to be present in this set of loans. This does not imply that the pattern of information availability is unimportant for the structure of the credit market. Information flows freely between borrowers and lenders within an extremely small geographic or social space. The fact that almost no loans are observed to cross the boundaries of this space is an indication of the advantages held by family members and village coresidents in the availability of either information or enforcement mechanisms.

### Risk Pooling

Wherever insurance markets are incomplete, credit markets are known to play an important role by allowing risks to be pooled over time; households borrow more when they suffer an adverse shock, and lend more when favored with a positive shock. The free flow of information within the village and among relatives may permit credit contracts to play a more direct role in insuring against risk. A striking finding is that repayments *owed* on a loan appear to depend upon the random production and consumption shocks received by both the borrower and the lender.<sup>24</sup> Such state-contingent contracting would allow households to pool risk more efficiently and would permit credit transactions to conform to the Islamic prohibition of fixed interest charges. The easy availability of information implies that a lender need not engage in statistical inference in order to detect a default on a state-contingent contract, because the degree of compliance with the contract is known to both parties.

I hypothesize that these credit contracts are contingent upon random production and consumption shocks that are observable by the borrower, the lender, and the community authorities who will enforce the obligations of both contracting parties. Examples of such events are flooding, wind damage to crops, or insect infestations on the production side, and medical problems on the consumption side. If these events are common knowledge to the community, then the enforcement of contracts that are contingent upon their realization poses no special difficulty. If the occurrence of these

events is exogenous to the agents' actions, or if the actions that affect their probability of occurrence are observable, then no moral hazard issue arises.

The institutional framework within which these contracts are made and enforced is well suited to state-contingent contracting. As noted earlier, contractual terms are set implicitly and are enforced by community leaders. At least two distinct types of state-contingent contracting could be supported in this environment. The first would permit renegotiation of loans after the realization of any random shocks. With rational agents this is equivalent to explicit *ax-ante*, state-contingent contracting, and can be enforced provided that the realization of the shocks is common knowledge. Second, there may be implicit but commonly known community standards that require adjustments to loan repayments depending on the realization of the random shocks. This type of contract would limit the flexibility of the borrower and lender in making the loan contract, but would economize on transaction costs and integrate well with the community-based enforcement mechanisms. In this section I will focus on establishing a case for the presence of state-contingent contracting; I will not attempt to distinguish between the alternative mechanisms through which it may be achieved.

Striking preliminary evidence in support of the hypothesis of state-contingent terms is revealed by data on the willingness of the lender to enter into another credit contract with the borrower. If the enforcement mechanism for these contracts includes the exclusion of defaulters from future borrowing, then data on the future availability of loans should provide information on the incidence of default. If contracts are *not* state-contingent, then a judgment that a borrower has defaulted depends on the realized interest rate (and, of course, on the unobserved promised terms), but *not* on the state of nature conditioned on the realized interest rate. However, as shown in table 5-2, for a given realized interest rate, a borrower is less likely to be considered in default if he was subject to an adverse production or consumption shock.

The simplest form of this loan contract, in which repayments depend upon the outcome of a particular project, is analogous to sharecropping in the land market. More generally, both parties may understand that if the debtor household's economic fortunes are good, the loan will be repaid with a relatively high interest rate; but if the household suffers an unexpected negative shock, the interest rate will be lower. The survey data show that realized interest rates are lower and repayment periods are longer for debtor households that have experienced adverse shocks (table 5-3, borrower). This observation is consistent with conventional credit contracts because those who experience adverse shocks are more likely to default. The evidence that repayments respond not only to the overall circumstances of the debtor household but also to those of the creditor household (table 5-4, lender), however, is not consistent with conventional models. These transactions,

Table 5-2. *Loan Defaults by Borrowers Who Received Shocks and Those Who Did Not*

Loans <sup>a</sup>	Realized monthly nominal return, $r$			
	$r < 0$	$r = 0$	$0 < r < 0.05$	$r > 0.05$
Total loans	108	194	147	140
Number in default	16	20	6	2
Percentage in default	15	11	4	1
Loans to borrowers who received an adverse shock <sup>b</sup>	38	118	19	41
Number in default	1	2	0	0
Percentage in default	2	2	0	0
Loans to borrowers who did not receive an adverse shock	70	76	127	99
Number in default	15	18	6	2
Percentage in default	22	24	5	2

Note: The difference between the within-interval proportions is significant at the 0.01 level, using the following test: Let  $p_{ms}$ ,  $i = 1, \dots, 4$  be the proportion of borrowers who received no shock who are judged to be in default as indicated by the statement that no further loans will be available. Let  $p_s$  be the similarly defined proportion of borrowers who received a shock who are judged to be in default. A chi-square test of the hypothesis that  $p_{ms} = p_s$ , for  $i = 1, \dots, 4$  against the open alternative yields a test statistic of 30.57. The hypothesis is rejected at the 0.01 level.

a. All loans are weighted by value.

b. A borrower is judged to have received an adverse shock if he reported an unexpected adverse event on any of the fields he farmed during the term of the loan. Common events were flooding, wind damage, and infestation by insects. A borrower who is not a respondent (that is, the respondent was the lender) is judged to have received an adverse shock if the respondent reported an unexpected, serious event that occurred in the borrower household during the term of the loan. Common events, in addition to those just mentioned, were medical problems, rain damage to houses, and other "household emergencies."

Source: Survey data.

therefore, are not analogous to equity investments by the lender in the borrower's activities. They are true risk-pooling arrangements between the two households.

It is interesting to note that tables 5-2 and 5-3 can be replicated for loans between relatives (see tables 5-4 and 5-5). The statistical significance of the results declines as a result of the reduction in sample size, but the pattern generally remains the same. Loans involving relatives, overall, are just as likely to be considered in default as are other loans, and the terms of loans between relatives seem to be just as responsive to realizations of random shocks.

The flexibility of these contractual forms allows for more efficient risk sharing between the debtor and the creditor than is possible with conven-

Table 5-3. *Realized Terms versus Borrower and Lender Shocks Received*

Recipient of adverse shock <sup>a</sup>	Sample mean		
	Monthly interest rate	Simple interest rate	Repayment period
Borrower			
No shock	0.5%	20.4%	67 days
Shock	-4.0%	-0.6%	72 days
Impact of shock on mean	Lower	Lower	Longer
t-statistic <sup>b</sup>	(1.58)	(2.20)	(1.03)
Lender			
No shock	-7.5%	-5.0%	89 days
Shock	2.6%	11.8%	80 days
Impact of shock on mean	Higher	Higher	Shorter
t-statistic <sup>b</sup>	(4.56)	(3.06)	(1.89)

a. A respondent (borrower or lender) is judged to have received an adverse shock if he reported an unexpected adverse event on any of the fields he farmed during the term of the loan. Common events were flooding, wind damage, or infestation by insects. The other party (borrower or lender) is judged to have received an adverse shock if the respondent reported an unexpected, serious event that occurred in the other household during the term of the loan. Common events, in addition to those just mentioned, were medical problems, rain damage to houses, and other "household emergencies."

b. The impact of the shocks is judged by a two-sided *t*-test of equal means ( $\mu_{\text{no shock}} - \mu_{\text{shock}}$ ). The absolute value of the *t*-statistic is in parentheses.

Source: Survey data.

tional fixed interest contracts. Access to conventional loans permits a household to consume its permanent income; the consumption effects of an unexpected shock to income (and therefore to wealth) can be spread over a period of time. In contrast, state-contingent contracting offers a mechanism through which both borrowers and lenders can neutralize the unexpected shock itself so that it has no effect on wealth. Only certain shocks, however, can be insured against through this market. In general, the loans described in this chapter are concentrated within single villages, and thus can serve to pool only the idiosyncratic shocks faced by households within the village. To the extent that these loan transactions do not cross village borders, they can contribute almost nothing to a household's efforts to respond to a shock that affects the village as a whole.<sup>25</sup>

To what extent do the shocks affecting these household originate in idiosyncratic as opposed to village-wide events? An analysis of the variation in farm yields across sample households indicates that of the proportion that can be explained by some combination of random shocks and village-level effects, 42 percent results from idiosyncratic shocks, and 58 percent results

Table 5-4. Defaults by Borrowers Who Received Shocks and Those Who Did Not, for Loans between Relatives Only

Loans <sup>a</sup>	Realized monthly nominal return, $r$			
	$r < 0$	$r = 0$	$0 < r < 0.05$	$r > 0.05$
Total loans	19	85	66	34
Number in default	2	8	0	0
Percentage in default	12	9	0	1
Loans to borrowers who received an adverse shock <sup>b</sup>	6	42	7	23
Number in default	0	0	0	0
Percentage in default	2	1	0	0
Loans to borrowers who did not receive an adverse shock	14	43	59	12
Number in default	2	8	0	0
Percentage in default	16	18	0	1

Note: The difference between the within-interval proportions is significant at the 0.01 level, using the following test: Let  $p_{in}$ ,  $i = 1, \dots, 4$  be the proportion of borrowers who received no shock who are judged to be in default as indicated by the statement that no further loans will be available. Let  $p_{is}$  be the similarly defined proportion of borrowers who received a shock who are judged to be in default. A chi-square test of the hypothesis that  $p_{in} = p_{is}$ , for  $i = 1, \dots, 4$  against the open alternative yields a test statistic of 7.39. The hypothesis cannot be rejected at the 0.10 level.

- a. All loans are weighted by value.
- b. For the definition of "adverse shock," see note b in table 5-2.

Source: Survey data.

from a combination of shocks that affect the entire village and other village level effects.<sup>26</sup> In principle, therefore, a significant component of the total risk faced by these households can be insured against through state-contingent loan contracting with other households within the same village. Furthermore, this contractual form provides a mechanism for circumventing legal restrictions on credit transactions.<sup>27</sup> The existence of these contracts in an information environment in which they are feasible, therefore, is not surprising.

More puzzling is the almost complete absence of credit transactions that cross community boundaries. This is an environment characterized by seasonal demands for finance that are highly positively correlated over small areas, and the analysis above indicates that there is a large component of yield risk that cannot be insured against within the village. It would seem that there could be high returns available to financial intermediaries able to move finance over wide areas.<sup>28</sup> The absence of direct lending from outside the community to the sample households can be explained by (a) the high

Table 5-5. *Realized Terms versus Borrower and Lender Shocks Received for Loans between Relatives Only*

Recipient of adverse shock <sup>a</sup>	Sample mean		
	Monthly interest rate	Simple interest rate	Repayment period
Borrower			
No shock	-0.7%	8.4%	69 days
Shock	-5.6%	1.7%	72 days
Impact of shock on mean t-statistic <sup>b</sup>	Lower (0.89)	Lower (0.69)	Longer (0.32)
Lender			
No shock	-0.7%	4.4%	84 days
Shock	0.1%	1.6%	80 days
Impact of shock on mean t-statistic <sup>b</sup>	Higher (0.37)	Lower (0.54)	Shorter (0.46)

a. For the definition of "adverse shock," see note a in table 5-3.

b. The impact of the shocks is judged by a two-sided *t*-test of equal means ( $\mu_{\text{no shock}} - \mu_{\text{shock}}$ ). The absolute value of the *t*-statistic is in parentheses.

Source: Survey data.

information costs of such transactions; and (b) the existence of village-based traders who provide financial intermediation.

The strict information requirements of the state-contingent contracts place the outside lender at a severe disadvantage. Since he cannot observe the production shocks, the outside lender is faced with a classic monitoring problem and the borrower has an incentive to claim a more adverse shock than he actually received. Leaving aside the monitoring problem, unless an outside lender can exclude a borrower from future access to other lenders, he cannot impose a strong penalty on a borrower whom he considers to be in default. These informational disadvantages raise the cost of credit provided by outside lenders.

These costs could be reduced by a contravention of the requirements imposed by Islam or by the development of alternative institutions (such as interlinkages with other markets) within which fixed interest charges can be hidden. A fixed-term contract would reduce the monitoring difficulties faced by outside lenders, and the availability of assets that could serve as collateral could alleviate the problem of contract enforcement. Land is available to serve as collateral for borrowing from outside lenders because, as noted earlier, both the rental and sales markets in land are active.

An important element in the explanation for the puzzling absence of outside lenders might be found in the role that village merchants play in

channeling outside credit to the village. In northern Nigeria, the Hausa tradition of long-distance trading has led to a class of merchants, dispersed through many villages, who have long-term relations with other merchants throughout Nigeria and beyond. These merchants provide market intelligence, advance short-term trading credit, and act as agents for each other. This intensive contact enables them to enter into information-intensive state-contingent credit contracts of the sort described above. Therefore, these village-based traders with widespread connections can act as pipelines for outside credit to enter the village, increasing the volume of locally available credit and keeping the cost of credit below the threshold that would induce the entrance of outside lenders.

The fact that village-based traders do at times use their access to credit from other traders to lend to local borrowers is fairly certain. It was confirmed to me in interviews with six such traders in three of the four sample villages, and it corresponds to Clough's (1981, 1986) description of merchant activities in Kaduna State. There is also some indication of its importance in the sample data. Of the 198 household heads in the sample, three are traders who have active relationships with traders in other locations.<sup>29</sup> Each of the three made far more loans than average, accounting for 37, 25, and 17 percent of the total value of loans made by the fifty sample households in their villages.<sup>30</sup> One of the three also had large loans from outside traders, accounting for 11 percent of all of the borrowing by sample households in that village. While too much should not be made of the behavior of one individual, it seems that at least in one village a significant amount of credit flows through this trader across village boundaries.

The degree to which this phenomenon is responsible for the absence of outside lenders in the local credit market is less obvious, because there are other potential explanations. It is possible that contravention or circumvention of the Shari'a prohibition of fixed interest rates is impossible. This would make the information barrier faced by outside lenders almost insurmountable. It is also possible that even peak demand for credit is small enough, relative to local supply, that 'pipeline' credit from local traders is not needed to keep rents below the critical value that would induce outside lenders to enter the market. An investigation over several years would be needed to make a definitive statement regarding the importance of local traders' access to external capital as a mechanism for excluding direct lending by external agents. The critical test would be to observe credit transactions over a longer period in more villages in order to see how borrowing by locally resident traders from outside traders and local lending by resident traders respond to different levels of local demand for credit. No such test is possible with these data; the study year was characterized by generally better than average yields (rainfall was just over the long-run average, and well distributed).

## Summary and Implications

The rural credit market in northern Nigeria appears to be significantly different from its counterparts in other areas of the world and from the idealized markets that appear in theoretical work on the subject. There is only minimal use of collateral and no evidence of contractual interlinkage with other markets. Contractual mechanisms to alleviate the difficulties posed by information asymmetries are not necessary because credit flows through paths that take advantage of the extremely free flow of information within a rural community. In this information environment, credit transactions can be viewed as state-contingent contracts that allow direct risk pooling between creditor and debtor and that conform to the prohibition on fixed interest charges by Shari'a law. There is some evidence in one village that these information-intensive contracts are spread over a wide geographical area by a network of village-based, long-distance traders.

The flexibility of the state-contingent credit contracts presents an exceptional challenge to potential formal sector lenders. They have neither the access to information nor (generally speaking) the administrative flexibility necessary to make state-contingent loans. Therefore, they cannot compete directly with lenders from within the community. The existence of assets that could serve as collateral for fixed interest loans may provide an opportunity for institutional change that could be exploited by formal sector lenders. In addition, the conditions that permit state-contingent loan contracting within rural communities, namely the free flow of information within the village and the availability of mechanisms to enforce agreements between village residents, may also allow the design of peer monitoring systems to support lending by formal sector institutions to groups of rural households.

## Notes

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1. See Bell (1988) and Bardhan (1989) for comprehensive bibliographies.
2. See, for example, Eswaran and Kotwal (1989).
3. See Chan and Thakor (1987). For a different approach, see Gangopadhyay and Sengupta (1987).
4. "[I]nterlinked transactions qualitatively differ from the anonymous and systemic interdependence of economic action in competitive general equilibrium theory, and are more in the form of package deals, with the terms of one transaction contingent upon the terms in another" (Bardhan 1989, p. 237). See Bell and Srinivasan (1989) for a recent empirical study.
5. Bardhan (1980, p. 86) describes one mechanism by which this might occur: "An interlinked system of personalized transactions may serve the function of reducing some of the market costs of work monitoring, contract enforcement, and of search by making the possible discovery of dishonesty or shirking by an agent in one transaction too costly for him in terms of spillover effects threatening other transactions."
6. Survey data are available at a nominal reproduction charge upon written request to the author.
7. Two households had to be dropped during the course of the survey, leaving a final sample size of 198 households.
8. The small sample size enabled me to meet all of the male respondents over the sample year, and I was able to intervene immediately when an enumerator sensed that a respondent was becoming less cooperative. I was able to spend a day a week in each of the four villages and thus kept a relatively high profile during the course of the survey. I was in regular contact with the leadership of each village and was readily accessible to any of the respondents. This was particularly important when (rare) conflicts arose between the enumerators and respondents or other village residents.
9. There is a large literature on Hausa family structure in which the fluidity and indefiniteness of household boundaries is documented. See especially Watts (1983), Guyer (1982), Raynaut (1977), Nicolas (1974), Goddard (1973), Buntjer (1969), and Matlon (1979).
10. Neither animal traction nor tractor plowing was in use during Norman's 1966-67 survey of three villages in the same area (Norman 1972). Currently, 15 percent of cultivated area (7 percent of plots) is plowed at least once by a tractor, and another 14 percent (9 percent) by bullock plow. Longhurst (1985) found heavier use of animal traction (45 percent of cultivated area) in a 1976 survey of one village near this area.
11. See Iqbal and Mirakhor (1987).
12. The monthly return is calculated only for those loans on which some repayment has been made and for which there is no explicit promise to repay more. Returns are calculated for 71 percent of the 821 recorded loans.
13. Data from the first quarter of 1988 to the first quarter of 1989, from IMF (1989).
14. I use the terms 'realized return' and 'interest rate' interchangeably.
15. Respondents who reported an interest rate explicitly set at zero seem to have been victims of an insufficiently flexible questionnaire. Several such respondents explained to me that, as they had told the enumerator, the amount to be repaid would be exactly the amount borrowed. After further questioning, however, they

acknowledged that under different future circumstances, repayments would either exceed or fall short of the initial loan value.

16. See Kreps (1990) for an introduction.

17. Male pronouns are appropriate in this context, as most borrowers and lenders and virtually all authorities to whom disputes are referred are men.

18. Only loans across households are counted as transactions; loans between members of the same household are excluded from the data.

19. A history of previous gift exchanges or credit transactions was defined as "long" when respondents reported more than three transactions extending over more than three years.

20. Hill (1972) documents some use of collateral in other parts of northern Nigeria.

21. See chapter 12 for a discussion of the suitability of land as collateral. See Hill (1982) and Shenton (1985) for details on the history and legal basis of land sales in northern Nigeria.

22. See Clough (1981, 1986) for evidence that market interlinkages are used for credit in some markets of northern Nigeria.

23. An anonymous referee points out that the coincidence of transactions is not sufficient to establish the existence of interlinkages because transaction costs might make simultaneous contracting in more than one market optimal, even if the terms of the different contracts are set independently.

24. Actual repayments of loans will generally depend on the random shocks received by the borrower, as long as defaults are possible. Here, *owed* repayments are at issue.

25. Some evidence is presented that in one of the four sample villages a significant amount of credit is transacted with individuals not resident in the village.

26. The results are derived from a cross-section regression of yields on village dummy variables and the self-reported shock variables used in tables 5-4 and 5-5.

27. Shari'a law, strictly interpreted, requires that risk be shared in proportion to the capital contributed to an enterprise (see Schact 1939). Thus no state-contingent contract is legal. This amounts to a prohibition on the payment of risk premiums (which are implicit in any conventional credit contract and in many forms of state-contingent contracting).

28. The absence of direct lending from outside the village is glaring given the importance of such lending in rural areas of other developing countries. See, for example, Bell and Srinivasan (1989). See Binswanger and McIntire (1987, pp. 78-79, 88-89) for a theoretical account of the development of a geographically widespread credit market in such circumstances.

29. These traders do little buying or selling within their own villages. They purchase and sell wholesale lots of grain at larger markets and have business ties with traders as far away as Sokoto (400 kilometers to the northwest) and Lagos (over 750 kilometers to the southwest).

30. Credit transactions involving these households were no more likely to overlap with transactions in other markets than were those of other sample households. Traders are not sources of interlinked credit.

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## 6

*The Nascent Rural Credit Market  
in China*

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*This chapter describes credit transactions of agricultural households in China based on information contained in recent surveys in the provinces of Jilin, Jiangsu, and Jiangxi. The data indicate that the institutional and noninstitutional credit markets are segmented, that noninstitutional credit is generally not fungible, and that consequently the bulk of the fungible credit is provided by institutional sources. Informal sources are significant but they do not appear to be profit-motivated. In Jilin and Jiangxi, authorities provide relatively large amounts of credit and inputs to agriculture. The majority of farm households there were observed to borrow. In Jiangsu, the incidence of borrowing is much lower. However, the extent of unsatisfied demand for credit is highest in Jilin, partly because inputs are more readily available. By contrast, in Jiangsu and Jiangxi, unsatisfied demand for credit is lower because input supplies are constrained. Possible reasons for the underdevelopment of the rural credit market are examined.*

IN A SERIES OF REFORMS COMMENCING in 1979, China has reshaped the organization of agricultural production. The most important change was the introduction of the "household responsibility system," which transferred farm management and decisionmaking authority from the communes, or the production brigades or teams of the communes, to individual households. Under the reform, the land of the communes was allocated to individual households on leases of typically fifteen years. This initial allocation of land was based on egalitarian principles, taking into account the number of

workers and dependents in each family. As a result, there is little variation in the size of the farm in any given village, conditional on the number of workers and dependents, and there are very few, if any, landless laborers.

Under the new system, farm households retain their outputs as rewards for their labor, subject to taxes and procurement quotas for certain crops, and are permitted to sell their outputs on free markets that were allowed to develop. The state also significantly raised procurement prices for the various crops. The improved incentives raised agricultural output and rural income (Lin 1988). During the period 1980–85, agricultural output grew by 8.2 percent annually, and rural incomes grew by more than 10 percent annually. The reforms facilitated the emergence of not only output markets but also, within limits, factor markets, including credit markets, in rural China.

The objective of this chapter is to review the empirical evidence on rural financial markets in China.<sup>1</sup> The data underlying the analysis are derived from farm household surveys undertaken by the authors in 1987 and 1988. The chapter is organized in three sections: the first section describes the institutional setting and the study areas briefly. The second section presents the findings from the sample. In the third section, reasons for the relative lack of development of the credit market, especially the informal credit market, in rural China are examined.

## The Setting

Before the reforms, agricultural households' direct involvement with financial institutions was essentially as depositors in the rural credit cooperatives (RCCs). Borrowing by households was limited as the communes handled financing for production or investment, and the government discouraged private residential construction and conspicuous consumption for ceremonial events such as weddings and funerals. The rural banking system acted primarily as a channel for mobilizing rural savings and transferring a major share of these to other sectors. However, the low levels of rural incomes limited the amount of rural savings.

The situation changed markedly with the reforms. Many households now need liquidity for seasonal production and consumption, or longer-term credit to finance investment, residential construction, and ceremonial social events, which are no longer officially discouraged. At the same time, the much higher cash incomes from agriculture imply that many households also have a surplus of cash beyond their consumption, production, and investment needs. Indeed, rural households' deposits in financial institutions rose from 10 billion yuan in 1979 to over 130 billion in 1987 (US\$1 = 3.71 yuan in 1987–88), while loans to rural households (including

nonagricultural as well as agricultural) increased from 1 billion yuan in 1979 to 48 billion in 1987. Despite the much faster growth of loans, the rural sector remained a highly significant source of net savings for the urban sector. By comparison, deposits of communes and other agricultural collectives remained approximately constant during this period, while loans to them increased approximately twofold.<sup>2</sup>

The structure of the institutional credit market in rural China is superficially similar to that of many other developing countries. There is a specialized government-owned agricultural bank—the Agricultural Bank of China (ABC)—and a nationwide network of RCCs, which are, in principle, under local control and management, but in practice they are controlled and supported by the ABC.<sup>3</sup> Specialized government programs and schemes (for example, programs providing cash advances for specific crops or inputs as credit in kind) are a further, but nationally relatively minor, source of institutional credit. The ABC itself does very little business directly with agricultural households, focusing mainly on state agricultural agencies and rural industrial enterprises (owned mostly by village or township entities, but also by individual households). The RCCs are thus the main financial institution interacting with agricultural households in China. The commercial banks in China, all government-owned, do not deal with agricultural households.

The interest rates for agricultural loans (as well as other loans) made by the formal credit institutions are regulated by the government, with slight variations according to loan categories. In 1987, the rates of interest observed for agricultural loans ranged between 7 and 14 percent, comparable to rates prevailing in the urban areas. The spread between the loan rate and the deposit rate is small but generally positive. The degree of interest subsidy is believed to be small. In 1988, a period of relatively tight credit and high inflation, the rates ranged between 7 and 18 percent. They thus adjust somewhat to market conditions.

Informal credit transactions were strictly illegal before the reforms. In any case, most households did not have much need for liquidity (World Bank 1988, p. 322). There were therefore very few reported informal transactions. With the reestablishment of the household as an autonomous decisionmaking unit, rising income, and the resulting new consumption demands, transactions among households increased. Scattered evidence suggests that the volume of liquidity obtained from noninstitutional sources is today substantial in China. Jiang (1984), for example, asserts that noninstitutional sources contribute roughly half of the credit volume in rural areas. As is typical in many developing countries, the most common sources of noninstitutional credit are relatives and friends. There is evidence of voluntary informal associations of households and rural enterprises that mobilize savings and extend loans to households and other enterprises (Tam 1988). Zhang (1985)

as well as others have also noted the emergence of middlemen linking lenders and borrowers who are not socially related and may not even live in the same village, but such middlemen are still quite rare.

Most loans from relatives and friends in rural China carry no interest charges or, if they do, have rates similar to those prevailing for institutional credit. Occasional incidence of considerably higher interest rates for informal loans has been reported, especially for loans from socially unrelated lenders.<sup>4</sup> The reasons usually cited for the high rates of interest include the high risk of agricultural investment and production, the distance from markets, and the lack of collateral assets.

In this study, the authors surveyed stratified random samples of 200 households each from four areas in China: Gongzhuling county (literally city) in Jilin province (December 1987), Tai and Jurong counties in Jiangsu province (March 1988), and Xiajiang county in Jiangxi province (December 1988). These four counties were purposely selected from the national sample of 846 counties surveyed annually by the State Investigating Team because they were deemed typical agricultural counties in their respective regions. The samples included only agricultural households, which in the Chinese context means households operating land leased from a commune.

Gongzhuling is in the corn belt of northeastern China, where agroclimatic conditions dictate essentially one crop season a year. This area has been settled only in recent times, and the population density is relatively low. The county is considered a major corn supplier at the national level. Local authorities, keen on maintaining the county's leading supply position, earmark for the county significant amounts of credit to agriculture as well as supplies of fertilizers and other chemical inputs.

Tai and Jurong counties are in the wheat-rice belt of central China. They are similar in many respects. The rainfall and temperature allow two crop seasons in a year. As this area has been settled for thousands of years, population density is very high and farm sizes are extremely small. Consequently, many agricultural households here seek additional sources of income off the farm, either through employment in township and village enterprises or by operating small-scale nonfarm businesses.

Xiajiang is in the double-cropping rice belt of southern China. The county is a major commercial rice producer. As in the case of Gongzhuling, the local authorities are eager to maintain the county's position and strive to provide adequate credit. The farm sizes are larger, reflecting the fact that this area was resettled recently, having been ravaged by wars and rebellions during the century prior to 1949.

Table 6-1 summarizes the key characteristics of the samples. The year 1987, for which the activities (agricultural and financial) of Gongzhuling, Jurong, and Tai were reported, was one of economy-wide monetary expansion. The overheating of the economy induced measures that were imple-



Table 6-1. *Characteristics of Sample Farm Households by County, 1987 and 1988*

Item	Gongzhuling (N=200) 1987	Tai (N=200) 1987	Jurong (N=199) 1987	Xiajiang (N=200) 1988
Mean holding size (mu <sup>a</sup> )	20.75	4.63	6.90	11.31
Share of income from:				
Off-farm employment (percent)	13.4	22.2	32.4	6.4
Nonfarm activities (percent)	4.4	24.3	13.8	7.0
Per capita income, winter season (yuan <sup>b</sup> )	498	275	192	483
Per capita gross value of crops, vegetables, and fruits, summer season (yuan)	701	183	366	797
Mean household size (persons)	4.28	4.46	4.18	5.32
Cropping composition in summer/fall season (percentage of sown area)				
Rice	1.3	65.3	74.9	89.9
Corn	79.5	3.5	0.1	0.0
Soybean	12.3	8.7	3.0	3.3
Cotton	0.0	8.9	5.0	0.0
Sweet potato	0.3	5.9	6.2	0.9
Others	6.6	7.7	10.8	5.9

a. 15 mu = 1 hectare.

b. In 1987 and 1988, US\$1 = 3.71 yuan.

Source: Survey data.

mented in late 1987 to contain the growth of liquidity. The effects of these measures are, however, not reflected in our data, which pertain mostly to credit transactions undertaken earlier in the year. The year 1988, for which the activities of Xiajiang are reported, was characterized by a tight credit policy. Thus, the real as well as perceived agricultural credit shortage was more acute. Among these four counties, Gongzhuling appears to be the most prosperous, followed closely by Xiajiang, and Tai the least.

## Principal Findings

### *Resource Flows*

Table 6-2 presents the average levels of selected assets and liabilities of the agricultural households in the samples at the beginning of the season surveyed. The savings account deposits (line 1) approximately equal the formal debts outstanding in Gongzhuling and Xiajiang (line 5), but far exceed the

Table 6-2. *Assets and Liabilities per Household, by County*  
(yuan)

Item	Gongzhuling (N=200)	Tai (N=200)	Jurong (N=199)	Xiajiang (N=200)
<i>Assets at beginning of survey period</i>				
1. Savings accounts	162.4	518.9	192.3	363.8
2. Cash	623.0	244.5	177.3	274.3
3. Inventory	674.1	161.9	215.4	539.8
4. Loans to others	197.3	120.5	171.7	116.9
Subtotal (lines 1-4)	1,656.8	1,045.8	756.7	1,294.8
<i>Liabilities at beginning of survey period</i>				
5. Formal debt outstanding	171.7	16.8	38.3	396.3
6. Informal debt outstanding	186.0	317.2	221.6	390.7
Subtotal (lines 5-6)	357.7	334.0	259.9	787.0
7. Ratio of informal to total debts outstanding (percent)	52.0	95.0	85.3	49.6
<i>New loans during the survey period</i>				
8. New formal loans	441.2	29.6	64.6	331.6
9. New informal loans	222.2	121.3	128.5	181.7
Subtotal (lines 8-9)	663.3	151.0	193.1	513.3

Source: Survey data.

formal debts outstanding in the Jiangsu counties. Thus, even for Gongzhuling and Xiajiang, which have both been targeted for production support by the government authorities, there is little net inflow of resources through the institutional sector. In the Jiangsu counties, the institutional sector does relatively little local lending to agricultural households, but merely performs its function of transferring surplus resources from the agricultural sector to the nonagricultural sector.

In all four counties, total informal debts outstanding at the beginning of the season surveyed are at least as large as total formal debts (lines 5 and 6); they exceed formal debts by a large multiple in the Jiangsu counties. Informal debts are thus, by volume, extremely important, even for counties where formal credit is relatively plentiful. The situation in the Jiangsu counties is, however, much more representative of rural China. In all counties except Gongzhuling, total informal debts outstanding (line 6) far exceed total informal loans made by the local agricultural households (line 4). This may indicate significant lending by relatives and friends in the nonagricultural sector, which is not covered by the surveys, or possible under-reporting on the part of the informal lenders. Of course, there is no reason why the total borrowing and lending must balance within the samples.

In all of our counties, assets exceed liabilities quite considerably (bear in mind that the values of structures—including residences, equipment, live-

stock, and jewelry—have not been included). Moreover, it may be noted, by reference to table 6-1 (lines 3 and 5), that the total debt outstanding per household is low relative to household income. The inventories of agricultural products are much higher in Gongzhuling and Xiajiang, which may be related to the delivery quotas and the in-kind repayment requirements of the fertilizer “loans” in these counties.

Finally, the amounts of new formal loans are large relative to the amounts of total formal debts outstanding, except in Xiajiang, where the two amounts are comparable, indicating very short maturities for formal loans, certainly no more than a year. By contrast, the amounts of new informal loans are typically less than the amounts of informal debts outstanding, except in Gongzhuling, indicating a much longer average maturity for informal loans.

### Participation in the Credit Market

Table 6-3 summarizes the borrowing activities undertaken by the agricultural households in the samples during the season surveyed. There is again a marked difference between Gongzhuling and Xiajiang on the one hand and the two Jiangsu counties on the other in the incidence of credit activities. Whereas only 21 percent of the Gongzhuling and 34.5 percent of the Xiajiang sample households have not taken out new loans from any source, the share of nonborrowers was 78.5 percent in Jurong and 67 percent in Tai. However, this difference may have been somewhat exaggerated because the supply of subsidized fertilizer (from official distribution sources) in Gongzhuling is linked to credit in a procedure that forces farmers to become borrowers regardless of whether they really need credit.<sup>5</sup> In Gongzhuling, the overwhelming majority of the sampled households (74.5 percent) utilized institutional credit during the season surveyed. Most of the

Table 6-3. *Borrowing Activities Undertaken during the Season Surveyed, by County (percent)*

Category	Gongzhuling (N=200)	Tai (N=200)	Jurong (N=199)	Xiajiang (N=200)
Nonborrowers	21.5	67.0	78.5	34.5
Borrowers from formal market only	56.0	20.0	8.5	42.5
Borrowers from informal market only	4.0	9.0	9.0	7.0
Borrowers from both formal and informal markets	18.5	4.0	4.0	16.0
Share of informal transactions that are interest-free	68.0	80.0	100.0	100.0

Source: Survey data.

loans were granted in the form of input credit in connection with fertilizer distribution. In Xiajiang, 58.5 percent of the sampled households utilized institutional credit. By contrast, in Jurong and Tai only 12.5 and 24 percent, respectively, of the sample obtained institutional credit. Most of the formal loans in Tai (85 percent by number and 27 percent by value) consist of an advance cash payment made to cotton growers by the cotton marketing agency as an inducement to grow cotton. The amount of liquidity entailed in such a cash advance is rather small (less than a third of a typical RCC loan).

In all four counties the incidence of *new* informal credit transactions is quite limited. The frequency of informal credit transactions is much lower than that of formal transactions in Gongzhuling, Tai, and Xiajiang, and is about equal in Jurong. Only 22.5 percent of the Gongzhuling sample, 23 percent of the Xiajiang sample, and 13 percent of the Jiangsu county samples had taken out new informal loans (lines 3 and 4). One implication of the low frequency of new informal loans is that the average new informal loan is a much greater amount than the average new formal loan. The overwhelming majority of the informal transactions consist of interest-free loans among relatives and friends, as is typical of rural China. Of the borrowers, there are relatively few who participate in both the formal and the informal credit markets. Given the significant differential in the rate of interest between the two types of loans, this may be taken as evidence that informal credit is not a good substitute for formal credit (otherwise every borrower would exhaust his or her informal credit before going to the RCC).

### **Composition of Loans by Source and Purpose**

Table 6-4 presents the composition of new loans in the samples by source. In Gongzhuling, Jurong, and Xiajiang, the RCCs, as expected, are the most frequent institutional lender, with the ABC playing a very minor role. In Tai, the cotton marketing agency is the most *frequent* institutional provider of liquidity. However, when the *volume* of credit is considered, the RCCs are the most significant institutional lender even in this county, because the amount of cash advanced by the cotton agency is small.

The share of institutional credit in the total *volume* of *new* credit (not shown in table 6-4) is 66.5 percent in Gongzhuling, 64.6 percent in Xiajiang, 33 percent in Jurong, and 25 percent in Tai, higher than its share in the stock of existing credit. This is largely a result of the relatively shorter maturities of the formal credit. Thus, in the two Jiangsu counties, loans from informal sources account for the bulk of newly borrowed funds, by volume. Such a situation is quite common. The high shares of institutional credit in Gongzhuling and Xiajiang may reflect in part the greater availability of such credit in the two counties due to the explicit policy of government authorities and in part due to the tie-in between fertilizer supply and credit.

Table 6-4. Sources of New Loans, by County  
(percent)

Source	Gongzhuling (N=259)	Tai (N=82)	Jurong (N=60)	Xiajiang (N=221)
Institutional	81.9	69.3	48.3	70.6
ABC	8.9	3.6	6.6	1.8
RCC	71.4	10.9	35.0	63.8
Other	1.5	54.8 <sup>a</sup>	6.7	5.0
Noninstitutional	18.1	30.7	51.7	29.4
Relatives	11.2	20.7	40.0	23.5
Friends	1.9	8.5	10.0	3.6
Other farmers	5.0	1.5	1.7	2.3

Note: Unit of observation is loan transaction (not household).

a. Cash advances to cotton growers.

Source: Survey data.

Even if one considers the total, rather than just the current, borrowing activities of the households, participation in the informal market still appears relatively limited. Table 6-5 presents the relevant data. The percentage of households in the samples that have outstanding informal loans at the beginning of the survey period is, with the exception of Xiajiang, around 20 percent, comparable to the percentage of households that have taken out new informal loans during the survey period (table 6-4) and to the percentage of households that have outstanding informal loans. The percentage of households with outstanding informal loans is much higher in Xiajiang—47.5 percent. These statistics suggest that there are no dominant informal lenders in the villages and are consistent with the lack of concentration of wealth at the village level and the “mutual aid” nature of most of the informal loans.

Table 6-5. Total Informal Borrowing and Lending, by County

Item	Gongzhuling (N=200)	Tai (N=200)	Jurong (N=199)	Xiajiang (N=200)
Households taking informal loans (percent)	18.0	22.0	19.5	47.5
Average loan per borrowing household (yuan)	1,033	1,442	1,131	822
Households making informal loans (percent)	18.5	21.0	31.5	24.5
Average loan per lending household (yuan)	1,066	574	545	487

Note: New loans in the season surveyed are excluded.

Source: Survey data.

Table 6-6. *Loan Purpose by County and Type of Lender*  
(percent)

County and type of lender	Sample size (loans)	Production	Farm equipment	Construction	Consumption	Social occasion <sup>a</sup>	Other
<i>Gongzhuling</i>							
Institutional	212	93.0	4.0	2.0	0.0	1.0	0.0
Noninstitutional	47	11.0	4.0	23.0	15.0	26.0	21.0
<i>Tai</i>							
Institutional	57	89.0	2.0	4.0	0.0	0.0	5.0
Noninstitutional	25	36.0	0.0	32.0	0.0	20.0	12.0
<i>Jurong</i>							
Institutional	29	48.0	10.0	10.0	3.0	10.0	19.0
Noninstitutional	31	6.0	19.0	29.0	13.0	23.0	10.0
<i>Xiajiang</i>							
Institutional	156	67.9	3.8	5.8	1.3	6.4	14.8
Noninstitutional	65	33.8	1.5	26.0	9.2	20.0	9.5

a. For example, weddings and funerals.  
Source: Survey data.

Table 6-6 presents the distribution of loans by purpose and by type of lender. It is readily apparent that the predominant stated purpose of institutional loans is for the financing of current production. Only a small part of institutional credit is used for residential construction and social purposes such as weddings or funerals. Construction and ceremonial social events require large cash outlays that typically cannot be covered from the farmers' short-run cash flow. Institutional lenders in China, as a matter of policy, give low priority to such nonproductive purposes (World Bank 1988, p. 257). While in principle the farmers can divert institutional credit to such purposes (assuming that they can roll over such loans annually), the amount of a typical formal loan can cover at most a small fraction of the necessary costs. Informal loans contracted for these purposes, however, cannot be easily diverted to finance day-to-day consumption or production, because the lenders, mostly relatives and friends, expect to see the completed constructions and attend the social events. Because residential construction has been a popular undertaking among Chinese farmers since the 1979 reforms (Tam, 1988, p. 64), partly because it confers on the builders the rights to use the underlying lands indefinitely, it generates a significant derived demand for credit, which has mostly been met by informal lenders. Indeed, the predominant declared purposes of informal credit are residential construction and ceremonial social events. The low incidence of formal credit for farm equipment acquisition reflects in part low demand, because farms are rather small and do not justify investment by most individual households, and in part the limited availability of institutional credit for such purposes (World Bank 1988, p. 261).

The total *volume* of credit that is *not* earmarked for easily verifiable non-production purposes, such as residential construction and ceremonial social events, may be defined to be *fungible* credit, in the sense that it can be used for financing any expenditure, including ordinary recurrent production and consumption needs. The bulk of the *fungible* credit in the study areas comes from the *formal* sector, which accounts for 87 percent in Gongzhuling, 78 percent in Xiajiang, 67 percent in Tai, and 57 percent in Jurong.

### ***Structure of Maturities***

The purposes of the loans generally dictate their maturities. In Table 6-7, the structure of maturities of the loans is presented by the type of lender. Practically all the loans from institutional sources in the samples are granted for a short maturity—less than twelve months typically—within the production season. There are extremely few medium-term (thirteen to forty-eight months) and no long-term (over forty-eight months) institutional loans observed. This is consistent with known agricultural lending policies in China (World Bank 1988, p. 261). Informal loans in Gongzhuling and Tai

Table 6-7. *Maturities of New Loans, by County and Type of Lender*  
(percent)

<i>County and type of lender</i>	<i>Short-term (12 months or less)</i>	<i>Medium-term (13-48 months)</i>	<i>Indefinite or unknown term</i>
<i>Gongzhuling</i>			
Institutional (212 loans)	99.0	1.0	0.0
Noninstitutional (47 loans)	76.6	23.4	0.0
<i>Tai</i>			
Institutional (57 loans)	100.0	0.0	0.0
Noninstitutional (25 loans)	88.0	0.0	12.0
<i>Jurong</i>			
Institutional (29 loans)	89.5	3.4	7.1
Noninstitutional (31 loans)	32.3	3.2	64.5
<i>Xiajiang</i>			
Institutional (156 loans)	97.4	1.9	0.7
Noninstitutional (65 loans)	44.8	15.4	40.0

Source: Survey data.

are also mostly short-term, but there is a somewhat greater proportion of medium- or indefinite-term loans. In Jurong and Xiajiang, over half of the informal loans are of either medium or indefinite term. Loans with indefinite term are apparently rolled over from time to time, depending on the borrowers' ability to repay, as the transactions take place typically among relatives. The generally longer maturities of the informal loans reflect the fact that they are used to finance large lumpy expenditures such as residential construction and ceremonial social events that may take individual farm households a long time to repay.

### **Loan Security**

How are the loans secured? In the institutional sector, the expected revenue from the delivery of the grain quota is pledged as security in most of the loans in Gongzhuling. In Jurong, most of the institutional loans do not carry an explicit security, while in Tai both third-party guaranty and the expected cotton harvest are used as security. In Xiajiang, most formal loans are without collateral or guaranty, although 20 percent have expected agricultural output from the harvest as security, and in four cases, houses are used as collateral. The informal loans are by and large without any security, although a few instances of third-party guaranty are observed in the samples.



### Credit Constraints

An interesting question is the extent to which the supply of institutional credit is *adequate* to support the households' desired activities. Put differently, what proportion of households in our study areas would desire an increased allocation of institutional credit on the same terms? The survey data collected permit an answer to this question. Borrowing households were asked if at the going rates of interest they would have liked more institutional credit than the amount they were actually granted. Households that did not borrow were asked the reason for not borrowing. The most common reason for not borrowing was availability of sufficient own resources. Those borrowers who indicated the desire for more credit, and the nonborrowers who responded that they could not obtain credit, are classified as credit-constrained. Approximately a third of farm households in Gongzhuling reported being constrained by credit, compared to 11.5 percent for Jurong, 25 percent for Tai, and 25.5 percent for Xiajiang (see table 6-8). The extent of credit constraints is thus significant, though not overwhelming, in three of the four counties. The existence of credit-constrained farm households does suggest some degree of credit rationing by the financial institutions. It is worth noting that the Jiangsu counties, despite their considerably lower total volumes of formal loans than Gongzhuling, had fewer credit-constrained households in the formal market.

Credit is a derived demand. Households desire credit in order to make certain production and consumption expenditures as well as investments. To the extent that there are anticipated shortages of production inputs or consumption goods at the prevailing prices, the household demand for credit will be diminished. Table 6-9 provides one measure of the extent of supply constraints—the proportion of farmers in the samples who indicated that they were willing to pay “free market” prices or more, but were unable to obtain the desired quantities of chemical fertilizers, diesel fuel, pesticides, and herbicides. The supply constraints are evidently not severe in Gongzhuling (10 percent or less of the sample affected), where authorities place a high priority on maintaining the level of corn production. But in the two Jiangsu counties and in Xiajiang, supply constraints on input availability are significant: two-thirds of the Xiajiang respondents could not obtain enough diesel fuel and over half of the Jurong respondents could not obtain desired levels of fertilizers. This implies that the derived demand for production credit (formal or informal) must have been negatively affected in these counties, and additional credit would not have affected the use of inputs and hence the supply of output of most farm households in these counties. Credit constraints would probably have been more pronounced in the two Jiangsu counties and Xiajiang if aggregate supplies of chemical inputs were increased.

Table 6-8. *Extent of Formal Credit Constraints, by County*

<i>Category</i>	<i>Gongzhuling</i>		<i>Tai</i>		<i>Jurong</i>		<i>Xiajiang</i>	
	<i>Sample size</i>	<i>Percentage constrained</i>	<i>Sample size</i>	<i>Percentage constrained</i>	<i>Sample size</i>	<i>Percentage constrained</i>	<i>Sample size</i>	<i>Percentage constrained</i>
Borrowers	157	40.8	65	21.5	43	30.2	131	30.5
Nonborrowers	43	16.3	135	26.7	156	6.5	69	15.9
All	200	35.5	200	25.0	199	11.5	200	25.5

Source: Survey data.

Table 6-9. *Farmers with Unsatisfied Input Demand, by County*  
(percent)

Input	Gongzhuling (N=200)	Tai (N=200)	Jurong (N=199)	Xiajiang (N=200)
Fertilizer	10	14	54	24
Diesel fuel	10	29	33	67
Pesticide	1	23	32	23
Herbicide	1	26	27	29

Note: The numbers show the percentages of respondents who stated that they were not able to obtain the needed inputs even though they were willing to pay market prices or higher.

Source: Survey data.

Referring back to table 6-8, we can see that despite the supposedly easy institutional credit made available by the authorities, Gongzhuling had the highest percentage of credit-constrained households. Jurong, which ranks with Xiajiang as the counties with the most severe constraints on the availability of chemical inputs, has the lowest percentage. There appears to be an inverse relationship between unsatisfied credit demand and the shortage of inputs. Xiajiang has a percentage of credit-constrained households equal to that of Tai, which is less input-constrained, but that may well be attributed to 1988 being a year of much tighter credit and monetary policies.

Another factor that may affect the demand for credit is the degree of nonfarm activities. In the Jiangsu counties, off-farm employment is prevalent. On average, close to half of the income of Jiangsu households in the samples is derived from off-farm employment or nonfarm activities. In Gongzhuling and Xiajiang the proportions are much lower: 18 and 15 percent, respectively. The cash incomes from such nonfarm activities tend to be less seasonal and more stable than the incomes from farming activities, thus diminishing the need for borrowed liquidity. However, nonfarm activities can also be an important end use for credit. In Jurong and Tai, a significant portion of the nonfarm income was derived from nonfarm business activities, which might have increased the net demand for credit. There is some evidence in Tai that the credit constraint affected the level of nonfarm activities of the households. However, the financing of nonfarm business activities was not identified as a major purpose of either formal or informal loans.

Still another factor is farm size. Farm sizes are much smaller in the Jiangsu counties than in Gongzhuling (by a factor of four) and Xiajiang (by a factor of two). The demand for credit for working capital purposes by a Jiangsu household would thus be expected to be smaller, other things being equal.

An interesting question is whether political connections of the potential borrowers make a difference in the availability of loans from the RCCs. In the

Table 6-10. *Liquidity Indicators by County*  
(yuan per unit of operated land)

Item	Gongzhuling		Tai		Jurong		Xiajiang	
	Credit constrained (N=71)	Not constrained (N=129)	Credit constrained (N=50)	Not constrained (N=150)	Credit constrained (N=23)	Not constrained (N=176)	Credit constrained (N=51)	Not constrained (N=149)
1. Savings account	1.9	22.8	41.3	128.4	11.5	34.1	24.4	43.1
2. Cash	31.5	50.4	33.8	74.3	15.8	37.0	26.1	30.2
3. Inventory	34.9	39.0	27.2	42.4	38.2	35.0	41.9	52.2
4. Fungible formal credit	18.3	17.0	5.0	5.2	.5	5.1	24.5	18.8
5. Fungible informal credit <sup>a</sup>	6.9	1.2	5.6	3.1	10.6	1.6	21.0	4.0
6. Total fungible borrowing	25.2	18.2	10.6	8.3	11.1	6.7	46.6	22.8
7. Total liquid resources (excluding inventory)	58.6	91.5	85.7	211.0	38.4	77.8	97.1	96.1
8. Total liquid resources (including inventory)	93.5	130.5	112.9	253.4	76.6	112.8	139.0	148.3

a. Excludes loans for purposes that could be easily verified, such as construction, equipment, funerals, weddings, and the like. In Tai county, formal credit includes cash advances to cotton growers.

Source: Survey data.

survey, each household was asked whether anyone in the immediate family had ever had a leadership position in the local government or party organization. Using the response to this question as an indicator of the presence or absence of political connections, one cannot find any evidence that it has any effect on the loan supply behavior of the formal lender.

The incidence of default on formal loans is not known but is believed to be quite low. However, a significant proportion of the borrowing households have been late on the payment of interest or principal over the previous five years. There is some evidence from Gongzhuling that such prior tardiness on the part of a household decreases the probability that a loan will be approved by a formal lender.

Table 6-10 presents several indicators of liquidity, standardized per unit of land to control for differences in holding size among households. In all counties, households that are categorized as credit-constrained on average have substantially lower savings account and cash balances, on average. Other data, not presented here, show that the share of nonfarm income in the overall income of constrained households is lower. Since the liquid resources of the credit-constrained households are smaller than those of unconstrained households, one would expect them to borrow more.<sup>6</sup> This is indeed verified by line 6 of table 6-10, which shows that credit-constrained households borrow from 25 to 100 percent more than other households. Overall, the liquidity positions of unconstrained households are substantially higher than those of constrained households, as expected. All of this provides independent confirmation of the reliability of our classification of individual households as credit-constrained or unconstrained on the basis of their responses to the survey questions on desired borrowing. Econometric analyses for Gongzhuling by Feder, Lau, Lin, and Luo (1990 and 1992) indicate that an increase in production liquidity for the credit-constrained households would increase their output supply and input demands, and an increase in the amount of credit would increase their productive as well as residential investment.<sup>7</sup>

### **Summary**

From these findings, what can one generalize about the credit market in rural China? First, the evidence indicates that savings deposits still exceed loans by a margin of greater than two to one in the institutional sector, reflecting the deliberate government policy of transferring a substantial part of rural savings for use in other sectors. Institutional credit availability varies geographically, but there is no evidence that it is used as an instrument of income redistribution.

Second, the rates of participation in the formal and informal credit markets also vary from locality to locality, being somewhat higher in the formal

than in the informal market, but both are rather low in some areas. By comparison, rates of participation in informal transactions are higher in other low-income countries such as India (see chapter 9 and Binswanger and others 1985) and Thailand (see chapter 8 and Feder, Tongroj, Yongyuth, and Hongladarom 1988). In terms of volume, total informal debts outstanding are at least as high as total formal debts and are often considerably higher. However, informal lending and borrowing are still by and large among relatives and friends and without interest.

Third, the formal and informal credit markets are quite segmented and cannot in general be considered effective substitutes for each other from the point of view of potential borrowers. The formal loans are, by government policy, intended for the financing of current production. Consequently, they generally have a very short maturity—between one and twelve months. The informal loans are often tied to largely exogenous, lumpy, and highly visible special consumption purposes such as funerals and weddings, or to non-productive investment purposes such as the construction of residential housing. As such, they usually have a longer-term or indefinite maturity. Moreover, diversion of proceeds from formal loans to ceremonial consumption purposes or residential construction, while feasible, is by itself generally insufficient for such purposes; whereas diversion of proceeds from informal loans from their stated purposes to recurrent production and consumption purposes can be easily detected. No interest is generally charged on informal loans. This constitutes further indication of the nonprofit and “mutual aid” character of the informal credit transactions, which confers upon the informal lenders the moral authority to assure that the loans are used for their intended purposes. As a result, the informal loans are almost always used for their stated purposes and do not normally increase the net liquidity available to the farm household for recurrent production and consumption needs.

Thus, households that are constrained in the formal credit market, that is, whose demands for current production credit cannot be met there, cannot expect to have their unmet demands satisfied in the informal credit market. Likewise, households that are constrained in the informal credit market cannot expect to have their entire unmet consumption or non-productive investment credit demands satisfied in the formal credit market, even if formal credit is fungible, because of the relatively small amount of the typical formal loan. In the absence of a commercially oriented informal credit market, the bulk of fungible credit in the rural areas is provided by the institutional sector. This differs from the situation in many other developing countries, where informal credit is more profit-oriented and the segmentation between formal and informal credit markets is less strict. In these developing countries, a much higher proportion of fungible credit tends to be provided by the informal sector.

Fourth, a significant, but not overwhelming, proportion of Chinese agri-

cultural households are found to be credit-constrained. The severity of the credit constraints might have been partially mitigated by the prevalence of input supply constraints: when inputs are unavailable on the market, the derived demand for credit falls. Thus, the more input-constrained farm households are less likely to be credit-constrained, given the same supply conditions on credit, and vice versa. Similarly, the shortage of building materials in the rural area will lower the demand for informal credit as it lowers the actual quantity of residential construction.

### **Reasons for the Underdevelopment of the Rural Credit Market**

The reasons for the underdevelopment of the rural credit market lie in both the supply and the demand sides (World Bank 1988, pp. 322–23). First, while there is an overall surplus of deposits over loans in the rural institutional sector, there is also a deliberate government policy, apparently successful, to limit the overall supply of loans to the agricultural households and to restrict the permissible purposes and the maturities. Currently, the only institutions, public or private, allowed to collect deposits are the rural credit cooperatives. Thus, the only alternative lies in the informal sector.

Second, the informal sector is by and large not motivated by profit, as it is in other developing countries. Past legal prohibition might be a factor: lending for profit may still be viewed negatively by some, for ideological reasons. The status of private lenders is not clarified legally, and they may not receive any official backing in the case of disputes. Moreover, collateral assets are not available to most farmers, because until very recently land leases were not officially transferable. In other developing countries, conditional pledges of land-use rights serve as a common security for informal credit (Stifel 1976). However, in China it is not clear that such transfers could be effected. They did not have official sanction at the time of the surveys, and since the land leases were granted without *quid pro quo*, it remains possible that they can be simply canceled. In the presence of information failures and the absence of effective enforcement mechanisms, most of the informal credit transactions observed are conducted between relatives and friends, where the motivation to lend is not profit, and the inducement to repay derives from the close social links between the parties (Ben-Porath 1980). The informal credit market is thus extremely segmented, with non-profit-motivated transactions taking place only within small circles of related households not open to outsiders.

Third, the fact that the endowments are approximately equal among the households may be another factor limiting both the supply and demand for credit. The total volume of loans that an informal lender can grant is in

general not very large. This, coupled with the fact that a significant (typically 20 percent) proportion of households are actually observed to lend, suggests that there may perhaps be too little potential market power for anyone to invest in the activity of information gathering on potential borrowers not already known. It is also significant to note that the poorer Chinese counties tend to have somewhat lower levels of informal lending activities.

As for factors that may diminish the demand for credit in China, one may first identify the relatively egalitarian distribution of initial endowments, given the number of workers and dependents. On average, households should have sufficient resources to support their own recurrent liquidity needs. Second, one may point to the production input supply system. In the absence of a free market in production inputs such as fertilizers and pesticides, some areas may receive input quantities (through the administrative distribution system) that fall short of the levels farmers would like to utilize at the prevailing prices, resulting in excess demand for fertilizers and other subsidized inputs. There are indications that farmers are willing to pay much higher prices for chemical inputs than those observed in the limited "free markets," yet they cannot obtain them. The unavailability of inputs diminishes the demand for production credit, other things being equal, which explains why the proportion of credit-constrained households is lower in counties with an ostensibly much lower aggregate supply of formal credit. Similarly, the unavailability of building materials also diminishes the demand for construction credit, which is mostly supplied by the informal sector.

Finally, there are some puzzles that cannot be adequately explained. First, it is not clear why there is relatively little informal lending for current production purposes, especially where a significant proportion of households are credit-constrained.<sup>8</sup> The lack of collateral is a possible factor. However, because most informal loans are among relatives and friends, it cannot be an important factor, especially since production loans are mostly short-term (recall that a significant proportion of informal loans are longer-term). Perhaps the explanation may lie in the one-time and often reciprocal nature of the ceremonial social events and the construction of residential housing, as compared to the ongoing, recurrent nature of working capital needs. One may be willing to help relatives and friends on a one-time basis, especially if reciprocity is expected, but may balk at providing indefinite continuing support.

Second, it is somewhat surprising that there is relatively little reported borrowing for nonfarm business activities, from either the formal sector (where such loans may be discouraged) or the informal sector, even where the proportion of nonfarm income is as high as one-half—for example, in the Jiangsu counties. Perhaps the nonfarm business activities, once established, generate more cash than they use, or perhaps they can be financed through



either the household's own resources or fungible credit if and when financing is necessary.

## Notes

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1. The effect of the availability of credit on output is examined in Feder, Lau, Lin, and Luo (1992). It is found that an increase in the availability of credit increases output.

2. While land and productive assets used in agriculture were distributed by the communes to their member households under the reform, the financial assets were, in general, not distributed.

3. The ABC was reestablished in 1979, after more than a decade in which it was absorbed by the People's Bank of China. Detailed discussion of the operations of the ABC and the RCC is provided in Tam (1988).

4. See, for example, the discussion in Feder, Lau, Lin, and Luo (1989).

5. The distribution of subsidized fertilizer is performed as a loan in kind, and no cash is collected from the farmer. The delivery of the fertilizer is registered in the credit cooperative as a loan, to be repaid after the harvest. Since most farmers wish to obtain fertilizers at the subsidized price, they become borrowers automatically even if they would prefer to pay cash.

6. The definition of borrowing utilized for this discussion refers to fungible credit, and it thus excludes credit that is earmarked for nonproduction purposes and the utilization of which for the purpose contracted can be verified. Credit in kind, such as fertilizer loans, is considered fungible, because the fertilizers can, in principle, be resold to other farmers.

7. See Feder, Lau, Lin, and Luo (1990).

8. This is true for all of the sample counties except Xiajiang.

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## 7

*Imperfect Information, Screening,  
and the Costs of Informal Lending:  
A Study of a Rural Credit Market  
in Pakistan*

*Irfan Aleem*

*Many governments have perceived the rural moneylender as usurious. This chapter takes a first step toward directly testing the validity of this view. In a study of services, costs, and charges of fourteen informal market moneylenders and their clients in Chambar, Pakistan, the chapter examines whether the high implicit interest rates charged reflect the actual costs of operating in that market. Estimates of the resource costs incurred by informal lenders for screening, pursuing delinquent loans, overhead, and cost of capital (including unrecoverable loans) suggest that lenders' charges are equal to their average cost of lending but exceed their marginal cost. This finding is consistent with the view that the informal credit market is characterized by excess capacity and monopolistic competition in the presence of imperfect information.*

CREDIT SURVEYS IN DEVELOPING COUNTRIES have generally noted that non-institutional lenders—moneylenders, traders, landlords, and so forth—charge interest rates far in excess of those charged on similar loans by institutional lenders such as banks.<sup>1</sup> The observed gap in interest rates raises a number of basic questions: Why is it not possible to arbitrage between the low-interest-rate institutional market and the informal money markets charging “usurious” rates of interest? More fundamentally, what determines

interest rates in the unregulated market, and why are they so high? One explanation for high interest rates is the problem of asymmetric information (that is, the lender has less information than the borrower about the latter's ability and willingness to repay a loan), with lenders expending resources to screen applicants and passing on the costs to borrowers. Yet it is rare to find evidence about the costs associated with screening and, more generally, about the effect of imperfect information on the behavior of credit market participants.

The objective of this chapter is to assess the costs incurred by noninstitutional lenders. The assessment is based on the author's survey of a rural money market in Pakistan that serves a market town and surrounding villages with a total population of approximately 2,400 farmers. I compare these costs with interest rates charged and advance the hypothesis that the evidence presented is consistent with Chamberlinian monopolistic competition as it applies to informal credit markets.

Imperfect information affects both the supply and demand sides of the informal credit market: first in its impact on the cost of lending, and second in enforcing product differentiation in cases where each lender has a relatively small number of customers.

When a potential borrower approaches a bank or a moneylender for a loan, it is impossible from casual observation to determine the risk involved in offering him a loan contract. Unlike the situation in other markets, the lender cannot sell loan contracts to every buyer that comes along, because this could easily lead to an increase in the riskiness of the loan portfolio that the lender would find unacceptable. The contract that the lender will offer, if he does make an offer, depends crucially on his assessment of the risk of default. The risk of default is dependent on, among other things, the borrower's credit history and the characteristics of the project he wishes to invest in. To overcome this informational problem, the lender expends significant time and resources on screening the loan applicant in an environment in which credit histories are not documented and pooled. The screening costs involved are further enhanced by moral hazard—any source of information has itself to be screened for reliability.

On the demand side, borrowers are not well informed about the terms under which loan contracts are available from individual lenders, because of such characteristics of informal credit markets as lack of advertising and a time-consuming and imperfect screening process by lenders. This enhances product differentiation in an environment in which the lender typically packages lending services with trading and marketing services.

The first section of this chapter describes the survey from which the data have been obtained. The second section outlines the difficulties faced by lenders in ascertaining the quality of loan applicants and actions taken to overcome the asymmetry in information. Besides providing information on

screening and its costs, this section estimates the total costs of the lending operation for informal lenders. The third section compares interest rates in the informal market surveyed with the costs of lending. The fourth section interprets the results and the extent to which they conform with the Chamberlinian model of monopolistic competition. The last section brings together the main conclusions of the analysis, including policy implications.

## **Background: Survey Profile and Context**

The evidence presented in this chapter is drawn from a broader theoretical and empirical investigation of the workings of credit markets in developing countries carried out by the author, which included a detailed survey of the literature and of the established facts about money markets in developing countries.<sup>2</sup> The empirical aspect of this investigation included an intensive micro-level survey covering supply and demand for credit in villages served by the market town of Chambar in Sind, Pakistan, during 1980–81.<sup>3</sup> The focus of the Chambar survey was the imperfections in the flow of information in credit markets.

### ***Survey Profile***

The often-imagined picture of a single village moneylender with monopoly power over clients in the village does not hold true in the Chambar context.<sup>4</sup> There are in fact a large number of informal lenders serving farmers in the Chambar area. Every village in the area does not have an informal lender. Instead, informal lenders tend to gravitate toward and concentrate in the market town, Chambar, and in some of the larger of the sixteen villages in the area served by Chambar and lying within a five-mile radius of the market town.

Of the sixty informal lenders estimated to be operating in the area, fifteen were based in Chambar, another fifteen were spread among the three largest villages, and the remaining thirty were based outside the market area, including twenty lenders based in urban centers located twenty to fifty miles from Chambar. The survey covered sixty borrowers (farmers) and fourteen noninstitutional lenders operating in the area under study. Borrowers were randomly selected for interviews using multistage stratified sampling.

Interviews with informal lenders were more difficult largely because of concerns that information so obtained might end up with the government. Out of the sixty informal lenders operating in the Chambar area, fourteen were selected for the individual interviews, which lasted approximately three hours each. The selection was not entirely random because it depended on the availability of personal introductions to these lenders. More lenders were

prepared to give interviews but were excluded because of time constraints. Interviews were carried out with the understanding that the interviewees would not have to provide information on interest rates charged; information on the costs of borrowing was obtained from the demand side.

A number of institutional sources of credit, primarily banks, were also present in the Chambar area, accounting for approximately 25 percent of the loans transacted in the 1980–81 period. Their operations were also reviewed, but the focus of the study was the noninstitutional market.

Chambar lies on the east bank of the river Indus, approximately 180 miles north of Karachi. It lies in an irrigated area where multiple cropping is practiced (with cash and subsistence crops being grown in alternative seasons) and high-yielding varieties of crops have been successfully introduced. A striking feature of the rural economy is the seasonal (and uncertain) nature of the farmers' cash flow. The seasons exert a strong influence on the demand for credit because there is a considerable time lag between the time that expenditures are incurred on farm inputs, such as fertilizers, and the crop is harvested and sold. This is reflected in market transactions: not only farm inputs but also food, clothing, and sometimes even medicines and doctors' services are purchased on credit to be paid off at harvest. Seasonal demands have an important bearing on the farmer's credit needs in the area and account for almost 50 percent of his total demand for credit.

### **Comparing Chambar with Other Credit Markets**

The market environment and structure in Chambar are consistent with key characteristics widely observed in credit markets in other developing countries. These include:

- *Duality or segmentation in market structure.* As has been observed in other countries, a highly regulated and nationally integrated institutional market with uniform and relatively low rates of interest coexists with an informal market that charges a widely dispersed set of relatively high rates.
- *Lack of specialization by informal market intermediaries.* Although the players and nature of the loan contract in the institutional market are well defined, informal commercial lenders come in various guises (traders, moneylenders, shopkeepers, landlords, and so forth) and are characterized by nonspecialization, with the typical informal lender combining credit with trading in crops and selling general merchandise.
- *Interlinking of loan and commodity contracts in informal markets.* Associated with the nonspecialized nature of the informal lender is the interlinking of loan and commodity contracts: only a limited number of loans were given in the conventional form of outright loans to be

repaid in cash with interest. In general, at least one end of the loan transaction involved the delivery of commodities, with the loan either extended or repaid in kind.<sup>5</sup> The cost of borrowing was the rate of interest when this was explicitly agreed upon. In the majority of cases, however, the cost of borrowing had to be estimated from the terms of commodity transactions reported by farmers in the demand component of the survey. For example, if the farmer paid 15 percent extra for purchasing pesticides on a three-month credit, the implicit annual interest rate after compounding was 75 percent. A similar calculation was carried out to estimate the charge and the implied interest rate on loans against which the farmer had agreed to a specific discount on his cotton crop, which he sold to the lender. For details of calculations in more complex transactions, see Aleem (1985).

- *Dominance of noninstitutional or unorganized money markets.* As in many other developing countries, noninstitutional sources of credit still dominate the market for credit, accounting for approximately three-quarters of the loans extended in the area, as indicated above.
- *Limited access of smaller borrowers to institutional credit.* Although the evidence is not unambiguous, the results of the survey suggest that, as in most developing countries, larger borrowers have greater access to institutional credit than their smaller counterparts.
- *Absence of security in loan contracts given by informal lenders and the relatively low risk of default.* Informal lenders generally give unsecured loans but face far lower risks of default than institutional sources, who normally lend against collateral but rarely foreclose.

## Screening and Lending Costs in a Market with Imperfect Information

### *Screening of Loan Applicants: Significance and Procedures*

Informal lenders operating in the Chambar area expend considerable effort to obtain information about loan applicants to reduce the risk of default. Because of the legal problems and associated high costs involved in selling land—the most common asset that farmers can put up as collateral—there were no practical alternatives open to lenders other than a careful screening process. One indication of the consequences of providing loans without adequate screening is the default rates in excess of 30 percent experienced by some of the institutional lenders operating in the area, although other factors, such as corruption and political pressure, also contributed to the problems.

Table 7-1. Steps Used by Fourteen Noninstitutional Lenders to Screen Loan Applicants

Lender	Assessing the applicant's previous dealings with the lender over one or more seasons (A)	Asking the applicant to provide references or personal sureties from persons known to the lender (B)	Making inquiries of other farmers in the applicant's village and in the market (C)	Visiting the applicant's farm (D)	Testing the applicant by giving a small initial loan (E)	Was lender prepared to consider applicants who had not gone through step A?	Location of customers within the Chambhar market <sup>a</sup>	
							All over the market area	Concentrated in specific villages
1	1 (one season)		2	3	4	Usually not	X	
2	1 (one season)		2		3	Never	X	
3	1 (one season)		2	3	4	Never		X
4	1 (two seasons)	2		3	4	Yes	X	
5	1 (two seasons)			2	3	Yes	X	
6	1 (two seasons)	2 <sup>b</sup>	3		4	Usually not		X
7	1 (one season)		2		3	Usually not <sup>c</sup>		X
8	1 (one season)	2 <sup>b</sup>	3		4	Usually not <sup>c</sup>		X
9	1 (two seasons)	2 <sup>b</sup>	3			Usually not		X
10			1	2	3	Yes		X
11	1 (one season)		2		3	Usually not <sup>c</sup>		X
12	1 (one season)				2	Usually not <sup>c</sup>		X
13	1 (two seasons)	2 <sup>b</sup>	3		4	Yes		X
14	1 (one season)		2	3	4	Usually not	X	

Note: The numbers in this table correspond to the sequence of steps undertaken by the lender.

a. Lenders located outside the market area (defined as a five-mile radius around Chambhar) had customers both inside and outside the market.

b. Only for applicants who had not gone through step A. (In one instance the lender also wanted gold as collateral.)

c. The exceptions in these cases were farmers who were living in the same village where the lender operated and whom he knew well.

Source: Survey data.



Table 7-2. *Costs of Obtaining Information about Loan Applicants and Some Screening Statistics*

Lender	Resources allocated to obtaining information on average loan applicant		Lenders experiencing a decrease in the cost of screening over time?	Average rate of rejection of loan applicants (percent)	Lenders prepared to give loans to farmers borrowing from other lenders as well?	Percentage of repeat borrowers in 1980 summer season
	Time (days)	Expense (rupees)				
1	3.0	20	Yes	75	No	82
2	0.5	0	Yes	50	No	78
3	2.0	50	Yes	80	No	83
4	1.0	30	Yes	50	No	67
5	0.5	0	Yes	75	No	60
6	1.0	50	Yes	20	No	91
7	0.0	0	Yes	10	Yes	80
8	0.0	0	Yes	20	No	67
9	0.5	0	Yes	90	No	83
10	2.0	100	Yes	70	No	100
11	2.0	30	Yes	25	Yes	85
12	0.0	0	Yes	20	Yes	52
13	0.5	20	No	60	Yes	85
14	1.0	20	Yes	70	No	75

Note: The rupees-to-dollar exchange rate was 9.9 (1981).

Source: Survey data.

Tables 7-1 and 7-2 give the salient features of the long process used by the fourteen noninstitutional lenders to screen loan applicants, including resources employed and average rejection rates. Although there is considerable variation in the methods used by individual lenders, there are some important common features. First, the lender generally does not entertain loan requests from farmers who have not had previous dealings with him, for example, in the sale of harvested crops or the purchase of farm inputs. These dealings, over at least one season, provide important information about the farmer, including his likely marketable surplus and the way he conducts business. Second, most lenders make further inquiries—both in the market and of farmers in the applicant's village who are known to the lender—about the applicant's indebtedness as well as his reputation in the market. Third, if the farmer satisfies the lender's requirements in the first two stages, he gets a small initial loan for one season for a further assessment before he can count on the lender to satisfy all his legitimate credit needs. The average successful applicant takes, on average, two seasons (approximately one year) to get to this stage.

Table 7-2 shows that the costs of screening are substantial—on average, screening costs one day of the lender's time and Rs20 (\$2.02) in transporta-

tion expenditures—despite the fact that many of the lenders had been operating in the area for periods in excess of five years and had virtually all experienced a learning curve effect. Variations from the average cost of screening can be attributed to the length of time that the lender has been operating, his market strategy—for example, he could concentrate on borrowers from a specific village or villages, as did some of the lenders who had the lowest rejection rates (10–25 percent), or he could have a diversified clientele from both Chambar and the adjoining areas—and the tradeoff the lender accepted between spending resources on screening and accepting a higher risk of default. The cost of screening, which ultimately has to be borne by the successful applicants, is magnified by the high proportion (on average, more than 50 percent) of applicants who were rejected by the lenders interviewed.

It should be noted that rejection of applicants was not significantly linked to the nonavailability of loanable funds; eleven of the fourteen lenders interviewed indicated that they could cope with an increased demand for funds by drawing from other lenders from outside the Chambar area (see the discussion below on the marginal cost of funds).

The high rejection rate has important implications for a farmer thinking about changing his source of informal credit and moving to a new lender: if the long screening process was not a sufficient deterrent, then the relatively small chance of success should certainly make him think twice.

### ***Screening and the Risks Facing Noninstitutional Lenders***

Table 7-3 outlines the risks facing the informal lenders operating in the Chambar area. It is clear from the table that the main risk facing the noninstitutional lender, whether his base is urban or rural, does not arise from nonrecovery. On average, the cumulative rate of default (defined as percentage of loans due that had not been recovered since the lender's inception of lending operations) was 2.7 percent, with twelve out of fourteen lenders experiencing a default rate of 5 percent or less. The cumulative rate of default is a good first approximation of the incidence of bad debt. Given the possibility that some of the more recent overdue loans may eventually be recovered, the cumulative rate of default is, if anything, an overestimation of nonrecoverable debt. It is therefore fair to conclude that the screening actions of the informal lenders are successful in limiting bad debts, especially taking account of the experience of institutional lenders and the fact that virtually all informal loans are unsecured (see table 7-3).

However, the screening process is not perfect. Delinquent loans, involving late payment, were a constant source of concern to the informal lender. As shown in table 7-3, lenders face a significant risk of loss from delinquent loans: on average 15 percent of all loans were delinquent with a delay of

Table 7-3. Risks Facing the Noninstitutional Lender: The Possibility of Nonrecovery and Delinquency (Delay in Repayment)

Lender	Percentage of due loans that had not been recovered since the inception of lending operations	Percentage of loans against which collateral is taken, and type of collateral	Percentage of loans repaid after due date	Average delay (months)	Percentage of delinquent loans on which no interest is charged for period of delay	Conditions under which additional interest is waived <sup>a</sup>	Was lender prepared to give extra loans to farmers facing crop failure?	Average time spent chasing each overdue loan (days) <sup>b</sup>
1	1	5 (gold)	25	3	50	(A)	Yes	2-3
2	10	0	20	6	50	(B)	Yes	2-3
3	1	0	25	4-6	40	(A)	No	2
4	0	0	15	6	100	(D)	Yes	3-4
5	3	0	15	6	100	(D)	Yes	2
6	1	0	5	6	60	(B)	Yes	5
7	2	0	20	6	100	(D)	Yes	2-3
8	5	0	20	6	100	(D)	Yes	0
9	1.5	2 (land lease or gold)	8	6	50	(C)	Yes	5
10	1	0	12	6	33	(C)	Yes	5
11	0	0	5	3	100	(D)	Yes	0
12	7	10 (gold)	10	6	100	(C)	Yes	5
13	3	0	20	12	50	(C)	No	2
14	2	0	15	3	50	(C)	No	2

a. (A) "Farmer in financial difficulty—for example, through crop failure." (B) "Exceptional or unavoidable circumstances." (New lender.) (C) "Return of principal is itself at risk" (that is, something is better than nothing). (D) "Always waived" (lenders explained that while no charge was levied on late payment, those who did not have a genuine reason were excluded from future loans).

b. This does not apply to the small credits extended to sharecroppers, which were, according to the lenders, not worth running after.

Source: Survey data.

approximately six months, and over this period interest was waived on 70 percent of these.

### ***Screening and Other Components of Loan Administration Costs***

Because there is little paperwork involved and no collateral, the main cost elements involved in administering a loan for the informal lender are in screening loan applicants and chasing up delinquent loans. Costs hereafter are cited per Rs100 lent (the average rupee-to-dollar exchange rate for 1981 was 9.9). The cost of handling commodities exchanged as part of a loan contract is assumed to be covered in the price of the commodity (these costs would have to be covered in a cash sale as well). Estimates of the costs of administering loans are made on the basis of a valuation of the time and resources allocated to managing a loan from application through recovery. The marginal and average costs of screening, in particular, and of loan administration, in general, are considered separately below.

*Marginal costs of screening and loan administration.* Table 7-4 shows the makeup of the marginal costs of loan administration for the fourteen lenders interviewed in the survey. The key assumptions used in the analysis include the time period and loan size over which screening and other administrative costs are spread, and the valuation of the lender's time. First, it is assumed here that the lender wishes to recover his screening costs from the marginal loan of six months' duration (one season). Screening costs should really be spread over all the loans that the borrower is expected to take; as revealed by table 7-1, on average 78 percent of customers are repeat customers, implying that the average borrower remained a repeat customer for approximately four periods, beyond which the farmer generally moved to another lender or left the market until he again needed to borrow funds. Hence the assumption that the lender wishes to recover all screening costs from the marginal loan assumes that the lender heavily discounts the future and makes the figure for marginal screening costs per Rs100 lent to the farmer, if anything, an overestimate.

Second, the relative amount of the charge for screening and other administrative costs depends on the size of the loan over which costs are spread. In this analysis it is assumed that on the margin the size of loan given by an individual lender is the same as he has been giving on average; there was considerable diversity in the average size of loan, and it appears that different lenders were catering to the needs of farmers with different amounts of land.

Finally, an important assumption implicit in the calculations relates to the valuation of the lenders' time. If lending was the only business activity and

Table 7.4. *The Marginal Cost of Administering a Loan per Rs100 Lent*

Lender	Resources allocated to obtaining information about loan applicants		Expected time to chase overdue loans (days) <sup>a</sup>	Opportunity cost of the lender's time (rupees) <sup>b</sup>	Expected cost for lender of administering marginal loan	
	Time (days)	Expense (rupees)			Time and resources (rupees) <sup>c</sup>	Percent <sup>d</sup>
1	3.0	20	0.63	18,000	229.42	19.01
2	0.5	0	0.50	13,200	42.31	4.51
3	2.0	50	0.50	24,000	242.31	20.32
4	1.0	30	0.53	15,000	103.56	6.01
5	0.5	0	0.30	18,000	46.15	7.85
6	1.0	50	0.25	18,000	122.12	2.45
7	0.0	0	0.50	7,800	12.50	0.50
8	0.0	0	0.00	10,800	0.00	0.00
9	0.5	0	0.40	36,000	103.85	4.20
10	2.0	100	0.60	18,000	250.00	1.67
11	2.0	30	0.00	7,200	76.15	15.82
12	0.0	0	0.50	9,600	15.38	2.07
13	0.5	20	0.40	10,000	48.85	1.63
14	1.0	20	0.30	18,000	95.00	5.49
	Mean					6.54
	Standard deviation					6.83

Note: The rupees-to-dollar exchange rate was 9.9 (1981).

a. The expected time cost of chasing overdue loans estimated as the average time spent on each overdue loan times the percentage of loans that is expected to be repaid after the due date (table 7-3).

b. Expected annual wage in employment. Average in the case of a number of partners.

c. Value of the lender's time and resources allocated to administering an average-size loan from application through to recovery. Value of time based on opportunity costs and 312 working days per annum.

d. Costs estimated in previous column expressed as a percentage of marginal loan and compounded to give effective annual rate, because the marginal loan is assumed to be given for six months.

Source: Survey data.

the lender had excess capacity (in the sense of time available for administering more loans), then the marginal cost of his time would be zero (neglecting any disutility of work). If he is carrying out other activities as a means of reducing business risk through diversification (the most frequently given reason for nonspecialization), then there is an opportunity cost to his time depending on his gain from these activities. The survey established that lenders are carrying out other activities, but that their profitability was less than that of the lending operation. No measures of the profitability of these other activities were available, however. In fact, it could be argued that providing loans may actually increase the incentive for borrowers to purchase (or sell) commodities from (or to) the lender, thereby increasing his other activities and the gain from them. In the latter situation, the opportunity cost of the lender's time devoted to the marginal loan could be negative. Absent other information, it has been assumed that there is a displacement of other activities and the opportunity cost of his time is estimated according to what the lender expected to earn in paid employment.

To the screening costs (columns 1 and 2 in table 7-4) is added the time cost of chasing delinquent loans. The costs are then compounded to give an effective annual charge. The final column in the table gives the expected cost of administering the marginal loan as a percentage of the loan's value. The mean for the group is 6.54 percent, with a standard deviation of 6.83 percent. The main reasons for dispersion in the estimated costs are variations in the intensity of screening and the foregone wage.

*Average costs of screening and loan administration.* The major problem in estimating average administration costs is the treatment of joint costs—overhead and variable costs between lending and other activities carried out by the informal lenders. The allocation of administration costs to the lending operation depends on the assumption regarding the lender's main activity, if any, and the dependence of the activities on each other. In table 7-5, loan administration costs have been estimated using two alternative assumptions. If lending is considered the primary activity and other activities considered either relatively minor or complementary to it, then it may be reasonable to allocate all administrative costs to the lending operation. This is the assumption made in columns 2-4 of table 7-5. In column 5, however, it is assumed that lending is a joint activity carried out in parallel with other trading activities, such as buying and selling crops and the sale of farm inputs and provisions. Trying to allocate overhead and operational costs in these circumstances is difficult. In the table these costs have been allocated according to the time allocated to various activities by the lender.<sup>6</sup> The average cost for the group is Rs49.52 (with a standard deviation of 50.2), using the assumption that lending is a primary activity. This estimate

Table 7-5. The Average Annual Costs of Administering a Loan per Rs100 Lent (rupees)

Lender	Average amount outstanding over the year (thousands of rupees) (1)	Assuming lending is the primary activity			Assuming lending is a joint activity, administration costs <sup>d</sup> (5)
		Variable costs <sup>a</sup> (2)	Overhead <sup>b</sup> (3)	Administration costs <sup>c</sup> (4)	
1	89.5	7.92	23.15	31.07	15.54
2	42.0	13.33	74.29	87.62	61.33
3	132.0	7.65	23.64	31.29	25.03
4	226.4	12.19	14.31	26.50	23.85
5	14.5	46.90	157.24	204.14	163.31
6	293.5	8.18	8.79	16.97	11.03
7	197.5	8.51	8.51	17.02	9.36
8	72.5	21.52	16.55	38.07	28.55
9	180.0	10.67	20.00	30.67	26.07
10	6,000.0	6.40	6.60	13.00	7.80
11	19.0	11.58	56.84	68.42	61.58
12	22.0	27.27	48.18	75.45	71.65
13	172.5	18.09	18.09	36.18	21.70
14	195.0	5.64	11.28	16.92	15.23
Mean				49.52	38.72
Standard deviation				50.20	41.40

Note: The rupees-to-dollar exchange rate was 9.9 (1981).

- Wages to employees, business travel, stationery, and entertainment.
- Opportunity cost to the lender (and any active partners) and rent of shop and warehouse.
- Sum of variable and overhead costs.
- Costs allocated to lending according to the proportion of the lender's time spent on this activity.

Source: Survey data.

declines to Rs38.72 (with a standard deviation of 41.4) when it is assumed instead that it is a joint activity.

It should be noted that both estimates of average costs are closely associated with the scale of the lending operation and decline sharply as the latter increases. As a corollary, there is a large variation in average costs reflecting in large part the considerable variance in the size of the average annual amount loaned by individual lenders, as shown in column 1 of table 7-5. The variation in the size of the loan portfolio is in large part a reflection of variation among lenders in the size of clientele: the number of borrowers per lender varied from 10 to 180, with an average of about 40 for the group of lenders interviewed. Thus the high and widely dispersed level of average costs results from the relatively small number of borrowers per lender and

the significant variation in the number of borrowers per lender. Estimates of the average costs of administration also depend on the opportunity-cost assessment of the lenders' time, which is the dominant component of overhead costs. An evaluation of the original survey results suggests that the assessment of their own opportunity wage by the lenders in the survey, although subjective, was realistic within the context of prevailing labor market opportunities available to them.<sup>7</sup>

### ***Other Costs of Lending***

The remaining costs of the lending operation are captured in the estimated charge on capital. This is made up of the following components: the opportunity cost of funds, a premium for bad or unrecoverable debt, and interest lost on delinquent loans. Table 7-6 shows the buildup of the capital charge on the margin and on average. This table shows that for the marginal loan, the mean capital charge for the fourteen lenders was 38.8 percent (with a standard deviation of 10.64 percent), whereas on the average loan the corresponding figure is 27 percent (with a standard deviation of 9.5 percent).

*The cost of funds.* The main reason for the high capital charge is the high (opportunity) cost of funds facing the informal lender. The marginal cost of funds, according to data obtained directly from the fourteen informal lenders, is quite high. It ranges from 20 to 50 percent, with an average for the group of 32 percent. The figures for marginal cost of funds were obtained in response to a specific question in the primary survey.<sup>8</sup> In most cases these figures reflected the cost of getting marginal funds from other informal lenders. The survey revealed that, on average, approximately half of the funds used by the informal lender come from his own savings, 30 percent from institutional sources, either directly or indirectly (from cotton mills, wholesalers, and so forth who have direct access to such funds), and the remainder from other informal lenders as well as from clients who use him as a safe deposit (at zero interest) for surplus cash. The use of institutional funds by informal lenders reveals that they are actively involved in arbitrage between the two segmented markets.

If own funds are priced at the marginal opportunity cost of funds (as is the case in table 7-6), then the average cost of funds ranges from 10.4 to 42.5 percent, with a mean value for the group as a whole of 23 percent. (If own funds were priced at the prevailing bank rate of 10 percent, then the average cost of funds would be significantly lower. The marginal cost of funds, however, is probably a better measure of the opportunity cost of own funds to the informal lender in the conditions existing in Chambar at the time of the survey.)



Table 7-6. *Other Costs of the Lending Operation: The Capital Charge per Rs100 Lent*  
(rupees)

Lender	Marginal cost of capital			Marginal capital charge (1) + (2) + (3)	Average cost of capital <sup>a</sup>
	Marginal cost of funds (1)	Bad debt (2)	Interest lost on delinquent loans (3)		
1	36	3.0	1.13	40.13	30.08
2	20	10.0	1.00	31.00	20.92
3	40	3.0	2.01	45.01	23.16
4	36	0.0	2.70	38.70	34.83
5	24	9.0	1.81	34.81	20.85
6	40	3.0	0.60	43.60	39.57
7	20	2.0	2.00	24.00	19.60
8	50	15.0	5.00	70.00	51.75
9	30	4.5	0.60	35.10	25.98
10	30	3.0	0.60	33.60	24.05
11	40	0.0	0.50	40.50	16.20
12	25	7.0	1.25	33.25	22.75
13	30	9.0	3.0	42.00	26.87
14	25	6.0	0.48	31.48	20.75
Mean				38.80	26.95
Standard deviation				10.64	9.48

Note: The rupees-to-dollar exchange rate was 9.9 (1981).

a. Sum of bad debt, delinquency costs, and cost of funds—all on an average basis.

Source: Survey data.

*Premium for bad debt.* The premium for bad debt on the marginal loan has been derived from data presented in table 7-3. As argued above, the cumulative rate of default is a good first approximation of the cost of unrecoverable loans, and these are included in table 7-6 in the estimation of the average capital charge. The cumulative rate of default ranges from 0 to 10 percent, with a mean value for the group of 2.7 percent. The cumulative rate of default is a reasonable approximation of the cost of default on an average loan, but it does not provide an assessment of the risk facing the lender at the margin—from new borrowers—which is likely to be higher. An assessment has been made by considering the risks facing lenders who have recently entered the market. The default rate they faced was two to three times the average for the group. The marginal risk for the more experienced lenders (those who had been in the market more than two years) has been estimated at three times their average risk; the estimates on the expected marginal rate of default range from 0 to 15 percent, with a mean value for the group of 5.3 percent. If anything, this is likely to be an overestimate, as is

the case with the other component of marginal costs discussed above, namely screening costs.

*Interest lost on delinquent loans.* Estimates have also been made of the interest lost on delinquent loans. This is the additional interest accrued (but not recovered) beyond the original due date of the loans (see table 7-3). The marginal charge for expected loss on interest payments has been estimated in table 7-6 at the lenders' marginal cost of funds and ranges from 0.48 to 5 percent, with a mean of 1.62 percent. The cost of this component in an average loan is included in the estimation of the average capital charge. It ranges from 0.2 to 4.25 percent, with a mean of 1.2 percent.

### Total Costs of Lending

The structure of total costs for the loan operation of the group of informal lenders surveyed is summarized in table 7-7. The first column gives the total marginal cost per Rs100 of loans recovered. It is the sum of the expected cost

Table 7-7. Structure of Total Costs for the Lending Operation per Rs100 Recovered (rupees)

Lender	Total marginal cost	Total average cost	
		Lending the primary activity	Lending a joint activity
1	60.97	61.77	46.08
2	39.46	120.60	91.36
3	67.34	55.00	48.68
4	44.71	61.33	58.68
5	46.88	231.95	189.86
6	47.47	57.11	51.11
7	25.00	37.37	29.55
8	82.35	94.35	84.53
9	41.15	57.51	52.84
10	36.36	37.42	32.17
11	56.32	84.42	78.05
12	37.98	105.59	101.51
13	47.95	65.00	50.07
14	39.33	38.44	36.71
Mean	48.09	79.20	67.94
Standard deviation	14.58	40.78	40.52

Note: Because the costs are allocated per Rs100 recovered rather than lent, they will exceed the sum of administration and capital costs shown in tables 7-5 and 7-6. The rupees-to-dollar exchange rate was 9.9 (1981).

Source: Survey data.

of administering the marginal loan (see table 7-4) and the marginal capital charge (see table 7-6), with the total adjusted for the fact that losses from bad debt have to be recovered from loans that are recovered. The mean is 48.1 percent with a relatively high dispersion (standard deviation of 14.6 percent). The last two columns give two estimates of the average total cost of the lending operation per Rs100 of loans recovered. These latter estimates have been derived from tables 7-5 and 7-6. The first of these two columns assumes that lending is the primary activity and this reveals estimates of average costs with a group mean of 79.2 percent and a standard deviation of 40.8 percent. The second assumes lending to be a joint activity, at par with other business operations being carried out by the informal lenders, and this leads to lower estimates of average total costs, with a group mean of 67.9 percent and a standard deviation of 40.5 percent.

### **Interest Rates and the Cost of Intermediation: A Comparison**

Average and marginal costs are compared with each other and with observed interest rates in table 7-7. Interest rates shown in the table represent the cost of borrowing, at an annual rate, on loans given during the year before the survey by informal commercial sources and are based on the terms agreed between the farmer and the informal lender at the time of the loan. These rates were derived from demand-side data that included loan contracts with the rate of interest explicitly agreed upon, as well as credit transactions involving sale and purchase of commodities with an implicit cost of borrowing (that is, implicit interest rates) built into the transaction, as discussed above. The figures in table 7-8 show that on an annual basis, the average cost of borrowing from informal sources was 78.7 percent. Although 78.7 percent represented the average rate charged by commercial sources in the informal market, there was a large dispersion in the cost of borrowing from these sources, as reflected in the standard deviation of 38.1 percent, with rates ranging from a low of approximately 18 percent (still well above the 12 percent rate charged by banks) to a maximum of 200 percent.

It is clear from the tables that estimates of average costs (whether one considers lending to be the main or a joint activity) are higher than estimates for marginal costs. If lending is considered to be the primary activity, then average costs exceed marginal costs for thirteen out of the fourteen lenders in the survey. Alternatively, if lending is perceived as a joint activity, then estimates of average costs exceed corresponding figures for marginal costs in ten cases out of fourteen. In either circumstance, marginal cost pricing would lead to losses for the large majority of lenders. In comparing marginal and average costs, it should be noted that for reasons discussed in the

Table 7-8. *Comparing Costs and Observed Interest Rates per Rs100 Recovered*

Item	Marginal cost	Average cost		Interest rate
		Lending the primary activity	Lending a joint activity	
Mean	48.09	79.20	67.94	78.65
Standard deviation	14.58	40.75	40.52	38.14

Note: The table gives the costs facing the informal lenders and the interest rates they charged. The rupees-to-dollar exchange rate was 9.9 (1981).

Source: Survey data.

previous section, it is likely that marginal costs have been overestimated. This implies that the divergence between marginal and average costs could be greater than indicated in table 7-8.

As far as the comparison between average costs and interest rates is concerned, the results support the view that interest rates are equal to average costs, but not unambiguously. If lending is considered the primary activity, then the mean average cost for the group is virtually identical to the interest rates observed in the market. If lending is assumed to be a joint activity, however, then a gap does emerge between costs and rates. The statistical significance of the gap between the mean values of the observed market rates of interest and the estimated average cost cannot be estimated because of the nonrandom nature of the supply-side information; absence of random sampling on the supply side raises the possibility that many of the smaller, higher-cost suppliers may have been left out. Another possibility that has been evaluated elsewhere is the use of weighted averages instead of the unweighted means given in table 7-8. Using weighted as opposed to unweighted means increases the gap between interest rates and average costs, but does not alter the qualitative conclusion that average costs of lending exceed marginal costs.<sup>9</sup>

## Interpretation of Results

The evidence presented above appears to be consistent with the classic Chamberlinian model of monopolistic competition as applied to informal credit markets. Each lender, because he does not specialize, offers a wide range of lending services that vary in terms of the types of loan contract, accessibility to the lender, marketing services provided with the loan, and so forth. As confirmed by demand-side interviews in the survey, each lender in this environment is perceived by borrowers to be offering a different prod-

uct; thus each faces a downward-sloping demand curve, which gives him some flexibility to price according to his own circumstances. Equilibrium in this model involves a distortion in the market: there are too many lenders in relation to the size of the informal credit market. With overhead spread over a relatively small number of loans, interest rates are forced up, above marginal cost, to cover average costs. Further, equilibrium is characterized by a dispersion in prices (interest rates); if interest rates are to cover average costs, then in the circumstances described above, not only will the level of rates be raised but they will be spread over a range. The key characteristics of the model are that prices are close to the average costs of lending and above marginal costs, there is relatively free entry into the market, and there is product differentiation.

### ***Interest Rates, Costs, and Market Distortions***

Although the evidence is not unambiguous, it is tempting to accept the hypothesis that interest rates are close to the average costs of lending and above marginal cost in the circumstances existing in the Chambar market. Indeed, a number of empirical questions that have been raised can be answered only by more (empirical) research regarding, in particular, the opportunity cost of lenders' time and the extent to which lenders' activities are complementary or competitive. If one accepts the observed levels of opportunity costs facing the informal lenders as realistic, however, then even the relatively weak assumption that lending is a joint activity leads to the tentative conclusion that average costs are higher than those at the margin. This implies that, in the long run, the desire to at least cover costs will lead to distortions in the market, with prices above marginal costs. In the study, the author was surprised at the large number of lenders operating in the small market area. If this is a long-run norm, then lenders have no choice but to charge relatively high rates in order to cover costs from a small clientele. This observation of "too many lenders" is not unique to the Chambar market. Similar observations have been made in studies of credit markets in other countries.<sup>10</sup>

There is a link between pricing distortions in informal credit markets and the government's policy regarding interest rates on institutional loans. As noted above, on average, approximately 30 percent of the informal lender's funds come directly or indirectly from low-cost institutional sources. Indeed, a major benefit to the lender from nonspecialization was the access that trading activities gave him to low-cost and subsidized institutional credit. To the extent that the availability of such subsidized credit allows the marginal lender to remain in the market he previously could not stay in because of the small size of his clientele, the policy of subsidizing institutional credit helps to support the distortion in the informal market.

### ***Market Entry***

One of the main assumptions behind the Chamberlinian model is that of free entry. Conditions in the Chambar market are broadly consistent with this assumption. The relative ease with which a large number of lenders (some of whom were urban-based) were operating successfully in the market supports this assertion. Indeed, two of the lenders interviewed had moved into the area within the past eighteen months to two years. Information about the creditworthiness of clients is a barrier to entry. The ease with which new lenders were able to enter the market and the number of lenders operating in the area, however, suggest that the problem can be partially surmounted by incurring higher screening costs in initial years.

### ***Product Differentiation and the Role of Information Flows***

Although the environment (as described above) is supportive of product differentiation, it is unlikely on its own, without accompanying informational problems, to cause the large variations in interest rates that were observed in the survey. Imperfections in the flow of information (or more specifically the technology of information flows, including the screening process) contribute to and strengthen product differentiation.

There are two key imperfections in the flow of information in the market that enhance product differentiation. First, on the supply side the screening process carried out by lenders is imperfect. Second, on the demand side, although farmers have a good idea about the location of various sources of credit, they are not well aware of the terms of the loan contracts offered by individual informal lenders. Because of these imperfections the lender does not have an incentive to cut interest rates in order to increase his market share, even when rates are well above his marginal cost of lending. In part this was because of imperfect information available to farmers about the terms on which loan contracts were being sold in the market. This imperfection implied that a lowering of interest rates was a signal that would filter through to only a limited section of the market. Part of the reason farmers were poorly informed was the wide dispersion in noninstitutional rates, unlike the uniform rates charged by banks, which were well known. At the same time information on the demand side appeared to flow less readily than in other markets. Lack of advertising, the farmer's reluctance to reveal his indebtedness to others, and the presence of loan contracts with the rate of interest not explicitly defined (and hence difficult to estimate and compare) were all contributing factors.

Even when borrowers became aware of a cut in rates by an informal lender, they would think twice before moving from their existing sources of credit. The problem was again one of information. Farmers were discour-

aged from applying by the long screening process involved, especially because they were uncertain about its outcome and the terms that they would eventually be offered, and they did not wish to jeopardize their relationship with their existing lender. Given the uncertainty about eventual terms, farmers felt that they could end up being worse off than with their existing lender; borrowing from multiple sources was usually precluded by the lender's requirement that the farmer market all his harvested crop through the lender. As a reflection of similar concerns and the extent of the monopoly power enjoyed by lenders, nearly two-thirds of the farmers interviewed said that they would have problems in obtaining credit if their current lender were to refuse to give them a loan.

On the supply side, information problems can prevent the lender from benefiting from any increased demand that follows a cut in interest rates. As indicated above, unlike in other markets, the lender cannot sell contracts to anyone that comes along, for this could easily raise losses from bad debt. But if he tries to separate out the high risks, the lengthy nature of the screening process means that he risks losing to his competitors the advantage gained from the initial cut in interest rates.

## Conclusions

This chapter has presented information derived from a survey on the costs of screening loan applicants in a particular setting—a rural money market in Pakistan—together with the costs and mode of operation of noninstitutional lenders active in the area. It is rare to get such detailed information on the costs and performance of informal lenders, and more specifically on the flow of information in the market, including the process of screening. This information has been used to derive the structure of costs facing informal lenders, including both the marginal and average costs of lending. These costs were then compared with the high and widely dispersed interest rates that were observed in the market. The evidence, although not unambiguous, provides tentative support for the hypothesis that interest rates in the market reflect the average costs of lending and are above marginal costs.

The above results (interest rates are close to average costs and above marginal costs) together with other information about the structure of the market (relatively free entry) and demand conditions (product differentiation) are consistent with the Chamberlinian model as applied to rural credit markets. Equilibrium in this model involves a distortion in the market: there are too many lenders in the market in relation to its size, and with fixed costs spread over a relatively small amount of lending, interest rates are forced up above marginal costs in order to cover average costs. Such an environment is also consistent with the high and widely dispersed interest rates that were

observed in the market. Informational imperfections—the imperfect nature of the screening process on the supply side and borrowers' lack of awareness of loan terms available from specific lenders—give rise to product differentiation.

In the short term it will be difficult to reduce the problem of imperfect information through, for example, such actions as enforcing laws to advertise the terms of loan contracts offered in the informal money markets. Policy can have an effect, however, on the structure of institutional interest rates. The above analysis suggests at least two effects of reducing the subsidy on these loans. First, given that a significant proportion (30 percent) of the funds available to the informal lender came from institutional sources, raising interest rates would raise the opportunity costs of funds for informal lenders, and some of the higher costs will be passed on to borrowers, thus dampening the demand for credit in informal markets. Second, it would discourage further entry into the informal money market (on the margin of lenders who would otherwise not be able to lend), and this could ameliorate the problem of "too many lenders" with its inherent inefficiency.<sup>11</sup>

## Notes

1. For references and a review of recent surveys, consult Aleem (1985, chap. 1).
2. See Aleem (1985) for a detailed literature survey. A flavor of the literature can be obtained also from Bottomley (1975), Ghatak (1975, 1983), Iqbal (1988), and Bliss and Stern (1983).
3. Survey data are available for a nominal reproduction charge upon written request to the author.
4. See, for example, the evidence on monopoly presented in Chandavarkar (1965); see also evidence presented in Bliss and Stern (1983).
5. It should be noted that, although interlinking of loan and commodity contracts has been observed in many developing countries, its dominance in Chambar may also be partly because of the conformity of this type of traditional contract with local social values. Islam, the main religion practiced in Chambar, does not prohibit return of risk or profit on a commercial contract. But the conventional loan involving a prearranged fixed rate of interest was considered un-Islamic. There was a clear preference to avoid interest payments, although the prohibition did not deter farmers from seeking low-cost bank loans, which at the time of the survey carried an explicit rate of interest. See also chapter 5.
6. For information on time allocation by the lender between credit and other activities, see Aleem (1985, table 20-A). Trying to allocate overhead in the described circumstances is difficult. Using time as a basis for allocating costs is the only reasonable approach within the constraints imposed by available information.
7. See Aleem (1985, p. 249).
8. See Aleem (1985, table 19).
9. See Aleem (1985, table 7).



10. Harriss (1983, p. 240) asks the rhetorical question: "Why are there so many small traders?" Her explanation of the "relative crowding" is, however, different from the reasons given in this chapter and is based on broader socioeconomic factors.

11. For discussion of inefficiency, see Salop and Stiglitz (1977).

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## 8

*The Thai Rural Credit System  
and Elements of a Theory:  
Public Subsidies, Private Information,  
and Segmented Markets*

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*Thailand has sought to increase farmers' access to credit by government intervention. In 1966 it created a government agricultural bank to lend solely to farm households, and beginning in the mid-1970s it required commercial banks to lend heavily in the rural sector, either directly or by making deposits in the agricultural bank. The result was an enormous expansion of credit in the sector. But because formal lenders were either unable or unwilling to solve the information problems involved in the broad range of rural credit transactions, the informal credit sector (which charged interest rates many times higher than the formal sector) continued to thrive. Using household surveys and surveys of moneylenders, this chapter provides a detailed analysis of the ways in which lenders in the informal sector have solved the information problems of providing credit. The authors argue that the informal sector is competitive, and that high interest rates reflect high information costs, not the scarcity of funds.*

THIS CHAPTER REPORTS ON A SET of investigations of the impact of Thai government policies to expand bank lending in the rural sector. Their pur-

pose was to increase farmers' access to capital and reduce their dependence on informal lenders. Fifteen years after the principal government measures were introduced, we hope to be able to answer several questions: How has the expansion of formal sector lending affected the informal sector? Did the increase in the supply of formal credit reduce the business of informal lenders and lower interest rates in the informal market? What has been the performance of the formal credit system in terms of coverage, efficiency, and incidence?

Lacking time-series data on the informal sector, we cannot give a direct answer to these questions. But we can with confidence say that the informal lenders are still very much alive. By examining the behavior of the rural credit market at the present time, we can throw an indirect light on what transpired over the last fifteen years.

Our main findings are the following:

- Based on our 1984–85 survey of households and moneylenders, credit from the banking system and cooperatives provided 40 percent of the total credit reported, compared with roughly 10 percent in 1975. But it is impossible to determine whether the absolute volume of informal lending has increased or decreased in the past fifteen years. Almost 75 percent of those active in the credit market still used the informal sector; in many cases, those households also used the formal sector during the survey period. The persistence of the informal sector is due to the rich variety of contractual relations that enable informal lenders to solve information problems that are currently beyond the reach of the banks and cooperatives.
- The formal sector has evolved a very cost-effective method of channeling credit to the rural sector through its peer monitoring system. But loans provided under this system are only short-term and reach primarily above-average income farmers. The credit needs of poorer farmers are still served by the informal market or not at all.
- Neither the formal sector nor nonresident informal lenders appear able to provide consumption loans needed in periods of bad harvests or low output prices. Resident lenders, however, are not adequate for the task because their financial state covaries with their borrowers'.
- Nominal interest rates in the informal sector have been remarkably stable over time, at least for the last two decades. Inflation rates have fluctuated, with spikes in the oil-shock years, and the real interest rates have been correspondingly affected. Otherwise, however, the inflation rates have remained below 10 percent in most other years and have tended to remain below 5 percent. There has therefore been very little secular trend in real interest rates in the informal markets.

From our analysis of the Thai rural credit market, we draw the implica-

tion that mere injection of funds into the rural areas does not lower informal sector interest rates or drive informal lenders out of business; funds are not the scarce factor. The injection of funds into the Thai rural credit market after 1976 did not achieve its objective of providing low-cost funds for most credit needs, although it was successful in the (very important) market for working capital. Despite repeated attempts, the Bank for Agriculture and Agricultural Cooperatives (BAAC) has been unsuccessful in expanding its scope of activities. A successful formal credit program that can compete with informal lenders over a broad range of their activities requires innovations in institution-building to compete with the mechanisms in place in the informal rural sector for solving the information and enforcement problems that lending entails.

This chapter is in seven sections. After describing our data sources we analyze the structure of the rural credit system and the rich variety of ways in which different lenders solve their selection, monitoring, and enforcement problems. We present results of a regression analysis of informal interest rates. In a brief critique of the theoretical literature, we argue that the extant theoretical tools, which focus on contractual relations between anonymous lenders and borrowers, do not fit the highly personal informal market in Thailand. We then propose an alternative model of the informal credit market. In our concluding section, we comment on the efficiency and distributional consequences of the Thai government policies for rural credit.

## Data Sources

Available secondary sources provide consistent information only on formal sector credit activities. For our study, we undertook three new surveys—two surveys mostly in Nakhon Ratchasima (NR) Province and one survey in six provinces across Thailand. NR Province, although officially a part of the impoverished Northeastern region, is close to the Central Plains and therefore somewhat more prosperous than its Northeastern neighbors. It is also Thailand's largest province and has within its borders a wide variety of physical and socioeconomic environments. The scope of our three studies was as follows:

- *Fifty-two-village household survey, NR Province, 1985.* The survey covered the economic activities of 1,600 rural households, including their borrowing activities but not their lending activities. The latter were excluded, because we felt that to raise such sensitive issues in a questionnaire would endanger the quality of the data in other areas as well.
- *Six-village survey of moneylenders, NR Province, 1984–85.* We sent six researchers to live in six villages for about six to eight weeks, using

informal methods to analyze in depth the social relations and the borrowing and lending activities within the villages and with people outside. This approach enabled the research team to identify the major lenders inside the villages and to gain their confidence. Two principal researchers then interviewed these lenders in depth to gauge their *modus operandi*. At no time did we attempt to get a precise measure of the size and turnover of these lenders' activities—the price we gladly paid to get valuable information that would not have been available otherwise.

- *National survey of informal interest rates, fourteen villages in six regions of Thailand, 1987.* To obtain information on regional variations in rural interest rates in the informal credit market, enumerators lived for two weeks in each village and administered a survey questionnaire to a total of 293 randomly selected borrowers and 37 lenders in the last five days of their stay.

### **Structure of the Thai Rural Credit Market**

The main factor separating formal from informal lenders is that the former are generally bureaucratic organizations within which there could be problems of monitoring and control. Informal lenders tend to be individuals or husband-and-wife teams. In our surveys we came across only one category of lender that was difficult to classify—sellers of durable goods on the installment plan. In many but not all instances, these are large-scale, bureaucratically run companies. We chose to treat them as informal lenders. This particular choice was convenient because it grouped together in the informal sector all lenders who receive no subsidies, and into the formal sector all subsidized lenders to rural households.

### ***Historical Overview of the Formal Sector***

Since 1916 the government of Thailand has experimented with different institutional frameworks to provide cheap credit to the rural sector. The method usually employed was to encourage farmers to set up credit cooperatives to which the government would provide loans, with the regular government agencies responsible for disbursing to and collecting from the cooperatives. Typically the default rate would be high and the finance would dry up after a few years. In 1966 the government created the BAAC, a specialized financial institution and a public enterprise under the Ministry of Finance to provide loans directly to farm households as well as to the cooperatives.<sup>1</sup> Between 1966 and 1974, the BAAC grew at moderate speed and succeeded in

establishing branches in fifty-eight out of Thailand's seventy-one provinces (Mingmaneeakin 1988, p. 123).

Radical changes took place in 1975. The 1973 departure of a military-dominated regime had ushered in a more democratic government. The countryside was the scene of intense struggles for the proverbial "hearts and minds" between the Bangkok government and the Communist Party of Thailand. The new democratic government was under pressure to transfer resources to the rural areas. In August 1975, in the middle of the planting season for most major agricultural crops, the Bank of Thailand sent a memorandum to all commercial banks, requesting each bank to lend to farm households an amount equal to at least 5 percent of its total stock of loans and advances outstanding at the end of 1974. Should any bank find it impossible to lend the full amount, it was to make a twelve-month deposit of the remaining sum with the BAAC.<sup>2</sup>

At the same time, the BAAC was ordered to expand its loan portfolio to 3.5 billion baht from the level of 2.65 billion baht lent out in 1974 (Mingmaneeakin 1988, p. 84).<sup>3</sup> Thus both the commercial banks and the BAAC found themselves suddenly having to extend a vast amount in new loans to farmers. The commercial banks, particularly the smaller ones, were unable to meet the new lending requirements. The BAAC consequently received substantial deposits from them and had to expand its operations very quickly (see column 8 of table 8-1). The rural credit system was entirely transformed by this policy.

After 1976, the commercial banks' required lending to farm households was gradually increased until it stabilized in 1979 at 11 percent of total deposits. This requirement appears to make the commercial banks the key source of funds for the agricultural sector. The official figures in table 8-1 show, for example, that at the end of 1984, commercial banks' direct loans to farm households were 70 percent higher than the BAAC's. Of the BAAC lending, 45 percent was financed by the commercial banks.

However, the official figures exaggerate commercial banks' direct lending to farm households. The central bank's monitoring of the quasi-regulation it imposed on the commercial banks is extremely lax. The central bank follows up on the implementation of its policies not by audits, but only through occasional general studies. The central bank's approach is in line with the position that it has maintained all along, namely, that this measure is enforced through "moral suasion," not regulation. Commercial banks have found it prudent to go along with this pretense, because the central bank has considerable discretionary power in many other areas—for example, in the number of new branches each of them may open.

The consequence is that the commercial banks have tended to include more loans under the agricultural category than would be warranted by a strict definition of the term. The size of the exaggeration may be gleaned

Table 8-1. *Activity of Commercial Banks and the BAAC in Agricultural Loans, 1975-85*  
(millions of baht)

Year	Commercial banks							BAAC total agricultural loans (8)
	Target (1)	Percentage of deposits (2)	Direct lending <sup>a</sup> (3)	Deposits with BAAC (4)	Total agricultural loans (5)	Central bank deposits <sup>b</sup> (6)	Excess or shortfall <sup>c</sup> (7)	
1975	4,333	5	2,234	1,671	3,904	0	-429	4,556
1976	6,139	7	3,810	3,161	6,972	0	833	6,555
1977	9,647	9	5,892	4,528	10,420	0	773	8,280
1978	11,771	9	8,100	5,511	13,611	0	1,840	10,208
1979	17,322	11	9,970	6,330	16,300	0	-1,022	11,699
1980	19,209	11	11,553	7,000	18,553	1,230	-655	13,448
1981	23,649	11	14,562	7,804	22,366	1,230	-1,283	15,208
1982	28,294	11	20,140	8,405	28,546	1,096	252	17,014
1983	35,330	11	28,613	8,806	37,419	765	2,089	18,271
1984	44,341	11	35,915	9,535	45,450	657	1,109	21,079
1985	53,820	11	37,727	10,685	48,412	0	-5,408	23,309
1986	60,348	11	39,682	11,113	50,795	0	-9,553	n.a.

n.a. Not applicable.

a. Excluding loans to agribusinesses.

b. In 1980, commercial banks were unable to lend the required amount to farmers and the BAAC was willing to accept only part of the shortfall for deposit, so the banks were required to deposit at the Bank of Thailand.

c. Derived from columns 5 plus 6 minus 1.

Source: Bank of Thailand, cited in Satsanguan (1988, p. 90).

from our statistical survey of NR Province, which shows that in April 1985, the outstanding debt of rural households to the BAAC was higher than that owed to the commercial banks in the ratio of 4:3. The absolute figures for the BAAC loans to farmers according to the BAAC and according to our sample survey are of the same order of magnitude. The figures submitted by the commercial banks to the Bank of Thailand, however, show the amount owed to them by agricultural households (a narrower category than rural households) of NR Province to be more than *twice* that owed to the BAAC, and about *twice* what our survey indicates (Poapongsakorn 1988, p. 26). In one of its studies, the Bank of Thailand, tracing from the actual transactions classified as agricultural loans by the banks, estimates the degree of exaggeration to be roughly 25 percent (cited in Satsanguan 1988, p. 115).

Aside from the exaggeration of the relative importance of the commercial banks as a result of sheer misreporting, there is also an exaggeration of its impact in terms of the number of farm households affected. In our survey, the average size of the commercial banks' loans was three times as large as the BAAC's (see table 8-2). The number of rural households with BAAC loans was higher than that with commercial bank loans in the ratio of 4:1 (see table 8-3).

The BAAC also lends to cooperatives. Despite (perhaps because of) considerable efforts put into these institutions by the government and lately by the BAAC, the performance of the credit cooperatives has always been poor. The default rate was high, and therefore the number of farmers reached dwindled rapidly after the initial flush of lending. From our statistical survey of NR Province, during 1984-85 cooperatives disbursed 20 percent of the amount

Table 8-2. *Loan Size per Transaction, Nakhon Ratchasima Province, 1984-85*  
(baht)

<i>Category</i>	<i>Amount</i>
<i>Formal sector</i>	11,000
BAAC	8,480
Commercial banks	23,462
Cooperatives	8,348
<i>Informal sector<sup>a</sup></i>	6,360
Cash loans	6,986
Suppliers' credits	1,246
Installment loans	21,965

*Note:* Data are from a survey of 1,600 rural households in fifty-two villages.

a. Excludes loans of less than 100 baht (US\$4), which are mostly loans contracted when food and household goods are purchased from a general store on credit, with repayment due at harvest time.

*Source:* Poapongsakorn (1988, p. 35).



Table 8-3. *Characteristics of Household Borrowers and Nonborrowers in Nakhon Ratchasima Province, 1984-85*

<i>Item</i>	<i>Number of households</i>	<i>Average assets (baht)</i>	<i>Average gross income<sup>a</sup> (baht)</i>	<i>Average net income per capita (baht)</i>
<i>Borrowers</i>				
Borrowing from formal sector only	43,743	188,697	45,558	4,141
Borrowing from informal sector only	88,145	126,754	30,626	3,171
Borrowing from both sectors	26,671	204,702	47,673	4,413
<i>Nonborrowers</i>				
Unable to borrow	4,670	116,927	25,016	2,583
Unwilling to borrow	111,976	145,022	32,400	4,094
<i>Source of loan in formal sector</i>				
BAAC	31,272	191,109	45,105	n.a.
Commercial banks	7,902	202,298	82,890	n.a.
Cooperatives	11,521	198,538	34,545	n.a.
Farmers' associations	430	268,945	27,058	n.a.
Others	1,580	109,164	50,367	n.a.

n.a. Not applicable.

Note: Data are from a survey of 1,600 rural households in fifty-two villages.

a. Income gross of farm production costs. This measure is useful when considering demand for credit.

Sources: Poapongsakorn (1988, p. 204); Tubpun (1988, pp. 8, 10).

borrowed by NR farm households from formal institutions. Almost all of the funds for these loans came from the BAAC (Poapongsakorn 1988, p. 33).

### ***Informal Lenders***

Despite the enormous expansion of formal credit after 1975, informal lenders continue to do thriving business. Their share of total loans given out has indeed declined from roughly 90 percent to 50 percent, but it is impossible to determine whether the absolute volume of their lending has increased or decreased. The decline in their market share seems to have occurred in every region of the country (Siamwalla 1989, pp. 197-98; Poapongsakorn and Nettayarak 1988, p. 15). Our own survey in NR Province indicates that of the households who reported some borrowing or repayment activity during 1984-85, 72.4 percent borrowed from the informal sector, accounting for 56.0 percent of the amount borrowed.

Informal lenders are very thick on the ground. In our fifty-two village

survey, each village headman was asked to give the total number of resident or outside lenders who are known to lend to the villagers. The modal number of lenders resident in the village is three, and the modal number of outside lenders is two (Siamwalla 1989, p. 234).<sup>4</sup> A question addressed to each resident lender as to the number of borrowers in his clientele yields numbers that range from one to forty-five borrowers, with the average loan portfolio being 36,000 baht (or US\$1,440) per lender (Poapongsakorn and Nettayarak 1988, pp. 41-44). The portfolio of nonresident lenders, particularly the traders, would of course be much larger because they lend to many villages, but we had no way of obtaining this number. The size per transaction in the informal sector is typically much smaller than in the formal sector, although this is not true of installment loans (table 8-2).

Table 8-4 classifies informal lenders by occupation and residence. About one-fourth of informal credit in the sample villages was supplied by nonresidents and, of that, most was supplied by traders. As shown in column 2 of table 8-4, over one-fourth of loans were interest-free. Such loans are between relatives and close friends and probably contain an implicit exchange component.

### ***Sorting of Borrowers across Lending Sources***

The above account gives the structure of the credit system as it would appear to an outsider. From the borrower's point of view it would look quite different. Whereas the data thus far presented may suggest a high degree of competitiveness among lenders, in fact most borrowers are unable to use multiple sources of informal loans or to easily switch from one lender to another. Of the households surveyed in NR Province who reported some borrowing from the informal sector, about five-sixths reported that they borrowed from only one informal source. Many of these also borrowed from formal sources, but as we shall argue below, formal and informal lenders are noncompeting.

A more telling set of figures comes from our national survey. Seventy-two percent of the informal sector borrowers in that survey reported that they had not attempted to borrow from other informal lenders during the past three years. Creditworthiness in relation to an individual lender takes considerable time to build up; the average period of contact involving credit transactions reported by these 72 percent was close to seven years! Switching of lenders does take place, but it has to be done slowly and may involve some costs and risks to the borrower.

More importantly, borrowers do not have equal access to all credit sources, particularly to those in the formal sector. Table 8-3 shows how borrowers appear to be sorted by wealth and income.<sup>5</sup> Forty-two percent of households do not report any credit transactions at all during the survey

Table 8-4. *Characteristics of Lenders in the Informal Credit Market in Nakhon Ratchasima Province, 1984-85*

<i>Lenders' occupation</i>	<i>Number of contracts (thousands)</i>	<i>Percentage of contracts interest-free</i>	<i>Total volume of loans (millions of baht)</i>	<i>Share of total (percent)</i>	<i>Size per transaction (baht)</i>
Resident farmers	66.4	36.4	394.6	32.6	5,945
Resident traders	25.9	22.5	135.7	11.2	5,240
Resident salaried individuals	20.5	23.1	204.1	16.9	9,970
Resident rentiers	3.8	26.6	39.9	3.3	10,425
Temple funds <sup>a</sup>	1.6	45.6	17.4	1.4	11,455
Nonresident farmers	6.3	11.8	55.9	4.6	8,882
Nonresident traders	31.1	1.6	209.5	17.3	6,740
Nonresident salaried individuals	1.7	0.0	19.4	1.6	11,455
Nonresident rentiers	0.9	0.0	1.4	0.1	1,524
Illegal trusts <sup>b</sup>	1.9	0.0	14.6	1.2	7,792
Unknown	13.2	36.3	117.4	9.7	8,870

Note: Data are from a survey of 1,600 rural households in fifty-two villages. Figures are blown up to province level.

a. Temple funds are set up after a collection among villages and loaned out at low interest rates.

b. Illegal trusts are partnerships of traders in market towns. They sometimes accept deposits. Trusts are supposed to be registered with the Ministry of Finance. These do not do so.

Source: Poapongsakorn (1988, p. 128).

period, and these include the poorest group in the villages. We did ask an admittedly vague question of these households: whether the reason they did not borrow was because they were unable to borrow or because they did not wish to borrow. Only a small minority, whose mean income is lower than those who were able to borrow, reported that they wished to but were unable to borrow. It is not clear whether the households that reported they had no wish to borrow (a) knew that a request for credit would be turned down by all lenders; (b) knew that they would be turned down by the formal sector, whose terms they were willing to accept, but were unwilling to borrow from the informal sector, whose terms they considered too onerous; or (c) really did not need to borrow at all. The mean income figure of this particular group in table 8-3 indicates that reason (b) is probably the dominant explanation.

Table 8-3 also shows the mean levels of assets of households who succeeded in obtaining loans from various sources. Well-to-do farmers are more

apt to obtain credit from formal sources. Households that borrow from the commercial banks in particular clearly belong to the richest strata.<sup>6</sup> That different strata sort themselves in this fashion is not a choice of the borrower but, as we shall indicate in the next section when we discuss how lenders solve their information problems, it is the result of sorting by lenders.

### How Do Lenders Solve Their Information Problems?

The size of rural loans in both the formal and informal sector is typically small, on the order of 10,000 baht (US\$400) (see table 8-2). Recourse to the state judicial system to enforce contracts would be absurdly uneconomical. The most important consideration facing a lender is therefore to ensure that the borrower will perform according to his contract. One can imagine him trading off among (a) a strict collateral requirement, (b) a stringent vetting of the borrower prior to making a loan, and (c) the use of third-party guarantees or peer monitoring. Measures (a) and (b) could be supplemented by (d) a strong effort in following up on a debt, sometimes with ex post penalties and rewards tailored to repayment performance. Lenders mix the various modes of enforcement in different proportions corresponding to their comparative advantage. Since the ease of implementing modes (a) through (d) also varies across potential borrowers, the result is a sorting of borrowers across lenders. Each of these modes takes on a variety of forms, and we describe the most important ones below.

*Collateral.* Eighty-seven percent of commercial bank loans and 43 percent of cooperatives' loans were backed by collateral (Mingmaneeakin 1988, p. 107). The sphere of operations of commercial banks and cooperatives therefore has been almost exclusively in villages where land titles have been issued (Tubpun 1988, pp. 55, 66-69).

Long-term loans from nearly all sources, including informal lenders, involve the use of land as collateral. The main exception is installment purchases, where the goods purchased are themselves the collateral. In cases where land title exists, farmers generally find little problem obtaining long-term loans, particularly from the commercial banks.<sup>7</sup>

The use of collateral is also central to the modus operandi of the illegal trusts.<sup>8</sup> A would-be borrower from one of these trusts obtains his loan by bringing in his land title and signing over the power of attorney to the trust's lawyer that enables him to dispose of the land, should the occasion require.<sup>9</sup> Loans are usually given for about one-quarter of the value of the land for a period of six months. Late payment results first in a fine of 100 baht (US\$4) a day, followed, if need be, by forfeiture. The only information required for such transactions is the quality of the land. Most of these trusts require only that the land submitted as collateral be in the same or a neighboring district.

*Vetting of the borrower prior to making a loan.* Resident informal lenders, of course, have a natural comparative advantage in screening loan applicants and ensuring loan performance. Those who live in the same village as their borrowers are aware of the goings-on inside the village and can evaluate the risks of each borrower better than any outside bureaucratic organization can. They reinforce these advantages through other means. Many operate a small general goods store, thereby creating a center for village gossip, which they can hear without much effort.<sup>10</sup>

*Peer monitoring.* The BAAC has a peer monitoring system for working capital loans with maturity of less than one year (about 75 percent of its annual loan disbursements). These loans are given to groups of eight to fifteen farmers. The group is jointly liable for each member's loan. Before the first loan is given out, and during the growing season of the crop as well, the bank's officer goes to the borrowers' village to examine their activities.

The most stringent requirement imposed by the BAAC is its refusal to roll over any working-capital loans. All borrowers are required to repay the principal when the loan falls due, even though, in the vast majority of cases, both the bank and the borrowers expect the loan to be recontracted within a month after borrowing. There is consequently a secondary credit market, with funds provided by informal lenders at a 10 percent monthly interest rate to enable farmers with liquidity problems to tide over this particular gap. The BAAC is fully aware of the existence of this secondary market, yet it insists on the ritual repayment. According to its management, this is its way of ensuring performance.

The BAAC has a preference for better-off farmers. This fact, together with the requirement that the group has to be a minimum size, effectively limits who is able to borrow from the BAAC. This is because group members themselves do not wish to have as their colleague anyone who will represent a bigger risk than they themselves will pose. The consequence is that a village whose mean income is one standard deviation above the mean of all villages has a 21 percent higher probability of having a BAAC group than a village whose average income is equal to the mean for all villages (Tubpun 1988, p. 53).

*Trade-credit interlinkages.* The most important enforcement mechanism used by a nonresident trader appears to be the requirement that borrowers sell their output to him. Failure to do so is considered tantamount to default, even if the borrower repays the money on time. The insistence on this trade-credit linkage makes the information on the size of the borrower's operations (and their changes) available to the creditors and to no one else. Trade-credit linkage thus closes the borrower's access to other lenders.<sup>11</sup> Interestingly, most nonresident traders prefer their borrowers to settle accounts at the

time of the harvest and have very little debt carried over from one season to the next.

Nonresident traders solve the problem of screening borrowers by relying on agents. An individual who wishes to borrow from a trader has to be introduced by someone whom the lender knows. If the trader wishes to expand his clientele, he engages an agent from among the villagers to recommend prospects to him. In return, the trader provides the agent an interest-free loan.

*Spot transactions as a substitute for credit.* One type of farmer who finds it difficult to borrow from nonresident traders is the cassava grower, for the simple reason that cassava, unlike other crops, can be harvested any time between four and fourteen months after planting. Without a fixed harvesting period, the enforcement problem becomes very difficult. Generally, cassava growers faced with liquidity problems can obtain credit only by selling outright the standing crop, subject to some conditions on the harvesting date when the land reverts back to them. An active market in standing crops exists in cassava-growing areas—and only in such areas.

*Interlinkage between the credit and land rental market through "usufruct loans."*<sup>12</sup> A common reason for borrowing in northeastern Thailand is to finance migration for work in foreign countries, particularly in the Middle East. Because fraudulent practices among labor contractors who arrange such migrations are widespread, these investments are quite risky.<sup>13</sup> For those with land, however, usufruct loans sometimes provide a neat solution to their problems—these are loans in which a borrower allows the lender to occupy and make use of his land until the principal is repaid. The borrower may not reoccupy the land until at least a stipulated minimum of two or three years has elapsed. The reason given for this condition is that the yield risk for two or three years' production is less than for one year. This sort of loan is free of default risk. It is used particularly by those who intend to emigrate from the village.

*Deposit of land title with the lender.* Standard practice when the size of a loan approaches 10,000 baht (US\$400) is for the borrower to deposit his land title with the lender. The deposit of title has no legal significance but prevents the debtor from borrowing a substantial sum from another source or from selling the land to a third party.

The devices just discussed alleviate the selection, monitoring, and enforcement problems arising from a credit transaction. In Thailand we also found evidence of interlinked credit transactions that were intended to solve information problems arising in labor and output markets. In these cases, credit was

an instrument for a forward transaction that would otherwise have been highly uncertain.

*Credit as an instrument for forward transactions in labor or output markets.*  
We provide three examples:

(a) The Thai sugar industry, located mostly in the Central Plain, imports an estimated 84,000 workers from the northeast during the harvesting season (Busayawit 1978, pp. 20–21). To obtain this labor, employers advance 5,000–10,000 baht (US\$200–400) to a village recruiter, who will then contact another ten to fifty fellow villagers, passing on part of the advance money two months before the harvest. If a group has already been working with the employer, its leader would get the advance as soon as the group completed the previous harvest (Poapongsakorn 1988, p. 77). The laborers would then come to work at the same rate as those who are recruited from the vicinity without any such advance.

(b) Cassava harvesting requires a few days' work in succession but, unlike the case of sugarcane above, the time of the harvest is highly unpredictable since it depends on cassava prices. In recent years cassava prices have fluctuated a great deal over short periods. To ensure that labor is available when needed, large cassava farmers will retain a laborer by giving him access to credit involving extremely small sums (100–300 baht or US\$4–12), needed for immediate subsistence purchases. The wages paid are again not affected by whether the laborers have borrowed. The loan is in this sense interest-free. As a quid pro quo, the borrower is expected to keep himself available for employment by the lender, even if it means turning down other job offers.

(c) Early season custard apple (a local fruit) is highly desired, while the mid- and late-season output is less desired. Middlemen have developed season-long relationships with custard apple farmers. Provided the farmers do not sell their early season output to itinerant spot traders, the middlemen agree to take up the entire mid- and late-season output from the farmers. The prices paid by the middlemen will vary with market prices, except that during the early part of the season, farmers would normally get a better price from the itinerant traders. To put the relationship on a firm footing, middlemen advance money interest-free to the farmers during the pruning season, about five months ahead of the harvest.

### **Interest Rates and Their Variations**

As in many developing countries, in Thailand there is a vast gap between the interest rates charged in the formal and informal credit markets. Commercial banks and the BAAC charge 12–14 percent a year. Informal lenders charge much higher rates—25 percent annually is the minimum and is

mostly to be found in the Central Plains, elsewhere 60 percent or more is usual. Based on regressions that we have run, the variation in interest rates in the informal sector appears to reflect variations in information costs and risks arising, for instance, from differences in collateral used.

### **The Formal Sector**

Although the central bank has been regulating the amount of credit that the commercial banks have to provide to the agricultural sector, it did not specify the rate of interest that they should charge. The banks' practice has been to charge 12 percent per year on loans (about the same rate as the BAAC) and 15 percent per year on overdrafts. These rates put the agricultural sector in an even more favored position than the banks' prime borrowers. It appears that the central bank has ignored the role of interest rates in inducing the commercial banks to lend more to the agricultural sector. However, it is uncertain that the commercial banks would respond to such an inducement. Their practice before the 1975 regulations was to ignore the agricultural sector, largely because they never had to face serious competition on the lending side of their operations in the highly profitable nonagricultural sector. Entry into the commercial bank business is subject to approval by the Bank of Thailand, and it has not approved a new domestic bank since 1966. Commercial banks have therefore tended to look at the agricultural loans regulation as a burden to be avoided as much as possible.

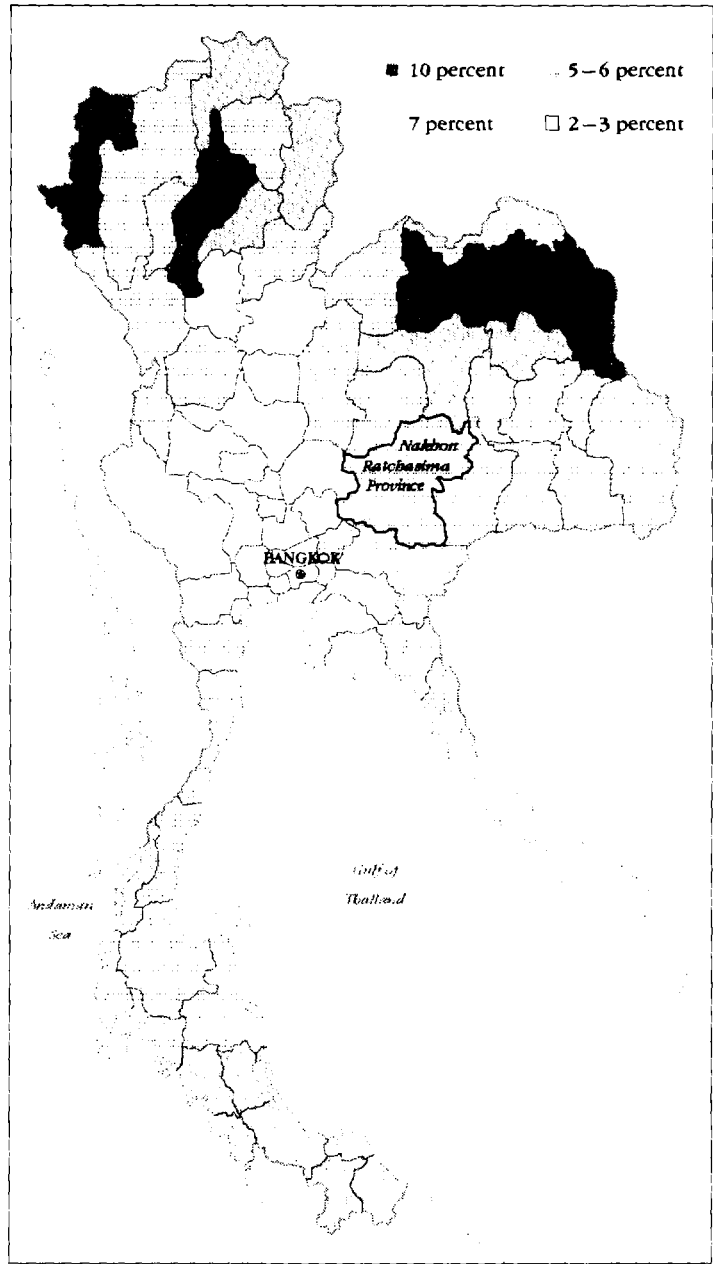
BAAC's policy toward the setting of interest rates has been subject to political constraints—its chairman is the minister of finance. Within these constraints, its practice has been to set interest rates according to its average cost of funds. The BAAC obtains soft loans from foreign donors and can rediscount its bills at the central bank at rates between 3.5 to 5 percent per year.<sup>14</sup> The BAAC charges interest varying between 12 and 14 percent per year and still makes a small profit. Obtaining subsidized funds from the central bank, the commercial banks, and foreign sources, the BAAC has never felt it necessary to expand the fund-mobilization side of its business. It must be added that given its smaller branch network, it is doubtful whether it could be as effective as the commercial banks in marshaling deposits.

### **The Informal Sector**

In much of Thailand except the commercialized Central Plains, the informal interest rate usually hovers around 5 to 7 percent per month for a loan of 8,000 baht (US\$320) for a period of six months, with no collateral but with the land title deposited with the creditor (see figure 8-1). Some of the more remote provinces report a rate of 10 percent per month, while the rate in the Central Plains is only 2 or 3 percent per month. Despite the significant



Figure 8-1. *Map of Thailand Showing Monthly Interest Rates for the 8,000-Baht Loan Contract, with the Borrower Surrendering Land Documents*



variations observed in individual contracts from our survey data, there is a sense of a standard rate over quite broad areas, provided one controls for (a) the size of the loan, (b) the length of the loan, and (c) the nature of the security offered by the borrower. Moreover, from our interviews it appears that the standard rates and their regional differentials have been quite stable for at least the last two decades, despite varying experiences with respect to government credit and monetary policies and inflation rates.

That the key factors determining interest rates in the informal sector are the size, duration, and required collateral of the loan has been confirmed by a number of regressions that were run with interest rates as the dependent variable. Table 8-5 shows the results of one such regression. It indicates that borrower characteristics do not seem to account for much of the variations. The regression also indicates some anomalous results. Irrigated areas and tree-crop areas, which are less risk-prone than upland areas, show a much higher interest rate. Since this is a village-wide characteristic, it is likely that there is a sampling bias, because there are only fourteen villages in the survey, among which four are irrigated and two are tree-crop villages.

Lender and contract characteristics account for some variations. For instance, by pledging land as collateral the borrower obtains a lower interest rate than by pledging jewelry. This is probably because many lenders (commercial banks, illegal trusts, as well as other informal lenders) accept land as collateral; the market for such loans is more competitive than for loans obtained by pawning jewelry.

### Critique of the Theoretical Literature

Three major sets of views have dominated the literature on rural credit markets. According to the traditional view, rural financial markets were shot through with monopolies, with inordinately high interest rates as the consequence. This view led to many heavily subsidized credit schemes in developing countries.

This traditional view of rural financial markets was strongly criticized in a series of papers, later collected in the volume by Von Pischke, Adams, and Donald (1983). The critique was enlivened by observations of credit policies in developing countries. Even a cursory look revealed a rich crop of disasters induced by poorly designed policies. This critical literature stressed the distortions introduced by government policies and, in doing so, tended to idealize the informal credit markets that did exist or that might have existed in the absence of the massive government intervention in the credit market. There was a presumption that an intervention-free rural financial market would approximate the perfect competition model.

A third view, much represented in this volume, emphasizes the informa-

Table 8-5. Results of "Hedonic" Regression of Interest Rates in the Informal Sector, Thailand, 1987

Variable	Regression coefficient	t-statistic
<i>Dependent variable: Natural logarithm of monthly compounded interest rate</i>		
<i>Contract terms</i>		
Logarithm of loan size	-0.07	-2.83
Logarithm of loan duration	-0.18	-6.29
Usufruct loan (dummy)	0.39	0.16
Surrender of title to lender (dummy)	0.16	1.80
Land mortgage (dummy)	-0.22	-1.31
Pawning of jewelry (dummy)	0.32	0.75
Written contract (dummy)	-0.17	-1.82
In-kind loans	-0.14	-2.40
Payment of interest in-kind	0.09	0.16
<i>Purpose of loan</i>		
Consumption (dummy)	0.03	0.51
Repayment of other debts (dummy)	-0.20	-1.10
<i>Borrowers' characteristics</i>		
Logarithm of landholdings	-0.03	-0.83
Ownership of titled lands (dummy)	-0.06	-0.93
Logarithm of borrowers' income	-0.03	-0.96
Borrower also a formal sector loanee (dummy)	0.12	2.09
<i>Lenders' characteristics</i>		
Nonresidency (dummy)	-0.16	-2.48
Farmers (dummy)	-0.15	-1.73
Traders (dummy)	0.06	0.51
Rice-mill owners (dummy)	-0.51	-4.59
Professional lenders of landlords (dummy)	-0.15	-1.13
Salaried workers (dummy)	-0.20	-1.12
<i>Relationship and interlinkages</i>		
Requirement to sell crops to creditor (dummy)	0.01	0.13
Logarithm of number of years of acquaintance	-0.01	-0.39
Direct kinship (parents, offspring of siblings)	0.10	0.70
<i>Socioeconomic environment (rainfed village has all dummy values equaling zero)</i>		
Irrigated (dummy)	0.60	3.56
Upland crop growing (dummy)	-0.02	-0.24
Tree-crop growing (dummy)	0.41	2.43
<i>Regions (northeast has all dummy values equaling zero)</i>		
Eastern	-0.69	-2.85
Central	-0.12	-1.12
Lower north	0.17	1.75
Upper north	-0.12	-1.17

Note: Data are based on survey of borrowers in twelve villages in six regions of Thailand in 1987.

Source: Poapongsakorn and Nettayarak (1989, p. 119).

tional problems that make credit markets inherently imperfect, even in the presence of competition among a large number of lenders. This view stresses the contractual aspects of the market under imperfect information, but maintains the notion of a "credit market" as an arena where strangers meet to borrow and lend. Lenders cannot observe or monitor the behavior of borrowers in certain respects, which leads to moral hazard and adverse selection. The lenders' solution to these problems may give rise to credit rationing in competitive equilibrium.

We accept the view that the information problem in the credit market is a serious one in Thailand. We have argued that lenders' attempt to solve it *effectively sorts borrowers into different parts of a highly segmented credit market*. We would argue, however, that many informal rural lenders (at least in Thailand) incur costs to acquire nearly complete information regarding their borrowers. For lenders who reside in the same village as their borrowers, this cost is not particularly great. As a consequence, nearer the mark would be a model that portrays the lender to have complete information about her borrower's resource endowment, tastes, and investment opportunities, so that she can conduct a Fisherian analysis of the borrower's credit requirements as efficiently as he can. What therefore appears as a borrower's decision on intertemporal consumption and production is, in reality, a joint decision of lender and borrower. After lending out the money, the lender can also completely monitor and regulate the borrower's behavior that may affect his intertemporal resource allocation.<sup>15</sup> Because of the resident lender's advantages over nonresident lenders, the former can provide "consumption" loans more readily than can any other type of lender.

For nonresident lenders and formal lenders, the problem is more complex. Here, the Stiglitz-Weiss (1981) model, where information is asymmetric, may be appropriate. What has not yet been explained in the theoretical literature is the coexistence of the various forms of informal and formal lending and how these interact to determine informal interest rates.

From table 8-4 it is clear that resident lenders are a very important part of the credit scene, accounting for close to two-thirds of all the loans obtained from the informal sector. Quantitatively, therefore, it appears that models of symmetric information would merit closer investigation than models of asymmetric information in vogue in the literature.

Some of the answers given in the literature to the central question of why interest rates in rural areas are inordinately high appear unsatisfactory. In our extensive interviews with informal lenders in Thailand, there is very little evidence that the volume of their business is constrained by the availability of funds. Besides, many informal lenders are engaged in other activities that could not possibly yield the 4-5 percent per month return that they obtain from moneylending (if we ignore the transaction costs). The cash flows from these other activities are siphoned to the moneylending business when the need arises. Indeed, if a particularly valued prospect wishes to

borrow and the lender is short of cash, she will borrow from the formal sector or even from another informal lender to relend to the prospect.<sup>16</sup>

We are inclined to accept the view that interest rates are high because transaction costs are high, particularly at the margin. For the borrowers who are already among the clientele of a particular lender, the transaction costs may not be very high, but if a borrower among this clientele were to shift to another lender, the marginal transaction cost the new lender would have to cover might be quite high. Knowing this, the present lender can then obtain an economic rent equal to the difference between his closest competitor's transaction cost and his own.

Our view is based on the hypothesis that rural credit supply requires two factors: loanable funds themselves and something that we will call "lending effort." Lending effort entails transaction costs. In our view, the supply of loanable funds is almost perfectly elastic at the formal sector interest rates, because the rural sector is now a relatively small part of the Thai economy (agriculture currently contributes only about 16 percent of the gross domestic product). But the lender's supply price of enlarging his clientele is high (much higher than the interest rate), because it is a fixed cost incurred to make a (typically) small loan. Moreover, the lender's supply curve may be inelastic with respect to clientele size. As he expands his clientele, he faces borrowers with whom he has had fewer contacts or who intrinsically have greater risk of default.

If we push these arguments to their logical limits, then the following observations would be relevant to our evaluation of the Thai government's credit policies during the last two decades. First, mere injection of funds into the rural areas will not necessarily reduce informal interest rates, because for that sector, funds are not the constraining factor. Second, a successful credit program would require the creation of formal institutions that can supply the additional lending effort to compete effectively with informal lenders in a wide range of segments of the rural credit market. In this view, if government credit subsidies crowd out informal financial intermediation, a cost arises not from the displacement of local efforts to mobilize deposits, but from the possible displacement of the information services provided by the informal lender. The key to successful government intervention in rural credit is institution-building that is innovative and efficient in tackling the information problems entailed in lending.

### **A Model of a Perfectly Competitive but Highly Personal Informal Credit Market**

This section presents a model of an informal credit market in which lenders can, at a cost, acquire complete information about a borrower's resource endowment, tastes, and investment opportunities. Moreover, she can prevent him from acquiring credit from other sources.

A Fisherian analysis based on the borrower's opportunity set and tastes will yield a borrowing requirement per year denoted  $b(r, \alpha)$ , where  $r$  is the rate of interest and  $\alpha$  is a shift variable. Let subscripts denote the partial derivatives and define  $\alpha$  so that  $b_\alpha > 0$ . Assume  $b_r < 0$ , that is, the desired transaction level between borrower and lender falls as the interest rate rises.

The lender's costs consist of two components: the cost of funds, denoted  $i$ , and the cost of her effort to obtain full information about the prospective borrower. Her cost of effort depends on the number of borrowers that she has to deal with (the size of her clientele, denoted  $n$ ) and the total number of lenders in the market, denoted  $N$ . We assume the cost function to be:

$$C = C(n, N) \text{ with } C_n > 0, C_{nn} > 0, C_N > 0, C_{nN} > 0.$$

The larger the clientele, the higher the lender's marginal cost of effort. Diminishing returns set in faster the more numerous her competitors are, so that she has to range further afield to obtain the same number of borrowers.

The lender's problem is to solve:

$$\text{Max}_n n [r - i] b(r, \alpha) - C(n, N).$$

The first term in the maximand is the gross profits that the lender can make from a clientele of  $n$  borrowers. The informal interest rate,  $r$ , is here considered a parameter for the lender, as is  $N$ . This framework assumes that all borrowers are identical, so all loans are characterized by the same size ( $b$ ) and interest rate ( $r$ )—we will relax this assumption shortly.

Two interpretations can be given of the lender's maximand. The first points out that her cost function consists of two parts: the cost of her effort, captured by the  $C(\cdot)$  function, and the cost of funds, captured by the term  $nib(r, \alpha)$ , where the supply of funds to the lender is perfectly elastic at the rate  $i$ . Another interpretation would emphasize that the function of the lender is to arbitrage between the formal and informal markets, and the extent of the arbitrage is limited by the cost of the effort invested in lending.

The first-order condition from the maximization problem is:

$$(8-1) \quad [r - i] b(r, \alpha) = C_n(n, N).$$

The market equilibrium is given by:

$$(8-2) \quad nN = B$$

where  $B$  is the total fixed number of borrowers. Entry or exit will occur unless the zero-profit condition is met:

$$(8-3) \quad n [r - i] b(r, \alpha) - C(n, N) = 0.$$

Equations 8-1, 8-2, and 8-3 together are the conditions for a perfectly competitive market equilibrium, with  $r$ ,  $n$ , and  $N$  as the endogenous variables.

A conventional comparative exercise on the three equations yields the following results, where  $\epsilon_{br}$  denotes the elasticity  $d \ln b / d \ln r$ :

$$(8-4a) \quad dr/di = \frac{1}{1 + [1 - i/r] \epsilon_{br}}$$

$$(8-4b) \quad dn/di = 0$$

$$(8-4c) \quad dN/di = 0$$

$$(8-4d) \quad dr/d\alpha = \frac{-[r - i]b_{\alpha}/b}{1 + [1 - i/r] \epsilon_{br}}$$

$$(8-4e) \quad dn/d\alpha = 0$$

$$(8-4f) \quad dN/d\alpha = 0.$$

To obtain clear comparative static results, we use the requirement for stability that

$$(8-5) \quad 1 + [1 - i/r] \epsilon_{br} > 0$$

which is a slightly weaker condition than  $|\epsilon_{br}| < 1$ .<sup>17</sup> This requirement means that a rise in the interest rate charged will increase the lender's arbitrage profits (before transaction costs). Thus, an exogenous increase in transaction costs can be passed on to the borrower.

The surprising and important result (from equations 8-4d and 8-5) is that an increase in the size of the credit transaction (captured by a shift in  $\alpha$ ) leads to a *decline* in the rate of interest. Recall that the cost of the lender's effort per borrower does not depend on the size of the loan. Hence, as the amount of the transaction between borrower and lender increases, the cost of that effort can be spread over a larger loan. Competition ensures that the cost saving will be passed on to the borrower. Another surprising result is that the number of lenders  $N$  and the size of the clientele  $n$  are unaffected by the change in credit requirements.

A second result (from equations 8-4a and 8-5) is that  $dr/di > 1$ : changes in the interest rate in the informal credit market will magnify any change in the cost of funds to the lender.

Neither of these results depends on the assumption of identical borrowers. Allowing for  $g$  different classes of borrowers changes the specification of the model as follows. The lender's problem becomes

$$\text{Max}_{n_1, \dots, n_g} \sum_j n_j [r_j - i] b_j(r_j, \alpha_j) - C(\sum n_j, N)$$

for which the first-order conditions are

$$[r_j - i] b_j(r_j, \alpha_j) = C_n(\sum n_j, N) \quad j = 1, \dots, g.$$

The two equilibrium conditions become

$$\begin{aligned} n_j N &= B_j \quad j = 1, \dots, g \\ \sum n_j [r_j - i] b_j(r_j, a_j) &= C(\sum n_j, N) \end{aligned}$$

where  $B_j$  is the total number of borrowers in class  $j$ .

Comparative statics results are exactly the same as when identical borrowers are assumed, except for the addition of the relevant subscripts. A strong result is that an increase in the demand of a particular class of borrowers does not affect the rate of interest charged on the remaining borrowers; that is

$$dr_j/d\alpha_k = 0 \quad \text{for } j \neq k$$

At first sight, this is surprising inasmuch as our explanation of the results in the identical-borrower case relies on the fixed-cost argument. One would therefore expect economies of scale arising from a demand increase of one class to benefit the other classes of borrowers. This is not so. Competition forces the lenders to segment the market completely so that the demand of each class of borrowers affects the interest rate for that class only.

This heterogeneous-borrower model can also be used to explain the observed inverse relationship between loan size and interest rate<sup>18</sup> and, with some modifications, it could also explain the inverse relationship between loan duration and interest rate.

Under a conventional flow-of-funds analysis of the informal credit market, the apparent stability in informal real interest rates over the past twenty years would be explained by the offsetting effects of (a) commercialization (increasing the demand for informal loans) and (b) new sources of loans through the BAAC and commercial banks (decreasing the demand for informal loans). However, under a conventional flow-of-funds analysis, it is difficult to explain the persistence of the huge gap between informal and formal interest rates, even if we allow for a higher rate of default on informal loans. The gap can, of course, arise from a rationed credit system that accompanies a controlled interest rate structure. But such a rationed system would in turn give rise to widespread arbitrage between the formal and the informal sectors. While some arbitrage undoubtedly exists in the areas we surveyed, we are surprised by its limited extent. In any case, the arbitrage would not be costless, but would involve the very same transaction costs between the would-be arbitrageur and the final borrower.

The model presented in this section, based on a transaction cost analysis of the informal credit market, provides a framework for explaining the



persistence of the gap between informal and formal interest rates, as well as of the stability of the informal rate. Within this model, (a) commercialization would increase the size of the transaction between the borrower and his sole-source lender in the informal sector (and the increase in  $b$  will in turn reduce the informal interest rate  $r$ ); (b) provision of loans from the BAAC would reduce  $b$  (and this would increase  $r$ ); and (c) provision of loans from commercial banks and the BAAC to lenders at low interest rate  $i$  will reduce  $r$ . The differential between formal and informal sectors would persist as a reflection of the real resource costs incurred by informal lenders in obtaining information about borrowers, and the fact that the formal sector does not appear to have the transactions technology to be able to process the general credit needs of the rural households. The only specific areas where it has been able to create this technology is in working capital loans (the BAAC) and in collateralized loans (the commercial banks).

Given the above analysis, it seems that much of the criticism of government policies limiting informal financial intermediation (for example, Von Pischke, Adams, and Donald 1983, pp. 108–09) is misplaced (at least in the Thai context) in that it emphasizes the role of the informal sector in generating new funds, which should then lower interest rates. Our own emphasis is on the role of informal lenders as gatherers of information, a role that has not been superceded by the massive injection of funds into the rural sector of Thailand.

## Performance of the Thai Rural Credit System

What has been the performance of the Thai rural credit system? And what is the place of a policy that has as its objective injecting a huge amount of funds into the countryside? We will briefly consider the Thai rural credit system's performance in terms of coverage, efficiency, and redistribution effects.

### Coverage

It is useful to distinguish loans for purposes of consumption, working capital, and long-term investment. The first two types of loans generally have repayment periods of less than one year and have been aptly termed "flow credit." Long-term loans have been called "stock credit." For flow credit, the information required by the creditor is the income flow of the borrower. By contrast, with stock credit it is the borrower's asset-and-liability situation that is of interest to the creditor.

Seventy-five percent of loans dispensed countrywide by the BAAC (Mingmaneeakin 1988, p. 177) and about 40 percent of the informal sector loans

in NR Province (Poapongsakorn 1988, pp. 110–11) are flow credit to finance working capital. For this category of loan, and also for long-term loans with collateral, the credit market appears to function smoothly. In both cases the formal sector lenders are active participants, although they have not succeeded in driving out the informal lenders. The rise of the BAAC in the past two decades probably undercut the position of the nonresident lender more than that of any other lender. However, in our interviews these lenders do not report any falling off in the absolute size of their businesses. The increasing use of agricultural chemicals in NR Province may have more than compensated for the inroads BAAC made in the nonresident traders' market share.

Rural households that have transitory income shortfalls or unexpected consumption needs still seek credit primarily from the resident lenders. Resident lenders are particularly suited for the task. Time and again in our interviews, both borrowers and lenders described the scenario of illness in a family that triggers an urgent need for cash. It is very difficult to design a bureaucratic credit system that would provide the household with that cash. Lenders resident in the village are perfectly suited to the task, even though the interest rate charged may be high.

However, when a region suffers a collective shock, such as low rainfall, the consumption loans market ceases to function (Pinthong and Nettayarak 1988, p. 38).<sup>19</sup> In theory, nonresident lenders and even bureaucratic organizations such as the BAAC could form a judgment not only of the credit needs but, more important, of the households' ability to repay, in order to provide consumption-smoothing opportunities to households. In practice, both the formal and nonresident informal lenders in Thailand appear to be unable to perform this function satisfactorily. Resident lenders, on the other hand, are not adequate to the task because their equity is least when demand for credit is greatest.<sup>20</sup>

### ***Efficiency: The BAAC's Achievements through Group Lending***

The fund injection that resulted from compelling commercial banks to lend to the agricultural sector is workable only because they can satisfy the requirement by making deposits with the BAAC, which then on-lends the money to the farmers. It is the ability of the BAAC to perform its task that lies at the heart of the sustained impact that the government has had on rural credit.

The major achievement of the BAAC lies in its approach to administering credit, which is totally different from that of the informal sector. In its group lending method, it discovered the means to achieve an initially high rate of loan repayment, which was increased further as the BAAC came to appear in farmers' eyes as a permanent institution.<sup>21</sup> The BAAC penalizes default in two

ways: (a) the amount overdue is subject to a higher (by about 2 percent per year) interest rate (which is as assiduously followed up on as the repayment of principal), and (b) no new loan is given until the old debt is sorted out, and even then the group cannot be sure of getting a new loan.

Moreover, BAAC has achieved this high repayment rate at a small cost. BAAC reports its administrative costs to be around 5 percent of the loan administered. Reckoning the costs of bad debts is problematic, but we may assume from table 8-6 that of the working capital loans that fall due each year, only about 3 percent eventually will be written off. If we further suppose that the *marginal* cost of its funds in 1984 was 12 percent, then the BAAC could comfortably lend without any subsidies to the rural sector at 20 percent per annum, well below the 50 percent per year that was being charged in the northeast or the 36 percent or more in the Central Plains.

True, from the point of view of borrowers, BAAC credit has a number of disadvantages, most notably a higher transaction cost imposed on them. We estimate this increase in transaction cost to be about 9 percent of the average loan (see Lapanun 1986, p. 97, for details of the calculation).<sup>22</sup> With this cost included, the resulting effective social interest cost would be 29 percent, still well below the rates in the informal markets, at least for areas outside the Central Plains. Thus, for the loans that BAAC made, the informal lenders would not be competitive even if the subsidies to the BAAC were removed. This is different from saying that the informal sector is altogether inefficient. The BAAC has been successful in one segment of the credit market, albeit a very important one, namely for short-term working capital loans. It has found a technology to "mass-produce" this kind of loan and in that way has overcome the problems that normally beset a bureaucratic organization engaged in giving small loans.

But despite repeated attempts, the BAAC remains unsuccessful in expanding its scope of activities. Even in its traditional working capital loans, it has been reluctant to expand its clientele to less monetized farmers or those in riskier areas. It is awkward to give working capital loans (in cash) to households that consume a large portion of what they produce. Because its interest charge is controlled, the BAAC has little incentive to make a determined effort in this area. That the informal sector still appears to thrive, either by lending to those left out by the formal sector or for activities that the BAAC does not finance, indicates that the informal sector also has a role to play within its sphere.

Whether the interest rate that the BAAC charges the farmers should remain subsidized is questionable.<sup>23</sup> A somewhat convoluted excuse that may be given, at least as far as one component of the subsidy (the implicit subsidy from the compulsory lending requirement) is concerned, is as follows: since the ban on new entrants has made commercial banks financially more sound, they have become a very efficient gatherer of deposits, including

Table 8-6. *Collection Records of Overdue Short-Term Working Capital Loans from the BAAC*  
(millions of baht)

<i>Period in which loan fell due</i>	<i>Amount due during year</i>	<i>Amount overdue</i>					
		<i>At end of year</i>	<i>At end of year +1</i>	<i>At end of year +2</i>	<i>At end of year +3</i>	<i>At end of year +4</i>	<i>At end of year +5</i>
1981-82	7,444	1,765	1,141	545	361	258	193
1982-83	8,451	1,883	760	346	251	180	
1983-84	10,493	2,298	1,169	637	413		
1984-85	12,056	2,865	1,374	623			
1985-86	12,782	2,593	925				

Note: The accounting year for the BAAC ends on March 31.

Source: BAAC (various years).

those from the rural areas. As a quid pro quo for the economic rent that they can thus earn, they should be asked to engage in this cross-subsidization scheme.

It is possible that if subsidies to the BAAC were removed and the BAAC forced to obtain its funds in the money markets—from the commercial banks or from any source willing to lend to it—it could still survive. New kinds of private institutions would probably enter the scene, obtain funds from the commercial banks (which would likely remain the most efficient deposit-taking machines), and lend to the farmers using the BAAC technology. At the moment, this possibility will have to remain a matter of speculation.

### **Redistribution**

What are the redistributive effects of the expansion of the role of the formal credit system into the countryside? In Thailand as elsewhere, most formal credit goes to the better-off rural households. Subsidies to rural credit would ipso facto seem to be a regressive policy within the rural sector. But the average urban per capita income is 2.5 to 3 times higher than the average rural income in Thailand. Thus, the impact of rural credit subsidies on the overall Thai income distribution remains unclear.

Rural credit also affects income distribution through its impact on the product market. By lowering the cost of working capital, it lowers the production cost of agricultural goods for farmers lucky enough to get the credit. For the poorer farmers there is now the added insult of lower product prices to add to the injury of having no access to the subsidized credit. This effect is not very large, however. Our computable general equilibrium exercise found that a policy of allocating 10 percent of bank deposits to the rural sector would lower agricultural product prices by 1.04 percent, increase per capita real income in rural areas by only 0.3 percent (per capita real urban income increased by 1.3 percent), and increase the Gini coefficient of rural incomes from 0.575 very marginally to 0.578 (Nijathaworn 1988, table 4.1).

The effect is small because Thai agricultural output is mostly traded (hence the small impact on prices), because working capital for agricultural production is mostly self-financed (hence the small impact on all variables), and because poorer farmers have lower marketable surplus (hence the small impact on the Gini coefficient).

### **Notes**

The authors are indebted to Karla Hoff for extensive comments.

1. The BAAC's mandate is to lend to farm households and for agricultural activities. It is now trying to lend to nonagricultural activities of farm households.

2. In 1975 the Bank of Thailand had no legal authority to impose selective credit control. It could do so only after an amendment to the Commercial Bank Act in 1979. This change, however, did not cause the central bank to impose this requirement as a legally mandated regulation. Its preferred style of regulation in this matter remains what it calls "moral suasion."

3. In 1985 approximately 25 baht equaled one U.S. dollar. Between 1955 and 1981, the baht fluctuated between 20 and 21 baht to the dollar, with the country practicing a relatively open trading regime. The domestic inflation rate therefore corresponds fairly closely to the dollar inflation rate, reaching double digits in the aftermath of the two oil shocks, but staying at fairly low levels after that, including in 1981 and again in 1984 when there were devaluations of 15 percent.

4. A more recent survey conducted in more regions indicated the same (Poapongsakorn and Nettayarak 1988, p. 40). In our survey, the average number of households per village is 112. The average number of people per rural household in Thailand is about 5.

5. To obtain a sense of these figures, note that average income per capita in the northeast of Thailand is 2,983 baht. Average income for agriculturalists throughout Thailand is slightly greater, at 3,062 baht. These figures are not strictly comparable to those of table 8-3 because of somewhat different definitions of income.

6. Actually, the wealthiest farmers borrow from Farmers' Associations, but these are quantitatively unimportant, as can be seen in column 1 of table 8-3. Farmers' Associations are groups of about 50-100 farmers formed hurriedly in 1975 by the Department of Agricultural Extension to obtain loans from the BAAC, in conjunction with the credit program of that year. Because their formation was politically motivated, their members tend to be rich and influential and, precisely for that reason, their repayment rate was poor. The BAAC has been trying to remove them from its rolls ever since. Those that remained in 1984 to be reported in this chapter were presumably those that behaved better than the vast majority of these associations.

7. Nevertheless, many farmers still prefer to borrow long-term from the informal sector at a higher interest rate. The explanation given is that if the creditor forecloses on the loan, the borrowing farmer stands a better chance to lease his land back from the creditor than if he had borrowed from the formal sector.

8. Such a trust is essentially a partnership of the main capitalists of a market town who would put up the equity, but the trust will also accept deposits at a somewhat higher than the market interest rate. Typically, it would not be licensed by the Ministry of Finance and would thus be illegal. However, while it would not advertise its location, its existence would not be a secret. It required very little effort on the part of the researchers to find such trusts and, once confidence had been gained, to discuss with the managers the *modus operandi*.

9. This is not a mortgage. The arrangement allows the lawyer to take over the land any time he wishes.

10. Because Thai village kinship structure is matrilineal and matrilocal, lines of influence tend to run through the women, and women tend to predominate among resident lenders.

11. There are other hypotheses to explain the insistence of the nonresident trader-lender that the borrower market his output through him. One hypothesis is that the trader makes a profit by buying at below-market prices. We made thorough

inquiries with both lenders and borrowers on this question and are satisfied that, with few exceptions, very little underpaying occurs. It does stand to reason that the trader should not encourage the borrower to default on the loan by underpaying at this stage. Whatever monopoly power the lender may have, he can already exercise through a higher interest rate.

Another hypothesis is that traders operate under conditions of excess capacity because of Chamberlinian monopolistic competition. Any measure that boosts demand for their services would therefore increase their profits.

12. The NR province has a low incidence of tenancy. Usufruct loans are the only important case of interlinkage between the credit and land rental market.

13. A study in one northeastern village with a large number of migrants to the Middle East indicates that as many as 50 percent of the households have been cheated by labor contractors during the past seven years (Sangthanapark 1988, p. 49).

14. The rediscount facility provided 12 percent of the total liabilities of the BAAC in 1984 (Siamwalla 1989, p. 40).

15. While the lender cannot exactly prevent a borrower from taking a further loan simultaneously from another resident lender, the latter is unlikely to lend because normally she would be aware that the borrower is tied to the first lender. She would be very suspicious of such an approach and may even check with the first lender.

Of course there is nothing to prevent the borrower from borrowing from a non-resident lender. However, the resident lender has a slight advantage at collection time (which is immediately after harvest), because she would be better informed as to the exact harvest date. Consequently, she would be able to make the first claim on the debt. Indeed, in our interviews with nonresident lenders, a common complaint has been that they would meet up with other lenders at the threshing yard, and would thus be unable to recover fully their debts. For a few, such incidents have become common enough for them to consider withdrawing from the lending business. See also table 7-2, column 5.

16. There is one important exception here. Loans to maintain consumption in the face of poor harvests or low output prices may not be available because of the shortage of equity among resident lenders arising from the covariance of risks.

17. The stability conditions arise from the following dynamic specification:

$$dn/dt = k_1 [(r - i) b(r, \alpha) - C_n(n, N)]$$

$$dr/dt = k_2 [B - nN]$$

$$dN/dt = k_3 [n(r - i) b(r, \alpha) - C(n, N)]$$

where all the  $k_i$ 's are positive. For this system to be stable, it is required that the principal minors alternate in sign (Gandolfo 1980, p. 278, condition (b) for D-stability), from which we obtain:

$$b + [r - i] b_r > 0$$

$$-N C_n - n^2 C_{nn} + nN C_{nN} < 0.$$

The intuition behind the first condition is explained in the text, which gives an

alternative elasticity version of the same inequality. A sufficient condition for the second inequality is  $-n^2 C_{nn} + nNC_{nN} < 0$  or  $n[nC_{nn} - NC_{nN}] > 0$ , meaning that the marginal transaction cost is more sensitive to the departure of a client than to the entry of a new competitor.

18. Assume two classes of borrowers who are at first identical, then let one of the classes increase its demand for borrowing. That is, let  $da_i > 0$ . Class  $i$  will then obtain loans at a lower rate of interest than the other class,  $j$ , whose demand does not increase.

19. The main recourse of farmers in this situation is to seek dry-season employment. If the sale proceeds from the poor year's harvest carry the affected farmers through part of the following year, and if that year is not also a bad year, then some loans would be forthcoming during the planting season from nonresident lenders.

20. The influence of covariant risk on the functioning of credit markets is emphasized in Binswanger and Rosenzweig (1986).

21. Actually, the idea of group responsibility and peer monitoring is not new. The cooperatives in a sense embody this approach. What is new is the very small size of the BAAC groups (between eight and fifteen people).

22. The 9 percent figure is the difference between the 10.9 percent figure for BAAC and the 1.3 percent figure for the informal lenders. The estimate leaves out the cost of risk, discussed in chapter 4.

23. There are two major subsidy elements in the Thai government's credit policies. The first is the requirement that the commercial banks lend 11 percent of their deposits to agricultural households or to the BAAC. This imposes an implicit tax on nonagricultural borrowers. Second, the BAAC uses an average-cost pricing rule in setting interest rates. In doing so it includes in its average the rates on many soft loans it receives from foreign donors (the BAAC is a favorite of many donors). A recent calculation indicates that the major portion of the subsidy arises from the average-cost pricing rule, because the elasticity of demand for bank loans is quite high. Nonetheless, the total size of the implicit subsidy turns out to be only about 1 billion baht (US\$40 million) (Siamwalla and Nettayarak 1989), surprisingly small compared to the total BAAC loan portfolio of 25 billion baht in 1987, or to the stated agricultural portfolio of the commercial banks of 46 billion baht.

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*An asterisk (\*) preceding an item indicates that it is part of the project being summarized. The word "processed" describes informally reproduced works that may not be commonly available through libraries.*

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## *Interactions between Institutional and Informal Credit Agencies in Rural India*

Clive Bell

*In an attempt to expand rural credit and displace the village moneylender, India created a system of rural cooperatives in the 1950s and expanded branch banking into rural areas in the 1970s. This chapter examines how these measures affected the rural market. It begins with the question of how large the expansion of institutional credit has been and the extent to which it has dislodged the village and nonresident moneylenders. The chapter also examines the (weak) evidence on intermediation between the formal and informal sectors. A formal model of the interaction between the informal moneylender and institutional lender is constructed under a variety of assumptions about the exclusivity of loan contracts and the competitive structure of the informal sector. The conclusions are drawn together in the form of four proposals for public policy.*

IN A LANDMARK STUDY of the system of credit and household indebtedness in the early 1950s, the authors of the *All-India Rural Credit Survey* subjected the role and operations of the moneylender, who then enjoyed a dominant position as a source of finance, to critical scrutiny. They did so on the premise that, in India, agricultural credit presented a “two[-]fold problem of inadequacy and unsuitability” (RBI 1954, vol. 2, p. 151). They envisaged only a minor place for him in their proposed solution, which took the form of a system of cooperatives covering all villages (pp. 481–82):

The moneylender can be allotted no part in the scheme [of cooperatives]. . . . [I]t would be a complete reversal of the policies we have been advocat-

ing . . . when the whole object of . . . that structure is to provide a positive institutional alternative to the moneylender himself, something which will compete with him, remove him from the forefront and *put him in his place*. [Emphasis added.]

The authors of the *Survey* did not, of course, lay out a formal model of India's rural credit system as it then existed; nor did they provide a formal analysis of the effects of introducing a system of cooperatives upon its workings. The above quotation and the whole tenor of their argument do suggest, however, that they were strongly convinced that the moneylender possessed considerable market power, the exercise of which was made very profitable by the peasants' pressing needs for credit. This power was to be curbed by competition from cooperatives, despite the fact that the record of this particular form of state agency had been rather patchy, as the authors themselves recognized (RBI 1954, vol. 2, p. 229 *passim*). Thus, their commitment to cooperatives was both ideological and something of an act of faith.

In the contemporary literature, the thesis that the moneylender remains powerful and that his dealings are an obstacle to progressive changes in rural economic life has been developed forcefully and at length by Bhaduri (1973) and his school. While their analysis has not gone unchallenged, both theoretically (Srinivasan 1979) and empirically (Bardhan and Rudra 1978), it seems fair to say that they have provided the clearest formal statement of what appears to have been the position of the authors of the *Survey*.

Be that as it may, how have matters turned out? The decennial surveys that followed revealed a steady growth of lending by cooperatives and banks to rural households and a great erosion of the moneylender's position, as can be seen from table 9-1. In his various guises of professional lender, cultivator, trader, and landlord, 80 percent of all rural debt was owed to him in 1951, but a mere 24 percent in 1981. Meanwhile, the proportion owed to institutions—cooperatives, banks, and government—rose from 7 percent to 61 percent, the residual being owed to friends and relatives. Thus, public policy, first in the form of the cooperative movement and then, in more recent years, in the extension of commercial branch banking in rural areas, appears to have "put him in his place." Indeed, table 9-1 suggests that the next decennial survey will reveal the private lender to be on the fringe of things, his grip on rural life broken by a competing supply of institutional credit.

On the official evidence, therefore, it is unnecessary to go any further, which would make for a commendably brief chapter. As I have argued in a longer version of this chapter (Bell 1990b), however, this evidence is open to very serious reservations, both on *a priori* grounds and in the light of independent surveys of various areas of India. In brief, the official surveys have it that (a) the debt-asset ratio of rural households declined from 5.9 percent in

Table 9-1. *The Share of Debt of Rural Households Held by Different Creditors: The Official Evidence*  
(percent)

Year and kind of debtor	Creditor								Total debt (millions of rupees) <sup>b</sup>	
	Government <sup>a</sup>	Cooperatives	Banks	Relatives and friends	Landlords	Agriculturalist moneylenders	Professional moneylenders	Traders and commission agents		Others
<i>1951</i>										
Cultivators	3.9	3.7 <sup>c</sup>		11.4	3.2	25.2	46.8	4.7	1.1	—
All families	3.7	3.5 <sup>c</sup>		11.5	3.5	25.2	46.4	5.1	1.1	—
<i>1961</i>										
Cultivators	6.7	11.4	0.3	5.2	0.9	48.1	13.8	7.1	6.5	31,257
All families	6.6	10.4	0.3	5.8	1.1	47.0	13.8	7.5	7.5	36,100
<i>1971</i>										
Cultivators	7.1	22.0	2.6 <sup>d</sup>	13.1	8.1	23.0	13.1	8.4	2.6	32,917
All families	6.7	20.1	2.4 <sup>d</sup>	13.8	8.6	23.1	13.8	8.7	2.8	37,541
<i>1981</i>										
Cultivators	3.9	29.8	29.5 <sup>d</sup>	8.7	3.7	8.3	7.8	3.1	5.2	21,641
All families	4.0	28.6	28.6 <sup>d</sup>	9.0	4.0	8.6	8.3	3.4	5.5	23,361

— Not available.

a. Some government departments, especially those connected with the Ministry of Agriculture, make loans to households, often in kind, such as seeds and fertilizers.

b. At 1970-71 (wholesale) prices. One 1970-71 rupee is worth about US\$0.40 (1990 dollars) at the official exchange rate in 1970-71.

c. Percentage is debt held by cooperatives and banks jointly.

d. Including insurance and provident funds.

Sources: RBI (1954, vol. 1, part 2, p. 3; 1977, p. 40; 1988, p. 38).

1951 to 1.8 percent in 1981; (b) the proportion of cultivating households reporting any debt declined from 69.2 percent to a mere 21.7 percent; and (c) the level of real debt per indebted household increased by just under one-quarter. In view of the growth of incomes and the intensification of agriculture during this period, these changes are quite implausible. Moreover, the figures for 1981 are strongly at variance with those from two fairly extensive surveys of villages that were conducted over periods of a year or more. These surveys were mounted under the auspices of World Bank research project RPO 671-89, "Impact of Agricultural Development on Employment and Poverty in India" (hereafter referred to as WBRPO) and the village studies program of the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT).<sup>1</sup> This critical evaluation suggests that official reports of the private lender's impending demise are much exaggerated.

This conclusion opens the door to several questions. First, if the moneylender is still very much in business, what is his main guise? It is argued in the first section of this chapter that the growing commercialization of Indian agriculture has encouraged the rise of the trader-moneylender, so that policies toward credit and commodity markets must be considered together. Second, to what extent has the expansion of credit from state agencies created opportunities for financial intermediation by private lenders? This is taken up in the next section. Third, what is an appropriate model of competition between institutions—that is, formal credit agencies and informal lenders—and what are the main conclusions to be drawn from it about the borrower's welfare and the allocation of resources? This is taken up in the third section. In the final section, I make four proposals for public policy.

### Private Lenders and Public Policy

The lender has several guises, which reflects what anthropologists call the "multiplex" nature of rural life. The same individual may lend to cultivators and laborers. If he has land and cultivates part of it, those of his tenants and laborers who borrow from him will think of him as a landlord, while other owner-cultivators will think of him as a cultivator who pursues moneylending on the side. In certain areas of India, some of the borrowers (though almost certainly not those who are laborers) may be his relatives and regard themselves as such in their dealings with him. Similarly, the village shopkeeper often lends to his customers in the lean season and may engage in commodity trading on a small scale at harvest time. As we shall see, traders and commission agents (who operate as brokers between farmers and both private traders and state purchasing agencies) are often heavily involved in financing cultivation, with the provision that their clients sell their crops to or through them, respectively. Thus, the lender's guise is very much in the

eye of his clients, and though the categories in table 9-1 look tidy and mutually exclusive, they must have seemed elastic and slippery to the respondents whose replies are reported therein.

The authors of the *All-India Rural Credit Survey* (RBI 1954) and their successors were aware of these difficulties of interpretation. Only interest-free loans between relatives or friends qualified for the category "relatives/friends"; only loans to tenants qualified for "landlords"; and the remainder were categorized by the principal business of the lender (RBI 1954, vol. 1, part 2, p. 1). Even so, this scheme is not watertight, and the quality of its execution by individual enumerators was surely variable. For these reasons, the changes in the composition of the debt owed to individual lenders reported in table 9-1 must be viewed with considerable caution. Nevertheless, such a comparison is called for if the influences of public policies on informal lending are to be identified and understood.

Between 1951 and 1961, according to table 9-1, the inroads made by institutional agencies into rural lending were fairly limited. Where the sources of credit are concerned, the striking change that occurred in this period was the overwhelming displacement of the professional by the agriculturist moneylender. It will now be argued that this displacement was more apparent than real.

There were two policy interventions that are especially relevant here. First, the state attempted to register professional moneylenders and regulate their practices. While some may have gone out of business altogether as a result, most probably assumed another guise and continued moneylending as a sideline. Second, during the 1950s, the zamindars' interests in land were abolished in favor of their registered tenants, and other land legislation that made own-cultivation more attractive was also enacted.<sup>2</sup> In all likelihood, therefore, many rural, and some urban, professional moneylenders responded by taking up cultivation in a substantial way. Certainly it would have been easy for them to do so. In 1951, before the abolition of zamindari, 68 and 29 percent, respectively, of rural and urban professional moneylenders reported cultivation as an additional activity, and a further 10 and 14 percent, respectively, reported that they were noncultivating landlords (RBI 1954, vol. 2, p. 170). Trading and related activities, which are not mutually exclusive with owning or cultivating land, were pursued by 38 and 78 percent, respectively. Only 2 and 6 percent of village and urban moneylenders, respectively, reported no other profession but moneylending in 1951 (RBI 1954, vol. 2, p. 170). There is thus no reason to believe that departures from this line of business were large. In all probability, most of the professional moneylenders who were active in 1951 had assumed the guise of agriculturist moneylenders, who were extremely active in 1961.

In the next two decades, according to table 9-1, the agriculturist moneylender suffered a fall from dominance at the hands of, first, the coopera-

tives, and then the commercial banks, which were nationalized in 1969. In contrast, the combined share of landlords, professional moneylenders, and traders decreased quite modestly.

The findings of the independent surveys by ICRISAT and the WBRPO cast considerable doubt on some aspects of this official account. In ICRISAT's areas, the traditional moneylender was still (just) holding his own in Mahboobnagar district, Andhra Pradesh; institutions were utterly dominant in Akola district, Madhya Pradesh; and relatives and friends were important sources in Sholapur district, Maharashtra. In the latter districts, the traditional moneylender had departed the scene some time before (Binswanger and others 1985). In the WBRPO's villages, a small proportion (3–9 percent) of all households reported making loans in the single season canvassed in 1980–81. These are, of course, almost certainly underestimates, for respondents are usually more reluctant to reveal what they have lent than what they have borrowed, especially in the earlier stages of an enumerator's stay. Even taking the data at face value, however, owner-cultivators and owner-tenants were relatively active as lenders in all three states, as were village traders, one-third of whom were lending in Punjab (Bell and Srinivasan 1985). Thus, the agriculturist moneylender and resident trader (usually shopkeeper) are still in business in these villages, from backward Bihar to commercialized Punjab.

The really intriguing feature of the WBRPO's data, however, is the importance of *nonresident* traders and commission agents as sources of finance in the most commercialized areas. Table 9-2 sets out the borrowings of cultivating households by source, with private loans classified according to whether they were interlinked with tenancy (land) or marketing (output) contracts, the residual category "other" being almost entirely made up of untied loans. Cross-sectionally, it is clear that commercialization is associated with heavier borrowings, not only from institutions, but also from traders and commission agents. Indeed, the average amount borrowed with output interlinking in Punjab greatly exceeded the average amount borrowed from all sources in Andhra Pradesh and Bihar. The same pattern was also evident *within* the latter states: traders and commission agents were making substantial loans to farmers cultivating potatoes near Patna in Bihar, paddy in the command area of the Nagarjunasagar irrigation system, cotton in Kurnool district, and paddy and sugarcane in Chittoor district, all in Andhra Pradesh. Thus, trade and (interlinked) moneylending flourish with advancing commercialization, as simple intuition would suggest.

Stated in a somewhat different form, this thesis has been pursued with considerable vigor by Harriss (1982, 1983), based on her detailed field studies in Tamil Nadu. Harriss reports that in the early 1970s in North Arcot district, about half of the traders' clients also borrowed from them. She argues that moneylending was a relatively competitive activity, with numer-

Table 9-2. *The Borrowings of Cultivating Households in the WBRPO's Villages, by Source and by Interlinkages, Rabi Season, 1980-81*

State	Loans from institutions	Loans from informal lenders interlinked with			Total
		Land	Output	Other <sup>a</sup>	
<i>Andhra Pradesh</i>					
Rupees per household	486	1	149	738	1,374
Percentage of total	35.4	—	10.9	53.7	100.0
<i>Bihar</i>					
Rupees per household	168	11	16	247	442
Percentage of total	38.0	2.4	3.6	56.0	100.0
<i>Punjab</i>					
Rupees per household	4,213	50	2,258	1,328	7,849
Percentage of total	53.7	0.6	28.8	16.9	100.0

— Not available.

a. All but a very small part is not interlinked.

Source: Bell and Srinivasan (1985).

ous lenders and fairly easy entry. In support of this position, she points first to the fact that interest rates barely exceeded legal ceilings. Second, where ease of entry is concerned, a fall in the volume of finance available from traders at one juncture appeared to induce a great expansion in pawnbroking, which catered heavily to poorer households (Harriss 1982).

It may be claimed with some confidence, therefore, that public policies that have promoted the growth of agriculture and its commercialization have also encouraged the rise of the trader and his associated lending activities. Indeed, Harriss goes so far as to assert that Tamil Nadu is a "Merchant State" (1983, p. 81).

### Institutional Funds for Private Lenders

One potentially important form of interaction between institutional and informal credit agencies is financial intermediation, the extent of which ought to have been influenced by the great expansion of institutional credit over the past forty years. Some important features of the pattern of intermediation in the early 1950s are summarized in table 9-3, which reports sample data for four categories of lenders: village moneylenders who are not also traders, urban moneylenders who are not also traders, traders, and indigenous bankers. Individuals in the third and fourth categories are likely to have been based in towns and cities, as individuals in the second category were. The group most likely to borrow were the traders, of whom almost



Table 9-3. *Moneylenders' Dependence on Borrowed Funds, 1951-52*

<i>Creditors</i>	<i>Number responding</i>	<i>Number borrowing</i>	<i>Number borrowing from</i>				<i>Total<sup>a</sup></i>
			<i>Commercial banks</i>	<i>Indigenous bankers</i>	<i>Other moneylenders</i>	<i>Others</i>	
Village moneylenders	622	174	7 (3.5)	11 (5.5)	136 (68.0)	45 (22.5)	199 (100.0)
Urban moneylenders	2,854	966	320 (25.5)	84 (6.7)	673 (53.6)	178 (14.2)	1,255 (100.0)
Traders	5,047	3,246	1,567 (34.6)	214 (4.7)	1,447 (32.0)	1,299 (28.7)	4,527 (100.0)
Indigenous bankers	152	83	34 (29.1)	13 (11.1)	42 (35.9)	28 (23.9)	117 (100.0)

*Note:* The numbers in parentheses are percentages of the "Total" column.

a. This will exceed the number borrowing if some lenders themselves borrowed from more than one source.

*Source:* RBI (1954, vol. 1, part 2, pp. 670-79).

two-thirds borrowed. The group least likely to borrow were the village moneylenders, and of those who did borrow, fewer than 4 percent of their transactions were with commercial banks. In contrast, between one-fourth and one-third of the borrowing transactions by predominantly urban-based lenders were with commercial banks. A significant proportion of lenders who borrowed did so from more than one source, as indicated by a comparison of the last column (total borrowing transactions) and column 2 (number of lenders borrowing). Directly and indirectly, therefore, commercial bank lending was enlarging the finance available to rural households even in 1951-52.

Unfortunately, it is very difficult to arrive at quantitative estimates of the extent of such intermediation. Cultivating families borrowed, on average, Rs2.0 and Rs11.5 from commercial banks and traders, respectively, in the years 1951-52 (RBI 1954, vol. 1, part 2, p. 3). The former accounted for 2.9 percent of all commercial bank advances (RBI 1954, vol. 2, p. 181), whereas advances for wholesale trade in agricultural commodities accounted for 16.8 percent (RBI 1954, vol. 2, p. 183). These figures suggest that intermediation probably resulted in significant indirect flows from commercial banks, though both direct and indirect flows were certainly small relative to the total borrowings of cultivating households.

The picture in more recent decades is much less clear, in part because the RBI, in concert with the National Sample Survey Organisation (NSSO), has ceased its enquiries of lending agencies. It is therefore necessary to rely on independent studies, which inevitably deal with limited geographical areas. Harriss (1982) constructs a convincing case that with the ending of the cooperative monopoly in fertilizer marketing, intermediation became extensive in North Arcot in the early 1970s. Dealers in agro-inputs were able to obtain credit both for the purchase of goods for resale and for crop production on their own farms and those of their clients. The interest rates charged by dealers were higher than those charged by cooperatives, but the dealers still accounted for about half of all fertilizer sales. In contrast, bank loans to paddy and rice traders were prohibited; but enforcement was rather feeble, and such loans were certainly made, perhaps on a large scale. Harriss also notes that larger farmers were themselves very active as lenders, drawing on the commercial banks, cooperatives, and dealers as sources of funds.

The WBRPO's survey was also confined to households resident in the sampled villages, so that the relevant information on the financial dealings of nonresident traders and commission agents, who are a very important source of rural credit in commercialized areas, is not available. The data reported by Bell and Srinivasan (1985) on borrowings by resident traders and moneylenders from informal and institutional sources in 1980-81 suggest that intermediation involving institutional agencies and resident trader-moneylenders was probably very small in Andhra Pradesh and Punjab. It

may have been significant in Bihar, however, where the institutional borrowings of resident traders and moneylenders represented 20 percent of the total amount borrowed by all households from that source in that season.

### Competition between Private Lenders and State Agencies

All lenders face three problems arising from asymmetric information and the fact that disbursement and repayment are necessarily separated in time. First, the terms of the loan contract may influence the characteristics of those who present themselves for loans and, hence, the distribution of the lender's returns. If the lender cannot, at reasonable cost, distinguish "good" borrowers from "bad," he faces a potential problem of "hidden information," to use Arrow's (1985) terminology—or, as it is usually called, adverse selection. Second, even if the characteristics of the borrower are fully known to the lender, the terms of the loan may influence the borrower's activities and performance in ways that affect the lender's returns. In an uncertain environment, where poor returns from the borrower's activities may result from bad luck rather than indolence, prohibitively costly monitoring of the borrower's actions will confront the lender with the problem of "hidden action"—or, as it is usually called, moral hazard. Third, when the loan falls due, the lender must recover principal and interest, either out of the borrower's returns or, if these are insufficient, out of any collateral specified in the loan contract. Thus, he faces a potential problem of enforcement.

Before attempting to analyze competition between private lenders and institutional agencies, therefore, some comments on the formers' system of operation are needed.

### *Moneylenders' Modus Operandi*

Many of those who have firsthand experience of dealings in rural credit markets emphasize the moneylender's intimate knowledge of the borrower's character and circumstances. Writers as diverse as Darling (1925), the authors of the *All-India Rural Credit Survey* (RBI 1954), and Harriss (1982) put such knowledge at the center of the moneylender's system of operation. For example, RBI (1954, vol. 2, p. 171) states:

[T]here is little that escapes his eye in the circumstances of his debtors or of those who may one day be his debtors. What cooperatives merely postulate, he actually possesses, namely, a local knowledge of the "character and repaying capacity" of those he has to deal with.

This passage makes it clear that moneylenders take the problem of adverse selection very seriously. It suggests that they solve it by confining their

lending to a group of known clients, such as they might build up by operating in a particular village or set of villages over a period of years. Of course, they must still make the relevant investment in building up a clientele, and adding to it when the occasion looks promising. Once they have done so, however, what was hidden information about their clients' characteristics becomes inside knowledge, which other potential lenders must acquire if they are to compete. This arrangement is a far cry from the pooling and separating equilibriums that feature so prominently in the literature on adverse selection in insurance markets, in which the characteristics of agents are not ascertained *ex ante*.

The fact that lenders prefer to deal only with long-standing clients and take on new ones reluctantly (and then only after extensive inquiries) makes it costly for borrowers to switch to other lenders. Because the game between a lender and his clients is likely to be repeated over a succession of seasons, the lender should find it less difficult to distinguish between bad luck and poor performance, especially when his clients reside in the same village and the risks each faces from variations in the state of nature should be quite strongly correlated. These considerations will influence the borrower's actions in ways that mitigate the problem of moral hazard for the lender. They do not, however, eliminate it entirely. Of the 622 village moneylenders and 2,854 urban moneylenders who responded to the RBI's inquiries, 344 and 1,497, respectively, replied to the question concerning the proportion of their loans to agriculturists that they considered doubtful. Of the latter, 104 and 529, respectively, put the proportion at 10 percent or greater (RBI 1954, vol. 1, part 2, pp. 477, 501). Where litigation for recovery is concerned, the numbers answering the question were 187 and 1,162, respectively, of whom 46 and 383, respectively, put the proportion of loans thus affected at 10 percent or more (RBI 1954, vol. 1, part 2, pp. 477, 503). This suggests that moneylenders had not fully overcome the problems of moral hazard and enforcement. Moreover, changes in India's legal and political climate since 1951 have surely exacerbated them, because politicians regularly vie with one another in promising, if elected, to impose a moratorium on the repayment of private and institutional debts alike. If this were done, informal lenders could no longer resort to litigation to recover their loans—though other methods would remain open to them.

Relative to other lenders, the trader-moneylender is especially well placed to enforce his claims. When the crop is sold to or through him, he is in a position to exercise first claim on the proceeds, to the detriment of the borrower's other creditors. There is also sometimes cooperation among traders in this regard, especially in towns with well-organized commodity markets. In Chittoor, for example, a commission agent who dealt in *gur* (a sugar product) told me that agents frequently know one another's clients. If a farmer attempted to sell through an agent other than the one with whom

he normally dealt, the former would deduct principal and interest on the loan, basing his calculations on the usual rule of thumb relating the size of the loan to the quantity to be delivered, and would hand over the said sum to the first agent. Others doing field research have reported similar practices elsewhere in India.

### ***The Terms of the Credit Contract in the Absence of State Agencies***

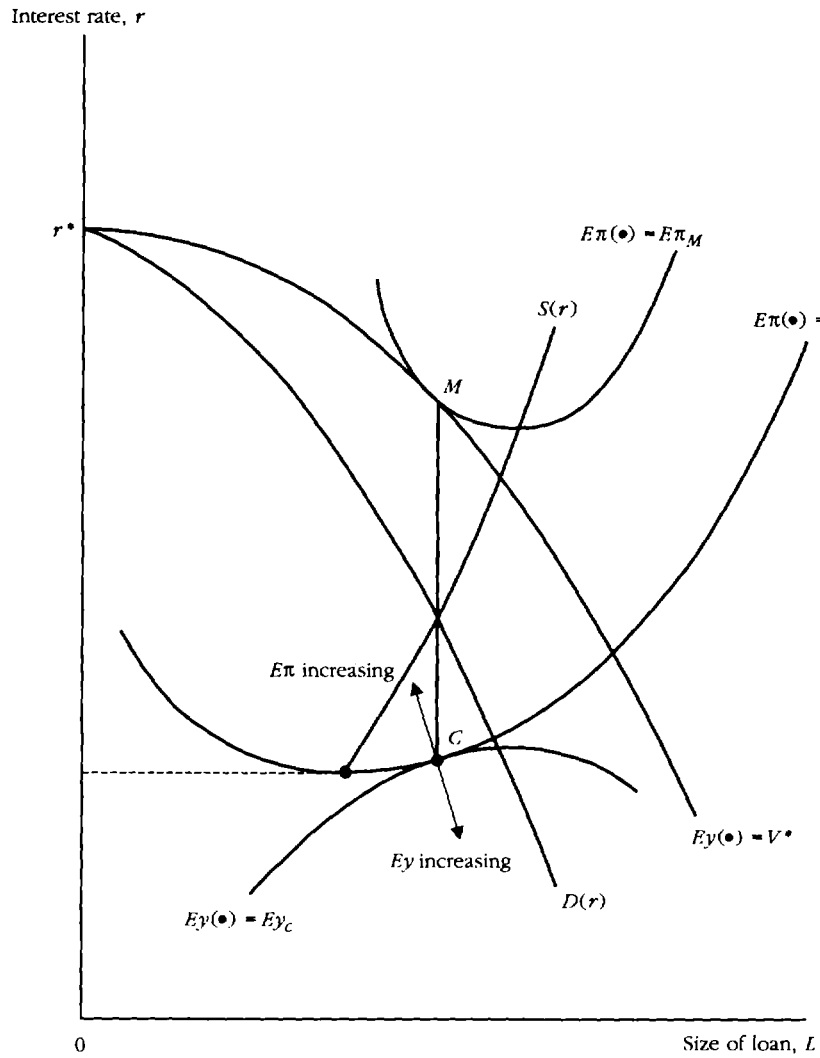
To analyze how the terms of a private loan are determined and how they will be affected by the presence of a state agency in the setting just described, a model of some kind is needed. The one underpinning the graphic analysis employed here is analyzed in detail in Bell (1990a) and has something in common with that of Milde and Riley (1988).

The moneylender is assumed to be risk-neutral, so that he will maximize expected profits,  $E\pi$ . In general, the iso-expected profit curves will be U-shaped in the space of the size of the loan,  $L$ , and the rate of interest,  $r$ , as drawn in figure 9-1. This follows from the usual influence of fixed costs, which include the lender's investments in acquiring inside knowledge about his clients, and the fact that in the presence of moral hazard, the probability of default will, at some point, increase with the size of the loan. In order to keep the exposition simple, and to avoid an excursion into certain technicalities, the contours of the expected profit map have been drawn as smooth and strictly convex everywhere; but it should be noted that these properties may fail to hold, even with quite "nice" underlying assumptions.

There are two polar cases of particular interest. First, if there is free entry into moneylending, lenders will make zero expected profits. Thus, based on his knowledge of the borrower's characteristics, the technology, and the distribution of the states of nature, each lender will offer the borrower the entire menu of contracts defined by the contour  $E\pi(L, r) = 0$ . Faced with this opportunity set, the borrower, who is also assumed to be risk-neutral, will select the contract that maximizes his expected net income,  $Ey$ . In figure 9-1, this is depicted as point C, where an iso-expected net income contour is tangent to the zero-expected profit contour  $E\pi(L, r) = 0$ . Observe that C lies to the left of the borrower's notional demand schedule  $D(r)$ , so the borrower is rationed in the sense that at the interest rate in his optimum contract, he desires a larger loan than the one specified in that contract. Such a loan will not be offered, however, because it entails negative expected profits for the lender.

At the other extreme, suppose the lender is a monopolist. In the absence of any competition, the lender is constrained only by the requirement that the contract he offers be at least as attractive as the borrower's reservation alternative of self-financing his activities, an option that yields the borrower

Figure 9-1. *The Loan Contract and Preference Maps in the Absence of an Institutional Lender*



Note:  $E\pi$  = borrower's expected profits;  $E\gamma$  = borrower's expected net income;  $D(r)$  = borrower's notional demand schedule;  $S(r)$  = lender's supply schedule.

an expected net income of  $V^*$ . Hence, the boundary of the lender's opportunity set is the contour  $E_y(L, r) = V^*$ . In figure 9-1, the contract that will maximize his expected profit is depicted as point  $M$ , where an iso-expected profit contour is tangent to  $E_y(L, r) = V^*$ . The lender will make the borrower (something slightly better than) this all-or-nothing offer. Observe that it lies to the left of the notional supply schedule,  $S(r)$ , and to the right of  $D(r)$ . At the rate of interest at point  $M$ , the borrower would prefer to have a smaller loan, whereas the lender would prefer to extend a larger loan.

Between these two extremes, both parties will have some bargaining power and the final outcome will depend on their relative bargaining strengths. It is plausible that the outcome will be Pareto-efficient, so that it will lie somewhere on the contract locus  $CM$ .<sup>3</sup>

### ***Exclusive Loans from Institutional Lenders***

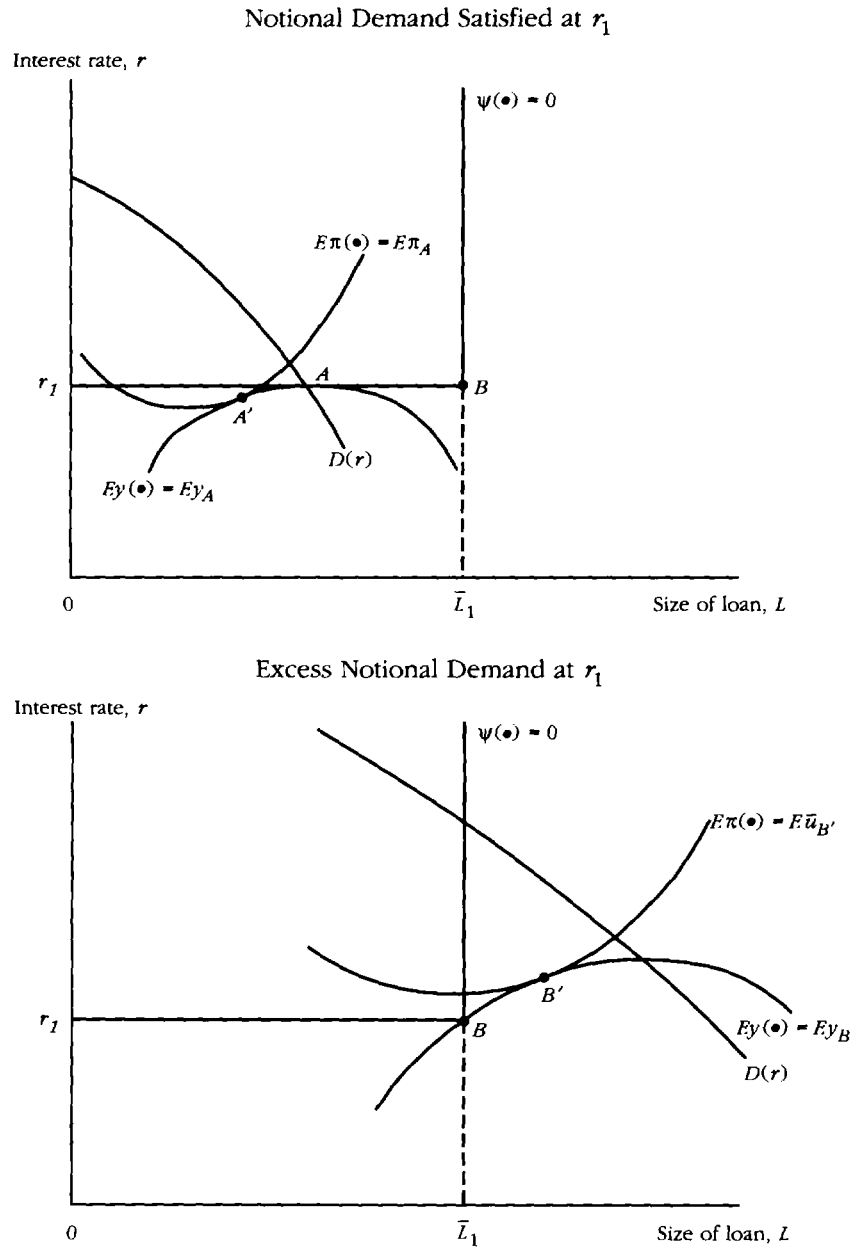
I now examine how the arrival on the scene of state agencies affects the welfare of borrowers and private lenders, as well as the terms of their loan contracts. In order to do this, I must begin by describing the terms offered by state agencies.

Assume that the rules and regulations of a cooperative or bank stipulate that a member or client in good standing qualifies for a loan up to a certain ceiling (or ration)  $\bar{L}_1$  at a given, regulated rate of interest  $r_1$ . The ceiling depends on the purpose of the loan, the extent of the activity (say, the area to be devoted to certain crops), and the form of any associated collateral, which may be just the crop itself. An influential individual might be able to get the rules bent to his advantage, particularly where the ceiling is concerned, but that will not detain us here. For the moment, it will simplify the exposition if private lenders are ignored. Then the boundary of the borrower's opportunity set in the space of  $(L, r)$  in dealing with a bank or cooperative is represented by  $\psi(\cdot) = 0$ , as depicted in figure 9-2. The individual will choose a loan of size

$$(9-1) \quad L_1^o = \begin{cases} D(r_1) & \text{if } D(r_1) < \bar{L}_1, \\ \bar{L}_1 & \text{otherwise,} \end{cases}$$

where  $D(r)$  is his *notional* demand for credit at the parametric rate  $r$ . These two qualitative outcomes are depicted in figure 9-2. In the top panel, the borrower's notional demand for credit at the rate  $r_1$ ,  $D(r_1)$ , is less than his ration  $\bar{L}_1$ . Thus, he chooses point  $A$ , where his notional demand schedule,  $D(r)$ , intersects the horizontal section of  $\psi(\cdot) = 0$ . By the definition of  $D(r)$ , the iso-expected net income contour that passes through  $A$ ,  $E_y(\cdot) = E_{y_A}$ , is tangential to  $\psi(\cdot) = 0$  at that point. In the bottom panel,  $D(r_1)$  exceeds  $\bar{L}_1$ ;

Figure 9-2. Competition between an Institutional and an Informal Lender: Exclusive Contracts



Note:  $E\pi$  = borrower's expected profits;  $Ey$  = borrower's expected net income;  $D(r)$  = borrower's notional demand schedule.



the borrower must make do with his ration, which puts him at point B, the “elbow” of  $\psi(\cdot) = 0$ . Since he is rationed, the iso-expected net income contour passing through B,  $Ey(\cdot) = Ey_B$ , must be upward-sloping at B.

### ***Equilibrium in the Credit Market with Exclusive Contracts***

I now reintroduce the private lender, and begin with the case in which he was a monopolist before the establishment of a cooperative or a branch of a state bank. To a first approximation, this would describe the situation in many backward areas, where low productivity and limited commercialization limit the size of the market for loans. If both the moneylender and the state agency can enforce exclusive contracts, then he must offer the farmer a contract that is at least as attractive as  $(L_1^o, r_1)$ . Since the borrower's iso-expected net income contours are an inverted U-shape in the space of  $(L, r)$ , the moneylender's optimum will be the point of tangency between the map of iso-expected profit contours and the borrower's iso-expected net income contour corresponding to the reservation alternative of borrowing from the institutional lender. In the top panel of figure 9-2, the point of mutual tangency,  $A'$ , is depicted as lying to the left of A; but  $A'$  will lie to the right of A if A lies to the left of the supply curve. In both cases, the rate of interest in the contract offered by the private lender is less than  $r_1$ , but it is packaged with a particular size of loan in an all-or-nothing deal. In the bottom panel, the moneylender's optimum is the all-or-nothing offer depicted as point  $B'$ , a contract in which both the rate of interest and the size of the loan exceed their institutional counterparts at B.

Now recall the benchmark case in which the borrower does not enjoy the alternative opportunities described by  $\psi(\cdot) = 0$ , either because the institutional lender does not exist or because he is unable to obtain a loan ( $\bar{L}_1 = 0$ ). In that case, he will obtain  $V^*$  from his loan from the moneylender. In the light of past and current interest rate policies, it can be assumed that for most would-be borrowers,  $r^*$  exceeds  $r_1$  by a good margin. Hence, the moneylender's expected profits will be lower, and the borrower's expected net income will be higher, following the arrival of the state agency—provided the borrower can obtain an institutional loan. Figure 9-2 is just a formal representation of how, if the moneylender had monopoly power in the informal credit market, the institutional lender has “put him in his place”—but not out of business, unless his expected profits at  $A'$  and  $B'$  are negative.

The analysis of the polar case in which there is free entry into moneylending is similar. I begin with the case in which the borrower is unrationed in the market for institutional loans. If  $Ey_A$  in the top panel of figure 9-2 exceeds  $Ey_C$  in figure 9-1, informal lenders will go out of business. Conversely, if  $Ey_C$  exceeds  $Ey_A$ , state agencies will find no clients. In the case in which the borrower is rationed in the institutional segment of the market, everything hinges on whether  $E\pi_B$ , is positive or negative. If it is positive,

state agencies will find no clients; if it is negative, private lenders will go out of business.

### ***Empirical Evidence: Nonexclusive Contracts by Institutional Lenders***

The above analysis affords some useful insights, but we must now examine whether the key assumption that exclusive contracts are enforceable is empirically relevant. Table 9-4 indicates that in the WBRPO's villages, a substantial proportion of borrowers obtained credit from both individual and institutional sources in Punjab, which is perhaps the most interesting case in this connection. In Andhra Pradesh and Bihar, the proportions are much smaller, but they are still significant among cultivators. In commercialized areas, therefore, it seems that the working assumption of contractual exclusivity by institutions needs to be scrapped.

At the time of the survey in Punjab, the rate of interest on loans from traders was typically 18–24 percent a year, whereas institutions were charging about 11 percent. Thus, if the lower rate on institutional loans was not eroded by higher transaction costs, one would expect borrowers to seek institutional finance first. Only if they failed to obtain as much as they desired would they consider seeking private finance. That is, rationing by institutional agencies might result in a spillover of demand into the informal segment of the credit market.

Support for this hypothesis is provided by table 9-5, which summarizes the transactions of the sample of Punjabi cultivating households that were members of cooperatives. First, if the real cost of credit from both sources

Table 9-4. *Borrowing Households in the WBRPO's Villages, Rabi Season, 1980–81, by Source*

State and borrower	Percentage of households borrowing			Total
	From informal lenders only	From institutions only	From both	
<i>Andhra Pradesh</i>				
Cultivators	70.9	21.6	7.5	100.0
All households	79.6	14.2	6.2	100.0
<i>Bihar</i>				
Cultivators	72.7	18.1	9.2	100.0
All households	84.4	11.9	3.7	100.0
<i>Punjab</i>				
Cultivators	27.2	27.7	45.1	100.0
All households	47.2	20.4	32.4	100.0

Source: Bell and Srinivasan (1985).

were the same and there were no rationing, borrowers would tend to go to one source alone, thereby avoiding the transaction cost of separate deals. In fact, 40 percent of the sample obtained credit from both sources. Second, those who borrowed from both sources borrowed, on average, almost exactly as much from cooperatives as those who borrowed from cooperatives alone, which suggests that cooperative credit was rationed. Third, those borrowing from cooperatives alone greatly outnumbered those borrowing solely from private sources, which is also consistent with cooperative credit being cheaper than private credit. Finally, where the timing of borrowing is concerned, of the eighty households that borrowed from both sources, forty-six transacted with those sources in different months (the smallest unit of time in the WBRPO survey). Of those forty-six, thirty-one borrowed from the cooperatives before turning to private sources, a result that falls well inside the critical region of a test of size 0.05 of the null hypothesis that the probability of that event is one-half (Bell, Srinivasan, and Udry 1990).

This last result suggests that cooperatives were not well placed to enforce exclusive contracts. In that case, it must be ascertained whether the moneylender would have any interest in preventing the borrower from taking an institutional loan. It seems probable that the moneylender will have no objection. The institutional finance will permit an expansion of the borrower's activities, and if the moneylender is in a position to exercise first claim on the returns produced by the borrower's activities, the institutional loan will, in general, improve the moneylender's expected returns from his loan. This question is pursued below.

### ***Equilibrium with Nonexclusive Institutional Contracts***

With nonexclusive institutional contracts, the borrower's opportunity set takes a more complicated form. The boundary of that opportunity set is

Table 9-5. *Credit Transactions of Punjabi Households Belonging to Cooperatives, 1980-81*

<i>Source</i>	<i>Households (number)</i>	<i>Average loan (rupees)</i>
None	37	0
Cooperative only	58	3,674
Informal only	21	2,622
Both	80	8,716
Cooperative	—	3,347
Informal	—	5,279
Total	196	

— Not available.

Source: Bell, Srinivasan, and Udry (1990).

made up of  $\psi(\cdot) = 0$  and an iso-expected profit contour, which is a member of the lender's map drawn with the point  $(\bar{L}_1, 0)$  as origin to reflect the fact that the borrower seeks institutional finance first. In figure 9-3, it has been assumed that the lowest rate the moneylender could charge and still make nonnegative expected profits,  $i$ , exceeds  $r_1$ . The location and shape of that contour will depend on the private lender's knowledge of what dealings his client had with the cooperative or bank and the ease of entry into lending activities. In Bell (1990a), it is established that the contours of the borrower's preference map become steeper in this setting, while those of the lender are unchanged or become less steep, depending on the information available to the lender on the borrower's dealings with the institutional credit agency.

The only interesting case is that in which the borrower is rationed in the institutional segment of the market. Since he deals with two lenders, the question of debt seniority must be settled first. As already argued, the moneylender is in a much better position to exercise first claim on the returns from the borrower's activities.

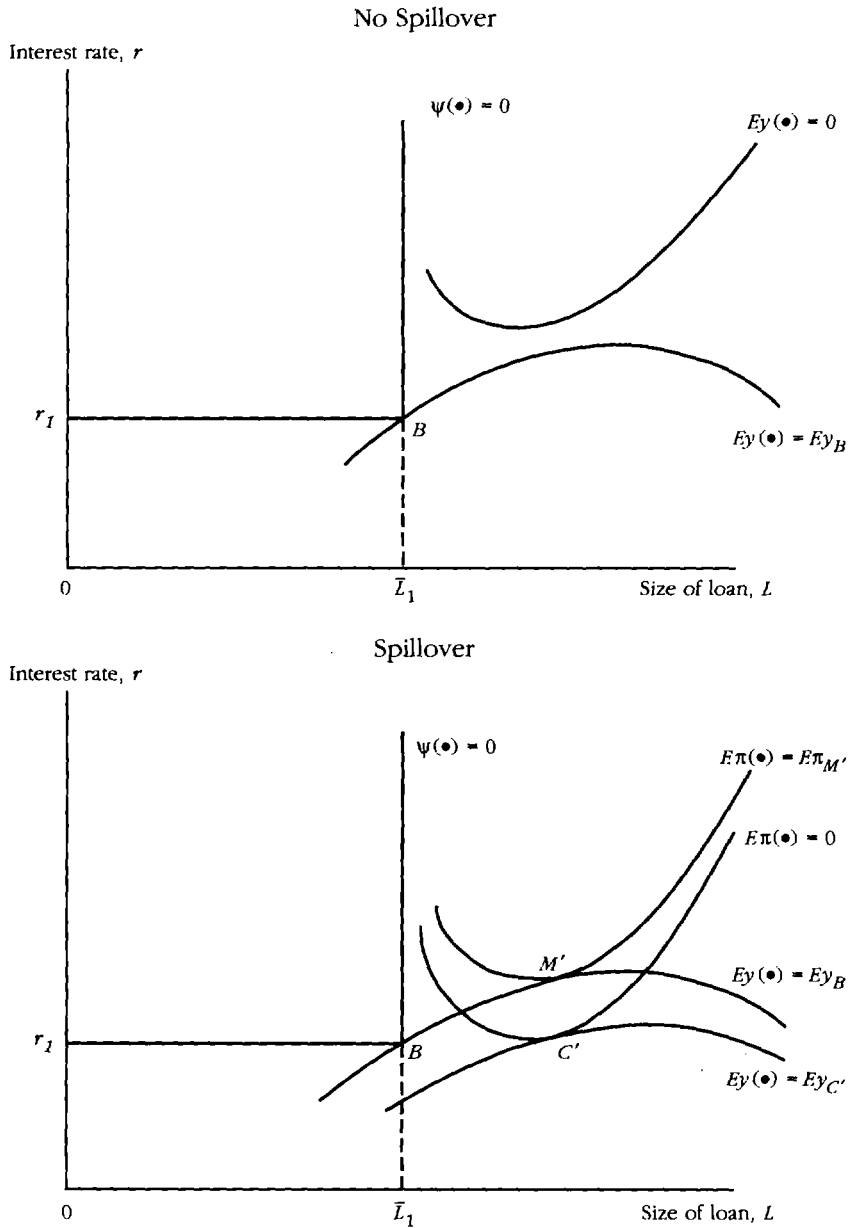
In the top panel of figure 9-3, the contour  $Ey(\cdot) = Ey_B$  lies everywhere below the zero-expected profit contour  $E\pi(\cdot) = 0$ , which is the most favorable menu of contracts that any moneylender would offer. Hence, although the borrower has unsatisfied demand for finance at the parametric rate  $r_1$ , no selection from the menu of contracts offered by the lender affords an improvement over B, and there is no spillover of demand into the unregulated segment of the market.

Two further cases are depicted in the bottom panel, where it is assumed that the contour  $Ey(\cdot) = Ey_B$  intersects the contour  $E\pi(\cdot) = 0$ . First, if there is free entry into moneylending for those willing to invest in acquiring inside knowledge about potential clients, then lenders will earn zero-expected profits and each borrower will face a menu of loan contracts described by the contour  $E\pi(\cdot) = 0$ . In that case, the borrower will choose point C', where an iso-expected net income contour is tangent to  $E\pi(\cdot) = 0$ . Second, private lenders may have sufficient market power to keep would-be borrowers at their reservation levels of expected net income, given the opportunities defined by  $\psi(\cdot) = 0$ . In that case, the moneylender will choose point M', where an iso-expected profit contour is tangent to  $Ey(\cdot) = Ey_B$ . This involves making the borrower an all-or-nothing offer of  $(L_{M'} - \bar{L}_1, r_{M'})$ .

### ***Intermediation between Institutional Lenders and Moneylenders***

I turn now to the effects of intermediation between institutional lenders and individual lenders on the terms and conditions of loans to rural households. To start with, let us suppose there is no uncertainty, natural or strategic. Then a fall in the moneylender's cost of funds will result in a fall in the rate

Figure 9-3. Competition between an Institutional and an Informal Lender: Nonexclusive Contracts



Note:  $E\pi$  = borrower's expected profits;  $Ey$  = borrower's expected net income;  $D(r)$  = borrower's notional demand schedule.

of interest he charges, whether the market is perfectly competitive or he is a monopolist. Moreover, unless he can practice perfectly discriminating monopoly, his clients will also be better off. Indeed, if there is perfect competition and marginal cost is (locally) constant, they will capture the entire gain.

In the presence of uncertainty, these conclusions continue to hold when suitably restated. With free entry into lending, expected profits will be zero. The associated iso-expected profit contour in figure 9-2 will shift downward (and perhaps rotate) as the lender's cost of funds declines, and all gains will be captured by his clients. In the case of monopoly with exclusive contracts, all gains will accrue to the lender unless the terms of the contract are constrained by an active threat of strategic default by the borrower, in which case the gains will be shared to some degree.

There remains the closely related matter of arbitrage between the formal and informal segments of the credit market. Anyone who obtains a loan from an institutional lender has the option of relending the money to another individual, usually at a higher rate. Three factors impose a limit on such arbitrage. First, individuals do not have access to an unlimited supply of loanable funds from institutions. Second, even if they did, they would still need inside knowledge of *their* clients, the costs of acquiring which are partly reflected in the spread between interest rates in the two segments of the market. Third, other activities, such as cultivation, may be more attractive, at the margin, than moneylending.

If there is free entry into moneylending for anyone willing to acquire inside knowledge on a group of clients, and if would-be lenders do have access to unlimited funds, at the rate of, say,  $r_1$ , then expected profits from lending will be zero in the long run. If, further, institutions cannot enforce exclusivity, then equilibrium will be at point  $C'$  in the bottom panel of figure 9-3, as argued above.

The idea that the terms of loans in the informal market are determined by such arbitrage and by the costs of administering private loans is pursued by Siamwalla and others in chapter 8. They implicitly assume that lenders can and do make a sufficiently strenuous effort to recover their loans in full, whatever the state of nature, so that there is no lender's risk. They also assume that contracts are exclusive, that lenders and borrowers take the rate of interest as parametric, and that borrowers realize their notional demands for loans at that rate. With the further assumption that the cost of a lender's effort depends on the size of his clientele, equilibrium values of the clientele's size and the rate of interest are determined by the (first-order) condition for profit maximization and the condition that long-run profits be zero under free entry. In the bottom panel of figure 9-2, this outcome would be depicted as the intersection of the notional demand schedule,  $D(r)$ , with the zero iso-profit contour. Now, the latter is independent of loan size  $L$ ; for by assump-

tion, lenders have overcome the monitoring and enforcement problem. Thus, the zero iso-profit contour is a horizontal line, whose height is determined by the lender's cost of funds, the shape of the function representing his cost of ensuring complete loan recovery, and the condition that he make zero profits.

### Four Proposals for Public Policy

The main objective of Indian public policy toward rural credit has been to ensure cheap and plentiful supplies to all rural households. The chosen instruments for this purpose have been, first, the promotion of cooperatives, and then, following the nationalization of the commercial banks two decades ago, a concentrated push to establish branch banking in rural areas. These policies have certainly enjoyed some success in attaining their objectives, but much less completely than the official estimates might suggest. The moneylender's grip has been loosened in commercialized areas, but remains tight in backward ones, where credit is dear and inadequate. Access to institutional credit is much easier, and credit limits far more generous, for the well-to-do than for the rural poor, although intermediation probably produces some benefits indirectly for the latter.

In recent years, however, institutions have been plagued with defaults, and the cooperative sector is in a sorry condition in many states. In the period 1973-74 to 1985-86, agricultural overdues expressed as a proportion of scheduled repayments rose from 23 percent to 45 percent in the case of the Land Development Banks, they hovered around 40 percent in the case of primary cooperatives, and fell slightly from 49 percent in the case of the commercial banks (RBI 1988).

It is in this context that public policy needs reexamination. Each of the following proposals draws on a different feature of the foregoing discussion.

#### ***Proposal 1: The Role of Private Lenders in Relation to Institutions***

It will be recalled that the moneylender was to have no role in the comprehensive scheme of cooperatives advocated by the authors of the *All-India Rural Credit Survey* (RBI 1954). Yet they also pointed to his vital knowledge of clients' "character and repaying capacity," which, they asserted, cooperatives do not fully possess (RBI 1954, p. 171). The desire to put the moneylender "in his place" was understandable, as was the fear that, once admitted to the cooperative, he would dominate it. By keeping him out, however, the cooperatives were also denied direct access to his knowledge. Moreover, the way was then left open for the agriculturist moneylender,

whose membership in the cooperative as a cultivator was to be eagerly sought. Leaving aside the merits of this policy in the 1950s, do current conditions and circumstances warrant its revision?

While both cooperatives and the banks have had serious problems with overdue loans, the sources of their problems probably were not the same. Despite the concerns about the moneylender's vital knowledge of his clients' character, it should be noted that the members of a cooperative belong to the same community and know a good deal of one another's affairs. Thus, the main difficulty would seem to be not so much one of information, but rather one of enforcement (Wade 1988). For the banks, however, inadequate information about their clients' characteristics and activities surely poses a severe problem because they have expanded their lending very rapidly from a small base and have been under constant political pressure to continue this expansion.

One way of alleviating the banks' difficulties would be to permit them to employ private lenders as their agents. In the commercialized areas of India the importance of traders and commission agents as sources of rural credit indicates that there are numerous private lenders who are well placed to grant and recover loans on behalf of institutions. In the 1970s, for example, such arrangements were adopted in North Arcot by banks and private fertilizer companies for dealers in fertilizer. The dealers in question were selected from a group of farmers who were not dealers in grain, and their lending and recovery activities were monitored by both the companies and the banks. The formal exclusion of dealers in paddy and rice, however, showed that the old reservations concerning their social usefulness as lenders lingered on. Be that as it may, the substantial intermediation that undoubtedly exists implies that many private lenders are already, in effect, acting as agents of cooperatives and commercial banks. Thus, the proposal made here would regularize their status and perhaps encourage further entry by other private agents and greater activity by all lenders. It would also enable the banks to concentrate more heavily on mobilizing rural deposits, a task in which they have enjoyed considerable success.

In support of this proposal, there is at least one other well-documented instance in which private lenders have been engaged by institutional lenders to act as their agents in granting and recovering loans. Wells (1978) reports on a fairly successful scheme organized by the Agricultural Bank of Malaysia, in which cooperatives, farmers' organizations, and private traders were appointed, after screening, as local credit agents of the Bank. The Bank set the rate of interest the agents could charge clients and the commission they received. In the early 1970s, these interest rates were 9 percent and 6 percent a season on unsecured and secured loans, respectively, with a 3 percent commission rate. These arrangements gave farmers some measure of choice and gave agents an incentive to compete for borrowers. As Wells notes, although the decision to admit private agents into the scheme was contro-



versial, their superior performance in utilizing lines of credit from the Bank and recovering loans vindicated the decision to include them.

Two questions remain. First, how should the terms and conditions of loans to households be regulated? Second, what is the appropriate design of a system of incentives? The scheme devised by the Agricultural Bank of Malaysia stipulated both the rate of interest and the commission that private agents could charge. As described by Wells, it lacked specific incentives for agents to compete for good borrowers and to take other steps to ensure recovery, since the commission rate was apparently linked to the volume of funds disbursed. This defect is likely to be important in India too, where the banks have experienced their own enforcement problems. Dhabal and Bhattacharya (1989), for example, after studying a fairly large sample of borrowers from a particular Regional Rural Bank in West Bengal, concluded that while better projects would have led to improved loan recovery, many of those undertaking successful projects were unwilling to repay. One way of overcoming this potential defect would be to base commission payments on agents' success in securing repayment of the loans they advance, with a small salary to make the burden of lender's risk tolerable (Miracle 1973).<sup>4</sup> Such a (linear) scheme would, of course, still leave the institution with the option of setting the rate of interest on loans.

### ***Proposal 2: Interlinking Institutional Credit with Marketing and Supply***

The authors of the *All-India Rural Credit Survey* (RBI 1954, vol. 2) argued that cooperatives would be more profitable if they also engaged in business related to lending, such as the supply of inputs and marketing of outputs, which is interlinking by any other name. This form of interlinking is clearly valuable to traders and commission agents, not least because it mitigates the problem of enforcement. It is also practiced by cooperatives in the sugar industry, though in this case, it should be noted that the nature of the crop and its processing affords especially favorable conditions for these arrangements.

Such special cases aside, one difficulty with the RBI's recommendation is that it would impose further, heavy demands on the organizational and entrepreneurial resources of the primary cooperatives. As we have seen, most of them have barely coped with their credit business, so it seems improbable that a significant proportion would be able to branch out successfully into marketing and supply. Even for those primary cooperatives able to do so, the fact that they would possess an additional means of securing repayment of loans does not ensure that loan recovery would actually improve. As for the commercial banks, they will not engage in such diversification, for this or any other reason.

Thus, the job of recovering loans at the point of sale would appear to fall

to marketing cooperatives organized at a level above that of the primary cooperatives, say, the block or *taluk*. With a full-time staff and a large membership, individual members will find it more difficult to exercise the sort of influence that prevents enforcement at the village level. Such an arrangement does, of course, require coordination between the lending agencies and the marketing cooperatives. At the time of disbursement, the primary cooperatives and the banks would report the amount due from each borrower, and upon successful recovery, the marketing cooperative would receive a fee from the credit agency. Marketing cooperatives would also be free to extend loans. In the sugar industry, they have done so for decades, often in concert with the banks.

The RBI's recommendation was taken up only fairly recently, as part of the Integrated Rural Development Programme. Whether it will reduce the cooperatives' overdues remains to be seen. In any event, such vertical integration is a potentially useful step toward the oft-stated objective of curbing the power of private traders in commodity markets, should it exist.

### ***Proposal 3: Regulating the Activities of the Trader-Moneylender***

It was argued earlier that the effects of the introduction of institutional lenders depend heavily on the ease with which private agents can enter into moneylending activities. Where entry is fairly easy, the threat of entry will keep lenders' expected profits close to zero. Thus, the institutions' costs of supervision under Proposal 1 will be modest, and there is no cause to worry about moneylender-traders capturing integrated credit-cum-marketing cooperatives, since the associated rents will be small. It is important to note that this conclusion also holds if private loans are interlinked with the marketing of output, as is commonly the case in commercialized areas, where traders and commission agents are numerous.

In these circumstances, the activities of the trader-moneylender should not be restricted. It has been argued that commercialization and the growth of a marketed surplus have fostered competition in credit markets, both among trader-moneylenders and between private lenders and public agencies. Hence, the avowed intention of the government to drive the private trader out of commodity markets and to supplant him with state trading organizations with exclusive purchasing rights would, whatever its other merits, have highly adverse effects on rural credit markets. In more commercialized areas, there would be adverse consequences also for agricultural output and incomes. Promoting credit-cum-marketing cooperative societies would be far preferable to banning private trade in commodities.

Where private lenders are few and entry is difficult, however, the above proposals will require closer (and more costly) supervision of lenders' activ-

ities. The opportunity to borrow from an institution also imposes a limit on the terms a private lender can exact, and so provides a form of indirect regulation of his activities. Whether such arrangements will bring about a substantial improvement in the borrower's lot depends on how the institutions actually function. It is often remarked that the behavior of the institutions' officials is influenced by the profitability of private moneylending. Thus, a borrower might face the unappetizing choice between a usurious loan from the local moneylender and a hefty side payment to the official who sanctions institutional loans. In that case, calls for strict regulation of the private lender's activities and an expansion of cheap institutional credit will, if heeded, create substantial opportunities for rent-seeking within the institutions. The question of what should be done in backward areas is not, therefore, by any means fully resolved by the preceding discussion.

#### ***Proposal 4: The Limitations of Institutional Credit in Backward Areas***

The claim that credit is comparatively plentiful and cheap in commercialized areas is hardly new and should not be especially controversial. For example, Harriss (1982), who can hardly be called sympathetic to moneylending and trading interests, has persuasively argued as much in the case of North Arcot. In backward areas, however, credit is scarce and dear, and the moneylender, often in the guise of the big cultivator, has a firm grip on village economic life. Casual observation of such areas suggests that their cooperatives are enfeebled or dormant, and that those who staff the few branches of commercial banks settle for a quiet, or even venal, life, thus leaving the private lender's power unchallenged.

It is probable that interventions in the credit market will do little to remedy the miserable conditions of life for the people of such areas. As argued earlier, only those borrowers with fair access to some institutional credit will be able to drive a more favorable bargain with the moneylender. If, moreover, the latter gets his hands on some institutional credit—as he usually will—he will also capture most or all of the gains from the resulting reduction in his cost of funds when making loans of his own. Most experience also suggests that in the circumstances considered here, the infusion of loanable funds through institutional lenders is too limited to make such credit widely available—except at a very heavy cost to the treasury. Attention should be focused, instead, on raising agricultural productivity and incomes directly, through public investments in infrastructure and the diffusion of new methods and crops. In order to take advantage of the opportunities so provided, cultivators will certainly require an initial increase in working capital. The amount in question should not be exaggerated, however, and there is ample evidence that even quite poor households are able

to muster some savings. Thus, an infusion of institutional credit is not necessary to get the process started. If the experience of commercialized areas of India is any guide, private lenders and public credit agencies will then follow; so that discussion of appropriate intervention in credit and related markets will then become relevant.

## Notes

Kaushik Basu, Karla Hoff, and several anonymous referees provided valuable comments on this chapter.

1. The relevant sources for present purposes are, respectively, Bell and Srinivasan (1985, 1989), Binswanger and Rosenzweig (1984), and Binswanger and others (1985).

2. Zamindars were essentially tax-farmers, who held title to the land on condition of payment of a fixed sum to the government and leased their land to tenants. There were often several layers of subtenancy, and in such cases those who actually cultivated the land did so under oral contracts. The zamindari system was established under the terms of the Permanent Settlement of 1793.

3. In this particular model, it turns out that CM is a vertical line, a result obtained by Milde and Riley (1988) for a similar model.

4. Miracle (1973) advocates a small salary and a commission based largely on success in securing repayment of loans.

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## 10

## Cooperative Credit in Agriculture— The Israeli Experience

Yoav Kislev, Zvi Lerman, and Pinhas Zusman

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*Cooperation in credit offers advantages in risk pooling through mutual liability and guaranty, but it also poses serious control problems. The debt crisis in the family farm sector of Israel, triggered in 1985 by anti-inflationary policies, revealed weaknesses inherent in the cooperative structure. Mutual liability encouraged overborrowing when possible and could not be enforced when needed. Cooperative credit could not survive in a highly unstable macroeconomic environment.*

PENILESS IMMIGRANTS WERE SETTLED ON national land with public assistance in the early stages of agricultural development in Israel, thus creating what amounted to fosterage relations between the farm sector and the public agencies that looked after it. Modern Jewish agriculture had received substantial public support since its inception in the nineteenth century. Ideology and expedience made cooperation the preferred form of organization within the agricultural sector. Cooperative agriculture developed gradually in the 1930s and 1940s, and its growth accelerated dramatically in the early 1950s, when the newly established state directed arriving immigrants to agricultural cooperatives and furnished them with housing and farm tools. Today 80 percent of Israel's agricultural product comes from the cooperative sector, both family farms and the collective kibbutzim.

A major form of cooperation in agriculture has been financial. It flourished for a long time; but financial cooperation has found itself recently in deep trouble and will need massive public assistance to overcome its difficulties. It is now too early to predict what kind of cooperation, if any, will

emerge from the crisis. Yet important lessons can be drawn even from this incomplete experience. This chapter concentrates on Israel's experience with credit in farming villages run by cooperative associations, the so-called moshavim. In each moshav, all farms are family-owned and -operated and all farmers belong to the multipurpose, democratically run village cooperative. The communal sector—kibbutzim—will not be discussed in this chapter.

We summarize our observations in the following. Financial cooperation supported intensive development of the family farm sector when stable financial conditions prevailed. When credit supply expanded with inflation, and when it was augmented by government support, overextension was encouraged, particularly in the cooperatives. When credit expansion was slowed down, the cooperative sector found itself trapped in financial impossibilities. Now cooperation ties farmers and their organizations together and intensifies the crisis.

Inflation in Israel accelerated steadily from a yearly rate of 12 percent in the early 1970s to more than 500 percent (annualized) in the first half of 1985. It was then halted by an abrupt change of direction in policy, and since then inflation has been at approximately 20 percent per year. The rising prices were fueled by the expanding supply of credit. Interest rates lagged behind inflation, and real rates were negative for most of the decade ending in 1985. These conditions encouraged overinvestment and overborrowing and discouraged saving. But interest rates also lagged when inflation decelerated in 1985 and, as a result, real rates skyrocketed. Unable to service their debt, agricultural cooperatives collapsed.

Agriculture, and particularly cooperative agriculture, was thus the victim of inflation and the measures implemented to halt it. But the crisis reveals weaknesses inherent in the cooperative structure itself, as well as weaknesses in government lending policy to agriculture. Many businesses suffered severely when economic conditions changed with the introduction of the anti-inflationary policy in 1985. But it is only in agriculture that a whole sector—the cooperative sector—collapsed financially. Cooperative financial intermediation was founded on mutual liability arrangements and the crisis brought out clearly the failure of these arrangements. Mutual liabilities encouraged overborrowing when that was possible and could not be enforced when the need arose.

## The Moshav and Second-Order Cooperation

In principle (practice varies) the cooperative association of each moshav purchases all farm supplies for its members and markets their farm products. It may also own and operate a variety of service facilities and manage directly some productive enterprises. In addition, the association encompasses all

municipal and many social functions in the village. Besides all these, the association also serves as a financial intermediary through which credit is channeled to the farmers. The moshav is therefore a supply, production, service, municipal, and credit cooperative.

Moshavim are members in two types of second-order (mostly regional) cooperatives: *supply cooperatives* (requisite societies, purchase organizations) set up to purchase farm inputs for their member-moshavim, and *regional service enterprises* (feed mills, slaughterhouses, transportation services, and others). The supply cooperatives act also as the spokesmen of their regions in the government offices. They engage in intensive lobbying and most have acquired a strong political standing.

Starting with back-to-back transfer of suppliers' credit to their members, both the moshav and the supply cooperative expanded into full-scale financial intermediation. In the two decades preceding the eruption of the crisis in 1985, the associations in the moshavim and the supply cooperatives were first and foremost credit associations. Moshavim were settled on national land; it was practically impossible for lenders, particularly suppliers and commercial banks, to repossess farms. This deficiency—that land and buildings could not be used as collateral—was the principal economic justification for the evolution of the moshav cooperative as a credit intermediary and for its mode of operation.

### Financial Intermediation

The pivotal role of credit intermediation in the activities of the moshav association and the regional supply cooperative is demonstrated in their balance sheets in table 10-1 (for additional details, see Lerman 1989). Members' debit balances—accounts receivable from members—are by far the largest asset the associations hold: 76.6 percent of the total in the moshav and 60.9 percent in the regional supply cooperative. The moshav and the regional coop raise debt capital from outside sources and lend to their members. The associations also function as clearinghouses, accepting deposits from members with financial surpluses (members' credit balances in table 10-1) and lending to members with credit shortages. The supply coop and its moshavim are closely linked: through credit, as can be seen in table 10-1 where 76.9 percent of the moshav's liabilities is short-term credit from the supply coop, and through joint ventures in the regional service enterprises.

The government was the major source of long-term credit and the major lender in the early stages of the development of the moshavim.<sup>1</sup> Government credit was generally supplied on concessionary terms and the



Table 10-1. *Balance Sheets of a Moshav Association and a Regional Supply Cooperative, September 30, 1981*  
(percentage of total assets)

	Assets		Liabilities	
	Moshav	Supply cooperative	Moshav	Supply cooperative
Fixed assets	3.7	3.5	Equity	0.7
Long-term investments and loans to members	3.5	13.7	Long-term debt	4.2
Inventories	4.0	n.a.	Short-term loans	0.6
Accounts receivable			Short-term loans from supply cooperative	76.9
Nonmembers	12.2	3.6	Suppliers' credit	4.1
Regional enterprises	n.a.	18.3	Members' credit	21.8
Members' debit balances	76.6	60.9	balances	13.5
Total	<u>100.0</u>	<u>100.0</u>		<u>100.0</u>

n.a. Not applicable.

Note: The data for the moshav are for an average association in a sample of thirteen moshavim, all members of the regional supply cooperative. Balance sheets are prepared in historical values, not adjusted for inflation. The financial reports in the moshav are for the cooperative association, not for the whole village. Information on individual farms is not included and is generally not available.

Source: Zusman (1988).

minuscule share of long-term (mostly government) credit in table 10-1 is a reflection of both inflationary erosion of unindexed debt and the growing availability of alternative sources of finance.

The balance sheet is prepared in historical values, and as a result equity capital in table 10-1 is understated. It was estimated that if adjusted to current values, equity would reach between 15 and 30 percent of the associations' liabilities. But even with fully revalued equity, items reflecting financial intermediation still dominate the cooperatives' balance sheets.

The regional supply cooperatives thus established for their members the moshavim—and they in turn for their members the farm operators—financial services with steady lines of credit and convenient saving facilities. Because of proximity and familiarity, asymmetric information was not a significant problem in cooperative agricultural credit in Israel. Still, interlinkage of credit and marketing was practiced (Bell 1988): farmers were expected to channel the proceeds of their marketed products through the moshav association and it, in turn, through the supply coop. Interlinkage formed part of the institutional setup that replaced collateral for loans.

## Financial Cooperation

The “classical” discussion of the theory of cooperatives (LeVay 1983) struggled with the definition of the goals of the cooperative firm and its behavior. Difficulties created by the cooperative’s egalitarian democracy were recognized but not formulated explicitly and not examined analytically. In the modern approach (Vitaliano 1983; Royer 1987; Zusman 1988), the cooperative is viewed as a collection of individuals, each guided by personal preferences but committed to joint performance of certain economic functions. The modern approach enhances our understanding of two central facets of the cooperative mode of action. First, laws and regulations governing cooperative life are often compromises and are not necessarily first-best, Pareto-efficient. For example, the optimal cost allocation rule is generally marginal cost pricing; but unable to agree on the distribution of side payments, the moshav most often settles for average cost pricing. This subject is treated at length in Zusman (1988). Second, members in cooperatives—in our case, farmers in a moshav or moshavim in a supply coop—are not subordinates in a centrally managed hierarchy; they are free to act within wide limits. By treating explicitly individual behavior and group decisions, the modern, contractual perception of cooperation throws new light on the advantages of cooperative credit intermediation and particularly on its weaknesses.

### *Advantages*

With cooperation, members in the moshavim and moshavim in the supply coops enjoy economies of scale in loan processing and professional financial management—particularly important in a high inflation, high tax economy such as Israel—and a stronger bargaining position in the credit market (as well as in other markets).

Perhaps the greatest advantage of cooperative credit, both in the moshav and in the supply coop, lies in risk pooling, implemented in two ways. In the short run, the association can use its own resources to smooth over the credit needs of its members. Outside lenders do not have to deal with transitory difficulties of individual borrowers.

A more fundamental mode of risk pooling is mutual liability and guaranty. Members in the moshav sign mutual guaranty agreements for the moshav association and representatives of moshavim pledge similarly for the loans raised by the supply coop. This creates explicit and implicit peer monitoring. The social pressure to comply with cooperative norms is strengthened under mutual liability arrangements, and in general the probability of the association’s default is reduced. Banks evidently recognized the advantage inherent in this arrangement, as credit to cooperative associations was often conditioned on renewal of mutual liabilities.

## Weaknesses

Several kinds of structural difficulties afflict the moshav. First is *moral hazard*—members may tend to invest in excessively risky projects on their farms, safe in the knowledge that mutual liability will bail them out should the investment fail. *Free riders* pose another difficulty—a member in the moshav may market the product of his farm privately, thus weakening the association's standing in the credit market. *Agency costs* are another problem—banks and other lenders view the cooperative associations as their agents and expect them to protect their interest (by limiting credit to failing farms, for example), but the associations are guided by their own interests, which are not always identical to those of the lenders. Similarly, officers in the associations may be tempted to expand operations and to assume risks that prudent members on their own would avoid. Finally, there may be *horizon problems*—members may support policies favoring short-term gains in expectation that in the long run they may exit, leaving those who stay to carry the cooperative's liabilities (Vitaliano 1983).

Enforcement of the moshav's norms and rules (which in practice implies enforcement of the collective marketing interlinkage arrangements) is critical to its continued functioning as a credit cooperative. However, compliance with the moshav's code requires high standards of cooperative ethics ("sympathy" in the usage of Sen 1966) and willingness to enforce the rules. Interdependence of the degree revealed in table 10-1 and close monitoring due to interlinking of credit with product marketing could be expected to allow effective control. However, this was not the case. Particularly where interdependence was strong, the moshavim and the farm operators who belonged to them had only limited access to alternative sources of credit and, consequently, the supply cooperatives were committed to continue funding their member moshavim, however weak and close to failure. Their elected officers could hardly afford the dire financial, social, and political consequences of members' bankruptcies.

These enforcement difficulties are reflected in the behavior of members of cooperatives. A rough measure of the financial exposure of a member is the ratio of outstanding debt to monthly sales through the cooperative ("credit months"). During the period 1977–81, thirteen of the twenty-four moshavim in the regional supply cooperative of table 10-1 exceeded twelve credit months (Zusman 1988). Moshavim with fifty-five and forty-two credit months were observed in another supply coop (Kislev and Marvid 1988). More than a few farm operators owe their moshav cooperative associations several times their yearly production capacity. Moshavim or individual farmers with such heavy burdens of debt compared to their production capacity will never be able to repay their loans or service them adequately. Heavy debt burden does not happen overnight; it evolves gradually.

Moshavim or individuals with dozens of credit months testify to the weakness of their cooperatives, a weakness that breeds permissiveness and lax financial discipline.

Moral hazard behavior and other weaknesses increase the risk to the lender and may even outweigh the advantages of cooperative credit. This indeed is observed in the aftermath of the recent crisis—lenders that were not previously involved are reluctant to extend credit to moshavim and to regional and national cooperatives.

### Regional Enterprises

Regional service enterprises were ordinarily organized as limited liability cooperative associations and their establishment was financed mainly by government investment grants and subsidized loans. Their membership consisted of moshav associations, mostly potential patrons of the service offered. Often the regional supply coop was also a member and in all cases it provided the enterprises in the region with short-term financing and purchasing services. Strong economic relations developed between the two kinds of regionals—the supply coop and the service enterprise—a relationship that proved detrimental when the financial crisis erupted at the end of 1985.

Zealous pursuit of rural development by public agencies, easy access to credit through the supply cooperatives, and strong political regional lobbies resulted in overexpansion of the service enterprises. These trends were particularly prevalent in the 1970s, when credit was in ample supply and economic optimism ran high. Not unlike firms in a cartel, regionals scrambled to grab their share in the service enterprises, with all the expected ensuing benefits. Consequently, in the early 1980s many service enterprises operated under capacity: 50–60 percent by the estimate of the state comptroller. The final outcome was that many of the enterprises could not even cover their operating costs.

The supply cooperatives, assuming the role of the financiers of last resort, found themselves financing not only operating losses but also the debt service of the regional enterprises. In 1981, the share of credit to the service enterprises in the assets of the supply coop in table 10-1 was already 18.3 percent; it grew substantially thereafter. In one case (Kislev and Marvid 1988) we found that a regional slaughterhouse that started operation in 1981 with equity representing 25 percent of its inflation-adjusted capital<sup>2</sup> began accumulating losses, and by 1985 its debt reached 2.5 times the value of its assets, most of that short-term loans from the supply coop. This was an extreme case but not atypical; when the service enterprises began failing in 1985, they took many of the supply coops down with them.

## Cost of Debt

Perhaps the greatest damage that inflation inflicted on the Israeli economy was the distortion of the cost of capital. Real interest rates varied markedly due to both market and administrative lags in adjusting nominal interest to the rate of price changes. Cost of borrowing in some channels was at times very high, while at other times and for other loans it was negative. For more than a decade, since the early 1970s, real rates of interest on most sources of credit were negative, primarily due to government intervention in cost of debt for preferred uses. Particularly well subsidized were government-supported development loans until they were linked to the price index in 1979. Moreover, as both interest expenses and indexation linkage of the principal were tax-deductible, taxpaying farmers and cooperatives enjoyed a negative effective cost of capital even for index-linked loans or for loans with interest rates fully adjustable to the rate of inflation. It was only in 1982 that tax regulations were introduced requiring inflation-adjusted accounting and thus eliminating loopholes that inflation created.

In a preliminary survey of eight cooperatives, both village and regional, we found that the *average* effective real cost of outstanding debt was zero in 1971 and it declined gradually thereafter; it was *minus* 40–50 percent per year in 1984. When inflation was halted in 1985, interest again lagged and real rates jumped to *plus* 15–20 percent. Current cost of credit varied even more: the real rate of interest on directed short-term credit in 1984, with inflation at its peak, was *minus* 59 percent. In 1985, the real cost of overdraft facilities was *plus* 100 percent per year.

## Credit Supply to Agriculture

It has often been claimed in Israel that agriculture suffered from credit shortage. Examination of the available information reveals, however, that credit has been in ample supply. The share of agriculture in the net domestic product of the business sector has been 6–7 percent; but over the past two decades, its share in the volume of credit was higher than 10 percent. With inflation, financial leverage increased, particularly in agriculture. In 1986 the ratio of outstanding economy-wide credit to gross national product was twice its 1969 value; in agriculture the same ratio increased by a factor of 3.8. The ratio of credit to net capital stock increased in agriculture between 1969 and 1986 by a factor of four, while in industry it rose over the same period by only 20 percent. As we have seen, credit was under-priced and the low, even negative real rates of interest evidently contributed to the feeling of shortage.

Another claim often made in Israel was that the maturity structure of loans did not match capital needs. Not enough long-term loans were available and investment projects had to be financed with short-term credit, creating a financing gap between the expected life of the assets and the duration of the loans. Again, with negative real interest rates and easy access to short-term credit, many farmers and cooperatives knowingly financed investments with short-term loans and knowingly created financing gaps.<sup>3</sup>

Whatever the origin of the financing gaps, farmers always turned to the government when financial stress became a cause for concern, usually with forceful lobbying and political backing. There were many cases, almost one a year until 1985, of "conversions" (rescheduling of loans): short-term credit was replaced by long-term loans, mostly on concessionary terms. The recurrence of the conversion episodes, sometimes general and sometimes specific to certain farms or regions, was one of the major reasons for the widespread belief that agriculture would not be allowed to fold. The remedy was, however, not always effective. In many cases farmers and cooperatives returned to the preconversion maturity structure just several years after rescheduling.

## Government

Cooperation in agriculture was encouraged by the government as a matter of policy: new immigrants were settled in moshavim; land and water were allotted to the moshav and distributed equally among the members; production quotas in milk, eggs, broilers, fruits, and other products were allocated on a village basis and the moshav decided on internal distribution; government agencies usually consulted with the cooperative association in the moshav on the allocation of long-term loans to farm operators.

Over time many of the newly settled operators acquired farming skills and cooperation became well established. Yet the view—held not only by farmers—that it was the government's role to maintain the welfare of the farming sector persisted, and the expectation that the government would actually shoulder this responsibility did not wane.

Government (in the wide sense of the term) is responsible for the laws and regulations of cooperative activity. Two instances of interest to our discussion can be mentioned. First, attempts to pass a "law of moshavim," strengthening the power of the association over individual members and improving their ability to control financial activities, failed because the law was deemed to infringe on the freedom of the members. Second, a regulation was recently issued that a cooperative cannot force members to participate in covering its losses. The argument is that a cooperative is a limited liability entity and members are responsible only up to the value of their shares (in principle, the limitation does not apply to cases of mutual guaranty). A judge

already applied the new regulation in one dispute and the case is now on its way to the Supreme Court. If upheld, it will mean a revolution in the mode of farm cooperation in Israel.

The most profound public involvement in agriculture was in credit.<sup>4</sup> By deciding on the allocation of subsidized credit, the government influenced regional development, lines of production, and farmers' income. The dependency on the government and the expectation that it would bail out farmers and moshavim in trouble created moral hazard problems, not unlike those that mutual guaranty created in moshavim and regional cooperatives. Lacking the usual mechanism of collateral, the government turned to close monitoring in the form of "concentrated credit": under this system, a moshav or a kibbutz concentrated all of its financial activity in a single bank; credit for both investment and short-term needs was granted only with the approval of a steering committee consisting, among others, of representatives of the bank and the Ministry of Agriculture.

Participation in the concentrated credit scheme was voluntary and moshavim were attracted by the additional loans they could get. Indeed, the program, which started in the early 1960s, covered in a few years most of the moshavim in the country. However, the increased credit supply in the 1970s, and particularly the convenient alternative sources offered by the supply cooperatives, eliminated the advantages of concentrated credit from the point of view of the moshavim and the program folded in mid-1970s. Thus the problem of moral hazard in the moshavim was recognized and tools to mitigate it were devised, but the will to maintain a strict policy could not withstand the flood of available credit. Concentrated credit is now proposed again in reaction to the current crisis.

## Crisis

The crisis erupted at the end of 1985 once creditors realized that agriculture, particularly cooperative agriculture, could not continue to service its debt in view of the exceedingly high, post-reform real interest rates and the inability of the government to continue to bail the sector out. Private lenders and commercial banks refused to extend additional credit and insisted that loans be repaid. This was impossible and most regional cooperatives and many of the associations in the moshavim collapsed. Farm production has continued, often with private credit arrangements (wholesalers, for example, pay in advance for farm products) and the farmers' personal resources. But this cannot be a complete solution to the crisis: (a) in most cases, the available sources will be insufficient for investment in equipment and machinery and farmers will find it hard to renew their production assets; and (b) banks and other creditors are still demanding repayment of the outstanding loans. For

most farmers, the heavy burden is not their own debt but their share of the mutual liabilities—their share in covering the debt of several heavy borrowers in the moshav and the debt of the regional service enterprises.

Agriculture cannot repay or service its debt in full; the question now is how to distribute the losses. Once this was realized, the government stepped in offering support in an effort to reach a debt settlement between the banks and the moshavim. An agreement was formulated in 1988, but its implementation has been slow because farmers still hope that they can gather political support for a more favorable settlement.

## Recapitulation

Inflation created a special opportunity for agriculture in Israel, particularly for cooperative agriculture. With negative real interest rates and erosion of debt, agriculture could have increased its equity capital and emerged from the inflationary period economically stronger. This did not happen; as we have seen, financial leverage increased in agriculture: farmers sank deeper into debt, partly to finance investment in production assets (often with overcapacity), partly to finance housing and consumer durables, and partly to increase current consumption and standards of living. Considerations of short-run inflationary gains dominated those of long-run economic health.

Myopia is common, but it afflicts cooperatives more strongly than individuals and private enterprises because of the cooperatives' internal politics and because of its incentive structure, which leads to moral hazard behavior, free riding, agency costs, and horizon problems. Still, the cooperatives were not the only ones at fault. Credit was distributed by the commercial banks; it was their money that was lent and it was their responsibility to secure the loans and to control their use. Evidently they neglected this responsibility.

However, cooperation is not the sole cause of the crisis. Government, by its policies to accelerate development and by ultimately yielding to political pressures, created the impression (which has since proven false) that it would bail agriculture out in case of difficulty. Government also carries the major blame for overcapacity in agriculture. Farmers and regional officers naturally tend to increase their share in aggregate capacity. Because most of the development projects were funded with government approval, it was the duty of the government to consider the aggregate picture and to balance the desire to invest against the needs. This was not done; policymakers and even the Ministry of Agriculture Planning Authority encouraged over investment. The crisis in cooperative agriculture is to a large extent the outcome of the favoritism it enjoyed for a long time.

Structural weaknesses in the moshavim and irresponsible behavior on the part of the government and the commercial banks reinforced each other in



precipitating the crisis. It is impossible to apportion the blame at this stage and it is probably not important. The significant question is what inference can be drawn from the analysis about the future of agricultural cooperation.

Although cooperation in general, and financial cooperation in particular, has many advantages, it also suffers from inherent weaknesses. It is not clear if cooperation—unless heavily assisted by public funds—can succeed or, in the long run, even survive the economic test of competitive markets. But the test of the crisis is much harsher. Even if cooperation is basically viable, it may now be destroyed because of the particular crisis conditions. Much will depend on the willingness of the members to maintain cooperation in agriculture and on their ability to make the required structural modifications that will increase the stability and reduce the probability of failure of cooperatives.

### Lessons and Recommendations

The failure of cooperative agriculture was a failure of control. If cooperation in agriculture and particularly cooperation in credit is to survive and succeed, control has to be tightened. But control is expensive and often inconvenient. Both incentives and appropriate structures are needed to assure optimal control.<sup>5</sup>

First and foremost, the government cannot and should not take explicit or implicit responsibility for agriculture or for cooperatives. Then both farmers and lenders will know that they are the sole residual claimants of profits or losses. It will be in their direct interest to tighten control and to follow prudent economic policies. Mutual guaranties should be severely limited to reduce moral hazard behavior at the farm and in the village and regional cooperative association, and external market control of cooperatives should be established wherever possible.

A necessary condition for efficient control is availability of accurate and timely information. Financial reports, including balance sheets and income accounts, need to be prepared and published regularly. The reports should be adjusted for inflation; prices are still rising in Israel at 15–20 percent per year.

Supply coops should be limited to commercial activity; they should not act as financial intermediaries. The regional service enterprises should be incorporated as limited liability companies and the members of the owner-moshavim should receive marketable shares. Moshavim and their members should be free to patronize service enterprises of their choice, whether in their region or elsewhere.

Members in the moshavim should be free to leave their cooperatives and operate privately or to form alternative organizations. Exit is expensive—it

raises the average cost of services to the remaining members, and the exiting farmer may forfeit his allocation of land and water and, in addition, his production quota and development loans. But exit is often the only way for patrons to enforce efficiency and for minorities to voice their opposition (Hirschman 1970). Lack of control may be more expensive.

The structural changes that we are proposing—and in many cases we adopt proposals that have already been made in Israel—are not easy to implement. Exposing the regional service enterprises to market competition may seem extremely painful in the short run; and indeed the Debt Settlement Administration is attempting to cure the enterprises by erasing their debt and assuring capacity operation through tying moshavim to their services. In the long run this is a recipe for inefficiency. The implementation of the changes we propose will require modifications of both law and attitude.

## Notes

The authors are indebted to Avishay Braverman for raising the issues discussed in this chapter and for his assistance and encouragement. Karla Hoff, Michael Lipton, and the referees offered constructive comments and suggestions. The responsibility for the analysis and the opinions expressed is ours.

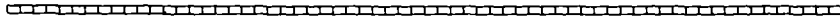
1. We lump together government and other public institutions.
2. A major share of the accumulated equity was due to the inflationary erosion of unlinked loans during the construction period, from 1976 to 1981.
3. In part, however, the government was also responsible for the financing gaps. For example, government-approved development loans were often dispensed with delays, forcing reliance on short-term bridging finance. In periods of inflation, delays create not only temporary but also permanent gaps in financing because of the inflationary erosion of the real value of the loans that were late to arrive.
4. Thirty to forty percent of the credit in Israel is supplied by banks from their own sources and allocated to borrowers at the banks' discretion. The rest is under government control—either originating from the government budget and the central bank or from bond issues and deposits administered by commercial banks but designated as funds for earmarked, government-approved projects. Public involvement in credit supply to agriculture is even larger, with more than 80 percent government-directed.
5. We focus on the Israeli experience with its particular characteristics; chapter 3 discusses the problem in the context of developing countries.

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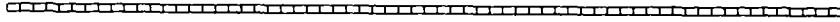
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*Part II*

***Rural Land Markets  
and Policies***





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# 11

## *Designing Land Policies: An Overview*

*Karla Hoff*

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LITTLE ECONOMIC ACTIVITY WOULD OCCUR in the absence of rights, or powers, to consume, obtain income from, and transfer assets. The level of economic development of a region will therefore depend on its system of property rights.<sup>1</sup> The next five chapters bear on two central questions:

- Under what conditions will government intervention in customary or extralegal land rights systems promote development (chapters 12, 13, and 14)?
- What has been the experience of redistributive land reforms? Chapters 15 and 16 analyze pitfalls in the Philippine and Colombian land reforms.

### **Systems of Land Rights**

In developing countries, official land records for rural areas are typically incomplete or do not exist at all. There are often conflicts between national systems of land rights, de facto rights of occupancy exercised by squatters, and customary land rights established by ethnic communities. In much of Sub-Saharan Africa, restrictions under customary law limit the transferability of rural land rights.

It has been widely assumed that government reform of rural land rights systems was needed in many developing countries to increase the security of property rights and the scope of land markets. Robert Seidman, a leading scholar in law and development, argued that, "Undoubtedly, the hardest

single rub in African law lies between the norms of customary land tenure and the demands for development” (Burg 1977, p. 525). Policymakers appear to have accepted this view in many cases. African countries that have invested in rural land titling programs include Kenya, Somalia, Uganda, and Zimbabwe (Barrows and Roth 1990). To increase security of land rights, many other countries—including Brazil, Indonesia, Thailand, and Yemen—have undertaken costly projects to improve land records.

The high cost and uncertain success of these investments have recently prompted economists to study the economic effects of land titling programs and indigenous African land rights systems. Chapters 12, 13, and 14 examine these issues. The conclusions in each chapter differ, however, because each focuses on a different environment, as described below and illustrated in figure 11-1. Taken together, these three chapters suggest the circumstances in which a government investment in land registration and titling is likely to promote land markets and security of land rights, and those in which it is not.<sup>2</sup>

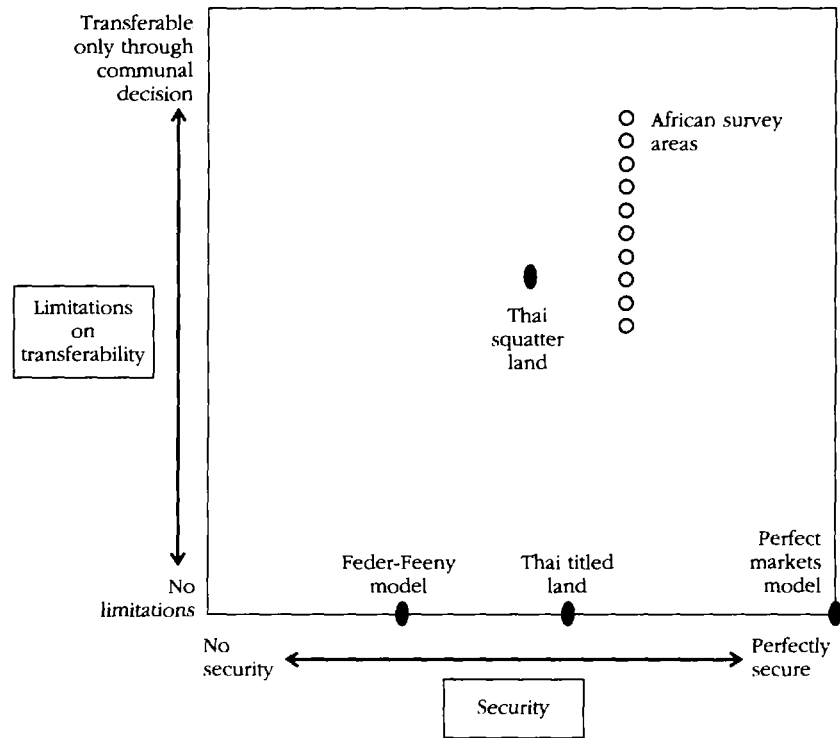
Figure 11-1 will be helpful in synthesizing the contributions of the next three chapters. The figure characterizes land rights systems according to two dimensions: transferability of rights and security of rights. These two dimensions are distinct. In the case study in chapter 14 of African indigenous land rights systems, use rights are quite secure but cannot, in many cases, be freely transferred. Data were collected on whether a head of household could exercise numerous use and transfer rights over particular parcels of land. For permanently held land, the right to transfer use rights was, in many cases, limited by the requirement (a) to obtain prior approval, (b) to limit the transfer to short duration, or (c) to make transfers only to someone within the family, lineage, or tribe. The unrestricted ability to transfer a use right is just one end of a continuous spectrum between communal control and a free market.

Security is a second, distinct dimension of land rights.<sup>3</sup> Insecurity of rights can arise under a regime of limited transferability of rights when the local community’s authority is weak, or it can arise under a regime of marketable rights because of absent or conflicting land records and inadequate enforcement. In the idealized market systems assumed in much of neoclassical economics, all land rights are marketable and security of land rights is perfect, as depicted by the southeast corner of the figure. The land rights systems considered in chapters 12, 13, and 14 are indicated as points in the space of the figure.

In chapter 12 Feder and Feeny explore, in a theoretical model, the consequences of insecurity of land rights (which are assumed to be perfectly transferable). They suppose that landowners live two periods, consuming as well as investing in land and capital in the first period, and hoping to enjoy the fruits of their investment in the second period. But they face a chance,



Figure 11-1. *Characterizing Land Rights Systems*



with probability  $\phi$ , of losing their land and the output on it at the beginning of the second period. The expected value of their final wealth is thus  $[1 - \phi]$  times the value of the land and its output at the end of the first period. *Insecurity of land rights is similar to a tax at rate  $\phi$ .*<sup>4</sup> Just as the burden of a tax consists of the resources paid plus an efficiency cost, the effect of tenure insecurity consists partly in the transfer to individuals who stand to receive the land (with probability  $\phi$ ), and partly in an efficiency cost.

The contribution of the Feder-Feeny model is to identify three distinct sources of the efficiency cost of insecurity of land rights. One obvious source is the distortion in farmers' incentives to invest in land. A second cost arises if land is used as collateral for debt. In this case, part of the risk of land loss is borne by the lender, and thus insecurity of land rights will reduce farmers' access to capital. The third efficiency cost arises because uncertainty in rural land rights depresses the price of capital much less (if at all) than the price of

rural land, under the plausible assumption that rural land but not capital is in inelastic supply. The increase in the relative capital-land price ratio will, through the usual substitution effect, reduce the capital intensity of farming.

The implication of the theoretical model is clear. To the extent that government measures, such as titling, increase the security of property rights in land, they will increase the efficiency of resource allocation in the rural sector.

The case study in chapter 13 is a cross-sectional analysis of two classes of farms in Thailand—squatter land in illegally occupied forest reserves and titled land. The absence of past government action against squatters in most illegally occupied areas, and squatters' own perceptions of the security of their land, suggest that the rights of the squatters in the surveyed areas are reasonably secure. Those rights are also highly transferable in the informal land market. However, they are not at all transferable through formal channels, with the practical consequence that squatters cannot use their land as collateral to obtain loans from banks. The two categories of land, squatter and titled land, are therefore represented in figure 11-1 as differing primarily with respect to the transferability of rights. Data for 1984–86 suggest that in Thai areas where (because of a high degree of commercialization) informal sources of credit were abundant, the possession of legal title had little effect on investment in the land or on output. In contrast, in areas where bank lending was an important source of credit, land titling had a strong positive effect on investment in land, output per unit land, and the market value of land. As Feder notes in chapter 13,

The results are strengthened by the findings elsewhere (Chalamwong and Feder 1988) that awarding title documents to squatters has a very high economic payoff in most of the areas studied: the benefits outweigh the cost of surveying, adjudicating, and certifying ownership by a wide margin.

Finally, Migot-Adholla and others (chapter 14) use cross-section evidence from Ghana, Kenya, and Rwanda in 1987–88 to examine whether restrictions on the transferability of land are a constraint on productivity. Their survey covered ten regions of rainfed agriculture. In the ten survey areas,

The distinguishing feature of different tenure regimes . . . revolve[s] around restrictions on the individual holder's ability to transfer land (only among family members, within the lineage or community, or to outsiders; and with or without approval from other lineage or community members), which also tends to coincide with the mode of transmittal (inheritance, gifts or bequests, and sale).

The African survey areas are indicated by the open circles in figure 11-1.

Surprisingly, the evidence here shows no relationship between cross-sectional variations in land rights and productivity. Comparison of land rights regimes across areas with different levels of commercialization and population pressures provides weak evidence in support of the hypothesis that Sub-Saharan customary land rights systems move autonomously toward full privatization in the presence of increasing commercialization and population pressure. The authors conclude that the binding constraints on Sub-Saharan rural development are not customary land rights systems, but lie elsewhere—for example, in poor rural health, education, infrastructure, technology, and access to output markets. They argue that government measures to promote the effectiveness of *existing* indigenous land tenure institutions are preferable to expensive formal registration and titling programs.

This argument is strengthened by their results that in traditional farming areas in Kenya, land titling programs have had little impact. The authors collected data from the cultivators of more than 100 land parcels in each of two traditional Kenyan farming areas. In one area, 75 percent of the parcels were titled, but only 8 percent were deemed salable by the operator. In the second area, only 14 percent were titled, but 67 percent were deemed salable. Kenya provides the best test case for land titling programs in Sub-Saharan Africa because it is the only country in that region with more than thirty years' experience with a national land registration program. Its experience demonstrates that titling is neither sufficient nor necessary to create a land market. Rather, land titles facilitate the expansion of a land market where social norms permit the alienability of land.

Taken together, the chapters in part II suggest that the benefits of land registration and titling programs are likely to be highest in areas where (a) land markets are active, but there is a high incidence of conflict over ownership of marketable rights, or (b) farmers' access to credit depends on having title to land. The benefits are likely to be small or negligible in areas where indigenous land rights systems are strong. In such areas, government programs to promote land markets and strengthen formal land claims may even decrease land rights security if indigenous law is undermined, but statutory law is too little accepted or enforced to supplant it.

## Land Reforms

Many studies indicate an inverse relation between farm size and productivity (see Berry and Cline 1979; Prosterman and Riedinger 1987, chapter 2). Consider table 11-1 based on a survey across India in the 1970/71 agricultural year. The data show a steep decline in income per acre as farm size

Table 11-1. *Inverse Relation of Farm Size to Land Productivity: All India Survey, 1970/71*

<i>Range of farm size (acres)</i>	<i>Average farm size (acres)</i>	<i>Income per acre (rupees)</i>
0-5	2.95	737
5-15	9.3	607
15-25	19.5	482
More than 25	42.6	346

*Source:* Indian National Council of Applied Economic Research, reported in Berry and Cline (1979, table A-1, p. 149).

increases, with productivity of the largest size category less than half that of the smallest.

Many factors, including differences in land quality, contribute to the widely observed inverse relation between farm size and productivity. In a careful statistical analysis of another set of data from Haryana, India, for 1969-72, Carter (1984) found that differences in land quality and capital could not explain a significant part of the inverse relation. Though the inverse relation between farm size and productivity that is due to farm size alone is not as dramatic as table 11-1 would suggest, nonetheless a decisive factor in the widely observed inverse relation is that smaller farms tend to be family farms using labor very intensively and making little use of hired labor; larger farms use labor less intensively and rely primarily on hired labor. Because of agency costs, monitoring problems, and imperfections in labor markets, family-run farms face a low implicit price of labor, while large farms using hired labor face a high implicit price of labor. Hence, it makes an important difference whether the labor owns the land, or the landowner hires the labor.

Redistributive land reforms have been carried out in many countries, often as part of social revolution, but sometimes as a deliberate policy intervention to capture the efficiency benefits of the family farm, reduce urban food prices, and decrease poverty (see Prosterman and Riedinger 1987, table 1). The two case studies on land reforms in the Philippines (chapter 15) and Colombia (chapter 16) illustrate what can go wrong when reform policies induce unforeseen changes in institutions.

The 1972 Land-to-the-Tiller Program in the Philippines converted share tenants into leaseholders or owners. The land rent or amortization payment was fixed at 25 percent of annual rice yields averaged over three normal years preceding the year in which the program went into effect. In an effort to ensure that the land reform beneficiaries remained the tillers of the land, legislation denied land reform beneficiaries the right to lease (or sublease) their land.

After 1972, public investment in irrigation in central Luzon and the diffusion of Green Revolution technology more than doubled paddy yields and made many of the beneficiaries of the land reform wealthy. With increasing wealth came a decline in the amount of farm labor that beneficiaries wanted to supply. Before the land reform, the usual practice by landowners who did not wish to farm was to lease their land for a fixed rent or a share rent. Since the land reform, this kind of contract has become very risky and rare, because a tenant who can prove to the satisfaction of the Agrarian Reform Office that he is the responsible "tiller of the land" is entitled to receive the land rights of the original land reform beneficiary. Hayami and Otsuka (chapter 15) provide evidence that tenancy contracts have been supplanted by a new form of (semi-) permanent labor contract, the so-called *kasugpong*. Under the *kasugpong* contract, the worker is paid either a wage or a 10 percent share of paddy output. Relative to the tenancy contracts used before the land reform, the *kasugpong* contract attenuates the worker's incentives to produce and thereby aggravates the agency problems that the land reform was intended to solve. It also has given rise to a new landless labor class that has less opportunity for upward mobility than did the pre-1972 sharecroppers whom they replaced.

Another example in which restrictions on land transfers were counterproductive is the *gogolan* land system found in parts of East Java, Indonesia.<sup>5</sup> The Dutch established land titles to irrigated riceland there in the nineteenth century and provided that these *gogol* could be transferred only as units; they could not be subdivided. In practice they were subdivided and possession rights were sold, but without legal title. Thus, although the land is legally titled, the way in which it has been subdivided has deprived the possessors of the benefits of title.

The last case study in part II is an analysis of sixty years' history of land reform policies in Colombia (chapter 16). This study places the system of land rights squarely within the broader political system. Colombia has periodically sought, beginning in the 1930s, to modernize its agricultural sector through redistributive land reform. However, instead of land redistribution, there have been a series of reforms that have (inefficiently) increased output on large farms at the cost of large public subsidies to wealthy farmers and explosive poverty among the smallest landholders and the landless.

At least until the writings of the school of public choice in economics, economists tended to argue that if a Pareto-improving action was available to a representative government, then it would ultimately be implemented. But recent work has shown how redistributive activity, in the form of competitive seeking of government largess, can lead to prisoners' dilemma games and Pareto-inferior outcomes. Rent-seeking behavior allows private groups to turn laws into private goods that reduce the income-producing capacity of an economy (as, for example, when efforts to obtain a government-created

monopoly use up productive resources). As Brock and Magee (1984) put it, the *invisible hand* is stamped on by an *invisible foot*. The foot represents the unseen costs that rent-seeking activity imposes on an economy.

In chapter 16, de Janvry and Sadoulet argue that initial land reforms in Colombia increased the political influence of the large landlords over the making of agricultural policy. They used this influence to divert capital, marketing programs, and other inputs to large-scale farms, often with big public subsidies. These government subsidies increased the value (to the large farmers) of their land and ultimately rendered a redistributive land reform with compensation infeasible. As a result, Colombia has been unable to capture the efficiency gains potentially offered by a redistributive land reform. De Janvry and Sadoulet suggest that a redistributive land reform might again become feasible if a period of fiscal stringency forced government to curtail subsidies to large farms.

## Notes

1. See Grey (1980) for an analysis of the modern view of property rights as a web of relations of entitlement between persons, rather than as the exclusive control over something. The usefulness of that view is illustrated in the case study of land rights in Sub-Saharan Africa (chapter 14 of this book) and in the analysis of property rights in surface water (chapter 25 of this book).

2. It is a separate question, not explicitly examined in this book, whether the expansion of fragmented land markets must increase (or at least not harm) efficiency. In the presence of fragmented insurance markets, this need not always be true. See Hoff and Lyon (1992).

3. *Security of rights* is also distinct from *tenure security*, defined as the ability of a farmer to cultivate, and claim rents from, a piece of land on a continuous basis. Though a farmer *A* has perfect security of lifetime use rights with respect to a parcel, and thus perfect tenure security were he to choose to cultivate the parcel, his tenant *B* with a short-term lease will not have tenure security. *B*'s tenure insecurity reflects *A*'s choice to alienate his land for a short period.

An issue that has been important for migrant farmers in parts of West Africa is that indigenous law precludes them from buying land. In those areas, tenure insecurity may not reflect *A*'s choice but rather be a consequence of the limits on the transferability of land under indigenous law.

4. For an elegant demonstration of this point in the context of urban residential land, see Malik and Schwab (1991). Their analysis also shows that if risk markets are missing, then land insecurity differs from a tax to the extent that the holders of contingent claims to the land value risk differently. The effective "tax" rate on a more risk-averse agent will be greater than on a less risk-averse agent.

5. I owe this example to an anonymous referee.

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## 12

# *The Theory of Land Tenure and Property Rights*

*Gershon Feder and David Feeny*

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*This chapter focuses on the relation between property rights in land and resource allocation in agriculture. The chapter discusses the impact of land rights on incentives, uncertainty, and the operation of credit markets. The chapter also briefly describes various kinds of property rights in land and the evolution of institutional arrangements to make them effective. Of particular relevance to developing countries, this chapter emphasizes the contribution of public sector infrastructure to effective land rights systems.*

*In a formal model, we derive the effect of increased property rights security on land values, the intensity of cultivation, and the use of credit. With increased security, land prices and agricultural productivity rise. The model clarifies the likely deviations between private and social assessments of the benefits of increased land rights security.*

THE SYSTEM OF PRIVATE PROPERTY RIGHTS in land found in modern Western economies is the product of centuries of economic, social, political, and legal change (North 1981). Most economic analyses presume Western-style exclusive, transferable, alienable, and enforceable private property rights in land. In this case, the traditional three pillars of economic theory—resource endowments, technology, and preferences—are sufficient to explain resource allocation. The fourth pillar, institutions, can be omitted without seriously distorting the analysis. Yet both historically and in the contemporary world, especially in developing countries, the presumption of exclusive, transfer-



able, alienable, and enforceable rights is frequently inaccurate and misleading. In such cases, institutional arrangements in general and property rights in particular need to be described. The fourth pillar needs to be specified (see, for example, Arrow 1985; Coase 1960; Feeny 1988; Solow 1985).

This chapter focuses on how property rights in land affect resource allocation in agriculture in developing countries. We consider the influence of land rights systems on incentives, uncertainty, and the operation of credit markets. Of particular relevance to developing countries, we emphasize the importance of public sector infrastructure in making land rights systems effective. We illustrate the effects of property rights security on land values, the intensity of cultivation, and the use of credit in a formal model. The model highlights the strong interactions between security of property rights and credit markets.

### Property Rights as an Institution

It is important to place land rights in the context of the overall institutional structure of the society and economy. There are three basic categories of institutions: constitutional order, institutional arrangements, and normative behavioral codes. The *constitutional order* refers to the fundamental rules about how society is organized—the rules for making rules. *Institutional arrangements* are created within the rules specified by the constitutional order. These arrangements include laws, regulations, associations, contracts, and property rights in land. *Normative behavioral codes* are the cultural values that legitimize these arrangements and constrain behavior (see, for example, Taylor 1988 on the ethical foundations of the market). The constitutional order and normative behavioral codes evolve slowly; institutional arrangements may be more readily modified.

In developing countries undergoing evolution in all three categories of institutions, there is the potential for a lack of congruence among the three types of institutions. Although the formal legal system may provide for alienability of land, the transfer of land to persons from another clan or ethnic group may represent a violation of cultural norms. Similarly, although the constitutional order may make provisions for private property rights and there may formally be laws establishing such rights, the corresponding registration and enforcement mechanisms may be largely absent.

Property rights are an important class of institutional arrangements. In general, “property as a social institution implies a system of relations between individuals. . . . It involves rights, duties, powers, privileges, forbearance, and so on, of certain kinds” (Hallowell 1943, p. 119).<sup>1</sup> Property rights are a bundle of characteristics: exclusivity, transferability, inher-

itability, alienability, and enforcement mechanisms (Alchian and Demsetz 1973). Thus property rights define the uses that are legitimately viewed as being exclusive and who has these exclusive rights. Uses of land may include hunting, passage, gathering, grazing, cultivation, the mining of minerals, the use of trees, and even the right to destroy the resource. For instance, in medieval England and contemporary South India, rights to the crop are private, while rights to the stubble after harvesting are communal (Campbell and Godoy 1986; Wade 1986). Similarly, in many parts of Sub-Saharan Africa land and tree tenure are separate (Feder and Noronha 1987). Land rights may further specify the conditions under which various types of transfer of rights may be effected and the parties to whom such transfers may be made. Rights also have a temporal dimension. Enforcement of land rights depends on a constellation of supporting arrangements and mechanisms such as courts, police, financial institutions, the legal profession, land surveys, record-keeping systems, and titling agencies, in addition to the social norms that give legitimacy to property rights in land.

There are four basic categories of property rights in land: none (or open access), communal property, private property, and state (or crown) property. Under *open access*, rights are left unassigned. The lack of any exclusivity implies the lack of an incentive to conserve, and therefore often results in degradation of scarce resources. Under *communal property*, exclusive rights are assigned to a group of individuals.<sup>2</sup> Under *state property*, management of the land is under the authority of the public sector. In *private property* an individual is assigned the rights. These four categories are ideal analytical types. If the group holding exclusive communal rights is large enough, the distinction between communal property and open access becomes moot. If private property rights are not viewed as being legitimate or are not enforced adequately, de jure private property becomes de facto open access. Nonetheless, the simple taxonomy is useful for describing property rights systems.

All or some of these categories of property rights may exist in a single society for different tracts of land. Furthermore, because of the multifaceted nature of property rights in land, the same tract of land can be categorized under more than one regime. In many societies, some or all land is constitutionally the property of the state, but exclusive use rights are given to individuals under a contractual arrangement with the state (as occurred in China, described in chapter 6). If these use rights are transferable with few limitations, and if the contract is sufficiently long-term (for example, ninety-nine years), then for most of the contract's duration there is very little difference between possession of use rights and full property rights.

The changes in economic relations and in power structures that characterize the development process generate changing needs for property rights and the institutions to regulate or enforce them. In the early stages of agricultural development, land rights may be split between the individual

and the community, with individuals assigned use rights (which can be long-term and inheritable), while the right to sell land or transfer the use right to nonheirs is retained by the community. Under circumstances where endowments are similar across households and land is abundant, such arrangements provide incentives to individuals to exert effort in tilling land and preserving fertility (through secure and inheritable use rights), yet they minimize social tensions. Social unrest may emerge when individuals lose their land rights, especially to nonmembers of the community, creating a landless class. When technology advances, however, and endowments of labor and other productive assets differ among households, the lack of transferability of property rights may adversely affect productivity. Efficiency considerations thus motivate changes in both the constitutional order and institutional arrangements relating to land rights.

Private property rights in land have evolved gradually in response to increases in the scarcity value of land and therefore the benefits to be derived from more precise and secure land rights. When land was abundant and labor scarce, property rights in labor (for example, slavery) were often defined with much greater precision than property rights in land (see Engerman 1973 and Feeny's 1982 case study of Thailand). Increasing population density, appreciation in the agricultural terms of trade, and technological change that made investments in land quality more profitable have enhanced the benefits from creating more precise private property rights in land.<sup>3</sup> The processes that helped to shape the historical development of land rights in the West are very salient today in many developing countries. Population pressure on land resources is common. Many new technologies have increased the returns to farmland. There is a strong demand in many developing countries for institutional arrangements to define and enforce property rights in land with more precision.

Changes in political power and the formation of interest groups are other dynamic factors affecting the definition of property rights. For example, the 1972 land reform in the Philippines, discussed by Hayami and Otsuka in chapter 15, provided new forms of property rights and transferred wealth to former tenants.

## **Intuitive Propositions**

Property rights serve to assign the gains and losses from actions to agents and therefore have a profound effect on incentives, resource allocation decisions, and economic performance. This section will discuss the role of property rights in land in (a) providing incentives to use the land efficiently and invest in its quality, (b) reducing asymmetric information and uncertainty, and (c) facilitating transactions in financial markets.

### ***Incentives***

Property rights provide agents with incentives to use land efficiently and to invest in land conservation and improvement. The establishment and enforcement of these rights are, however, not costless. When land is abundant, the gains that enhanced property rights afford may be more than offset by the transaction cost of providing for the property rights. If land becomes scarce, however, or changes in technology create new investment opportunities, the forgone gains become more important and the provision of property rights in land then has the ability to enhance productivity. *Communal rights* may represent the best land rights regime where opportunities for investing in the quality of the land are limited, the community is small, but land is sufficiently scarce that it pays to exclude outsiders from using it. In such a situation communal rights economize on transaction costs. Outsiders are readily detected and the entire community has an incentive to enforce their exclusion. When the community is sufficiently small, transaction costs of regulating use among members are not prohibitive. However, it is often observed in larger communities that mechanisms for imposing restrictions on individuals' land use patterns that are harmful to the group's interest are deficient, and communal ownership then leads to efficiency losses. Furthermore, when new market opportunities arise or new technologies provide large benefits from investments, communal rights may no longer provide sufficient incentives for effort or investment.

### ***Asymmetric Information and Uncertainty***

Given the effect of land rights systems on incentives, it follows intuitively that risks to the possession of such rights (for example, the risk of state expropriation or of private challenges to land rights, or the risk of tenure agreement cancellation faced by a tenant) will hurt production and investment. Here we wish to emphasize a particular aspect of efficiency loss due to asymmetric information. In the early stages of agricultural development, transactions in land take place mainly among members of the same community. Information is thus fairly symmetric: the identities of those who possess transferable rights over specific tracts of land are reasonably well known to all members of the community. With more advanced stages of development and increased mobility of individuals and entrepreneurs, transactions among individuals who are not members of the same community are more frequent. As a result, the scope for asymmetric information and, hence, land disputes increases. The price of land will then not reflect its true social value, and the extent of land transactions will be less than optimal. Land transactions generally increase efficiency in resource allocation, because agents with high (potential) marginal productivity of land acquire land from agents with low marginal productivity.

In order to reduce the inefficiencies arising from uncertainty, societies develop sophisticated institutional arrangements for recording and enforcing land rights. One such arrangement is a centralized public record of land tracts and the possessors of rights over these tracts. Such records have coverage at various levels of geographic units (for example, county, province, or national), presumably with higher costs as the unit of coverage expands. As early as 600 B.C., the Bible describes that for a land transaction between the prophet Jeremiah and a relative, two copies of the record of the transaction were kept with a certain priest in the capital, Jerusalem. This arrangement enabled individuals who were considering buying or renting land from others a way to verify that the rights they were about to purchase did indeed belong to the seller or renter. In later times, officially maintained land records and title documents have become a much more systematic institutional arrangement to reduce risks and information asymmetry. A central record is of course only one of the institutions designed to reduce uncertainty. A functioning legal system and effective enforcement mechanisms are necessary as well. In the absence of such public services, each individual will increase his private allocation of resources for enforcement through, for example, guards and fences. It is normally more efficient to reduce the risk partly through expenditures on a public good (police and judiciary) than through individual actions only.

Risk and asymmetric information with respect to land rights are particularly great in frontier areas where unsettled land is being claimed by individuals migrating from other areas. In such circumstances, there is no established community from which knowledge can be obtained. The large number of claims and challenges to claims typically overloads the administrative infrastructure (land record offices, courts, and police). It is not uncommon in such areas to find private (and necessarily segmented) institutions to protect property rights over land (gunmen and fortified properties).

### ***Land Rights and Credit Transactions***

The business of lending is inherently risky. The use of collateral on loans can reduce uncertainty and moral hazard problems for creditors. Collateral is more valuable the more immobile and immune to damage it is, and land has traditionally been an ideal collateral asset in areas where land is scarce (Binswanger and Rosenzweig 1986). The emergence of profit-motivated credit activities (whether formal or informal) among agents within and outside established communities is frequently an important element in inducing institutional change with respect to land rights.

Land's usefulness as collateral is dependent on the absence of uncertainty and asymmetric information with regard to the rights (in particular, transfer rights) of the operator-occupier. A lender, for the same reasons that concern a potential buyer or renter, would like to be assured that the borrower-

operator has indeed the right to dispose of the land or its use rights by sale or transfer (a well-defined set of use rights over a sufficiently long time period has a capitalized value that can serve as collateral). The availability of land as collateral and documentation of land rights that make such a collateral credible affect the willingness of creditors to make loans (Feder, Onchan, and Raparla 1988). In addition, formal procedures for registering liens on property rights provide important enforcement mechanisms. Thus, the same institutional arrangements that increase incentives for productive use of land also facilitate a more efficient credit market.

Formal procedures, however, may also entail high transaction costs. There is evidence of comparable informal mechanisms with lower costs. For instance, one device is for the debtor to leave the physical title (document of land rights) on deposit with the creditor. Although this does not provide for the formal registration of the transaction and therefore does not provide for a secure mechanism for foreclosure in the event of default, it does ensure the creditor that the property will not be disposed of without his interests being protected. It also enables the creditor to limit the total liabilities of the debtor in that other formal (or informal) credit transactions requiring the presentation of the title cannot be performed without the knowledge of the creditor. Formal and informal practices of this nature have been observed in Africa, India, and Thailand (Meek 1946, p. 256; Stifel 1976). A contemporary informal variation that has emerged in Thailand recently is a signed power of attorney agreement for the debtor to retain use of the land while leaving the land title document with the creditor (see chapter 8). The availability of the land title document provides the creditor with added security, making it possible for individuals to extend credit to persons with whom they are not closely familiar. For the debtor these informal arrangements provide access to larger sums at lower rates and reduce market segmentation. Thus, while titles have a more significant role in formal credit markets, they also enhance the efficiency of many informal credit markets.

### ***Public Sector Resources to Promote Land Security***

In the rural areas of many developing countries, the institutional arrangements necessary to provide incentives for efficient land use to reduce uncertainty and asymmetric information are often not well developed or are largely absent. This is not because the forces that tend to generate these institutional arrangements are absent, for these forces are clearly present in many instances: high population-land ratio, technology requiring soil fertility enhancement, and active or potential credit markets where property rights in land could serve as collateral. Rather, the deficiencies stem from the overall inadequacy of public sector resources. The administration dealing with land records may suffer from deficient technology (for example, handwritten record retrieval methods where microcomputers would be much

more efficient), insufficient manpower, and inappropriate storage facilities. The judicial and police systems may be understaffed or underpaid, creating conditions for rent-seeking and for a slow process of property-rights enforcement. This situation may, of course, be satisfactory to some influential groups that benefit from the ability to manipulate the deficiencies of the formal system and use their influence to retard or slow attempts to reform.

In some countries the legal apparatus defining property rights may be excessively complex, requiring various types of documents and affidavits that may be useful in an urban context but not in an agricultural context. The complexities increase the fixed transaction cost associated with enhancing the security of property rights (for example, they may require the assistance of expensive lawyers and substantial time inputs from farmers). This may create a stratification whereby wealthier and larger farmers find it worthwhile to finance these transaction costs (that tend to be relatively size-invariant), while smaller and poorer farmers do not undertake them.

The inadequacy of public sector resources for reducing uncertainty in property rights is aggravated by a public institutional framework that makes it difficult or impossible for private sector agents to substitute, at least in part, for the lack of public infrastructure. In some countries, private land surveyors are not recognized and certified, or the facilities to train such surveyors are not established. The verification of boundaries is thus totally dependent on public sector land surveying, which is a function of public budgets.

In such circumstances there frequently emerge localized and informal risk-reducing institutional arrangements. The segmented nature of these local arrangements implies a smaller volume of transactions and, thus, a less efficient resource allocation than would arise under a well-functioning formal institution, but such local institutions may be better than no institution at all.

A well-studied example is taken from the U.S. western expansion period (Anderson and Hill 1975; Dennen 1976). Under the provisions of homesteading, ranchers in the Great Plains were able to claim as private property parcels of land that were too small to profitably support herds of livestock. Ranchers therefore supplemented grazing on private lands with grazing on the public domain, creating the potential for conflicts. Voluntary collective action in the form of cattlemen's associations helped to ameliorate the situation. The cattlemen's association provided informal property rights to the range, organized the spring roundup (an activity for which there were economies of scale), and helped in the recognition and enforcement of brands, a means for recording private property rights in livestock. These mechanisms were especially important in the period before the availability of barbed wire, a cheap means of enforcing rights to the range in an environment where wood, stone, and other natural fencing materials were scarce.

## A Model of Investment, Production, and Land Price Determination

In this section, we summarize the results of a formal model that is presented in the appendix to this chapter. The model incorporates a number of simplifying assumptions, but it captures, nonetheless, important characteristics of a rural economy where land rights are subject to risk. We model the link between land rights and the credit market by supposing that the farmer's access to credit is positively related to the value of the land acquired (as it would typically be when land is a collateral for loans) and negatively related to the probability of land loss.

The model assumes that the farmer's objective is to maximize the utility of current consumption and next period's wealth by allocating the initial endowment and borrowed funds among three uses: current consumption, land acquisition, and investment in physical capital. Land and capital are used to produce next period's output through a neoclassical production function. Output and land value, minus debt repayment (principal plus interest) make up next period's wealth. The risk to property rights is represented as the probability that in the next period land (and the output derived from the land) will be lost to the present decisionmaker. The farmer thus perceives an *expected* value of next period's wealth that depends on the probability of land loss.

In the model, the capital-land ratio is positively related to the price of land, for the usual reason that as land becomes more expensive capital is substituted for land (current consumption would increase as well). An increase in the risk of land loss would, at a given land price, reduce the demand for land and the demand for capital investment in land by (a) lowering the farmer's likelihood of receiving the fruits of the land and investment in land and (b) reducing farmers' access to credit as it increases the risks borne by potential creditors. Land prices, however, cannot remain unaffected by increases in the risk of land loss. As farmers' demand for the fixed supply of land falls, an excess supply is created that drives down the equilibrium price of land. The reduction in land values with increased risk diminishes further the supply of credit per unit of land. While the total amount of land employed in equilibrium is fixed, the combination of reduced incentives to invest in production capital due to increased risk, and the reduced supply of credit per unit of land, reduces the total amount of capital acquired. As a result, at equilibrium the capital-land ratio declines and it is shown that productivity (output per unit of land) is negatively related to the riskiness of property rights.

The model indicates that the equilibrium price of land contains a "collateral premium," which is the result of the owner's ability to obtain additional and cheaper credit by pledging the land as collateral. This has an important



implication for the financing of land acquisitions: because the sales value includes the collateral premium, the purchaser will not be able to pay for the land out of the benefit stream while at the same time retaining a portion for consumption unless he acquires it out of equity, at least in part. In the context of land reform, landless beneficiaries with no equity cannot therefore be expected to compensate former owners at full market price from the revenues of the farm.

“Net social benefits” per unit of land for each period may be defined as the expected value of output minus the value of real resources (capital) consumed in the process of production. In the model, if there is no risk of land loss and an interest rate that equals the rate of time preference, the price of land will equal the discounted value of the stream of net social benefits. But with a nonzero risk to land rights, the price of land will be lower than its social value (that is, the stream of net benefits it generates). The reason for this distortion is that the risk of losing land (aside from causing an assumed one-period loss of output) is a risk of asset loss to individuals, but not to society. This distortion will cause individuals’ private benefits of eliminating the risk to property rights to exceed the social benefits. That is, individuals will be willing to support a larger expenditure on uncertainty-elimination than is socially optimal. A caveat is in order with respect to this result. The model assumes that farmers are identical in their farming skills, and differ only in their endowments. In reality farmers also differ in their farming skills. The elimination of uncertainty in land rights could bring social benefits by expanding the market and facilitating more land sales from low-productivity to high-productivity individuals. Empirical results from a case study in Thailand (see chapter 13 and Feder, Onchan, Chalamwong, and Hongladarom 1988) confirm many of the propositions propounded in this and the preceding section.

## Conclusions

The definition and institutionalization of property rights in land have been an important issue for societies throughout history. The nature of these rights and the way they are enforced have significant consequences for resource allocation and economic efficiency. Changes in population density, technology, and political power generate changes in the assignment of property rights and in the institutional arrangements associated with these rights. Generally, secure individual property rights over land, or secure and long-term use rights on land, induce exertion of higher levels of labor and management efforts and higher levels of investment to protect or enhance land fertility. There are exceptions to this proposition, such as cases where unregulated individual use generates externalities (for example, excessive removal of tree cover). The provision of secure property rights requires not only

social rules for allocation of land rights, such as a constitution that recognizes individual land rights, but also adequate implementation and enforcement mechanisms. In the absence of such mechanisms, uncertainty regarding land ownership rights will generate inefficiencies in the allocation of resources. The inefficiencies are aggravated where the use of land as collateral affects credit availability. In this case, the same institutions that improve the efficiency of the land market also have a positive impact on efficiency in credit markets.

Asymmetry in information regarding the allocation of land rights between agents transacting in land is another potential source of inefficiency that is likely to emerge with agricultural development. The asymmetry promotes the segmentation of land markets, constraining the volume of transactions and thus hindering efficient resource allocation. Various institutional arrangements were developed over time to reduce the extent of asymmetric information, such as land records and title documents. These arrangements typically require public sector involvement because of economies of scale and complementarity with other public sector activities—for example, cadastres for taxation purposes and judicial and police functions.

While there are obvious social benefits to the provision of secure property rights and to the removal of information asymmetry, it is likely that private evaluation of the benefits of secure land ownership rights exceed the contribution of such security to society's income. Individuals may be willing to support policy measures improving ownership security to a point where marginal costs exceed the marginal gain in net output. Appropriate taxes or user cost procedures can be used when implementing some of the institutional arrangements to enhance the security of land rights, so as to bring individuals' willingness to support such programs in line with the net output gains accruing to society as a whole. However, the gains in the scope of land and credit markets that result from reduction of uncertainty in land rights may generate output gains that individual landowners do not take into account, and these gains may be large in economies with relatively free markets in land and credit. The optimal extent of security enhancement (and the associated costs) will require an assessment based on the specific situation at hand. In areas where credit and land markets are not yet developed, an investment in titling and land registration may entail an excessive cost compared to the benefits, and security of tenure can be enhanced by cheaper methods, such as investing local institutions with legal authority.

### **Appendix: A Model of Investment, Production, and Land Price Determination**

For simplicity, assume a two-period horizon where the land acquisition, consumption, and investment decisions made in the first period that deter-

mine production in the second period. Capital is completely used up in the process of production. Capital is the numeraire good, with price 1, and is available with infinite supply elasticity to the rural sector. Individuals maximize an expected utility function that is separable in two arguments: current consumption and terminal wealth. A further simplification is that the utility function is linear in terminal wealth. Risk to property rights is introduced through a nonzero probability  $\phi$  that the second-period output as well as the land will not be possessed by the current decisionmaker because of factors such as takeover by other individuals (whether by force or through legal challenges). The possibility of *gaining* land through such actions is viewed as an exogenous probabilistic event. Although the benefits of such a windfall should enter the objective function, it can be shown that this element does not affect the results of the model, and for simplicity it is not included explicitly.

The notation used in the model is:  $T$  = land,  $P$  = price of land,  $k$  = capital-land ratio,  $C_0$  = first-period consumption,  $W_0$  = initial wealth,  $\phi$  = probability of ownership loss,  $U$  = utility of first-period consumption, and  $y$  = output per unit of land.

### Model Components

The production function exhibits constant returns to scale in land and capital. The per hectare output is therefore

$$(12-1) \quad y = y(k); \quad y' > 0; \quad y'' < 0$$

Utility of current consumption is a concave function with decreasing marginal utility

$$(12-2) \quad U = U(C_0); \quad U' > 0 \quad U'' < 0$$

Individuals' expected utility is composed of the utility of current consumption plus expected terminal wealth. Terminal wealth is equal to output plus land value, minus debt repayment, provided that land rights are not lost. Maximization of expected utility is subject to a budget constraint whereby the value of land, capital, and current consumption cannot exceed initial wealth plus borrowed funds.

It is assumed that credit is rationed and that the ration is binding for all farmers. The ration is proportionate to a borrower's landholding value, with land serving as collateral. Denote the proportion by  $s$ . Because land is collateral, the total credit ration (say,  $S$ ) is positively related to land's ownership security; that is,

$$(12-3) \quad S = s(\phi)PT; \quad s' < 0; \quad 0 < s < 1$$

A fixed rate of interest,  $r$ , is assumed. The model could be developed with an assumption of an interest rate dependent on risk to property rights, yielding

even stronger results. Because all farmers are assumed to be rationed, the marginal productivity of capital is necessarily higher than the cost of credit.

If land rights are lost in the second period, the farmer is still obliged to pay the debt acquired in the first period. (It could be assumed that only a proportion of land is lost,  $\gamma$ , and that farmers repay their debts from their remaining wealth. In this case, the results of the model would be practically unchanged, with the term  $\gamma\phi$  replacing  $\phi$  in all derivations. For simplicity, the calculations in the text assume  $\gamma = 1$ .) Even though all debt is ultimately repaid, lenders are concerned about the risk of land loss because of the transaction cost of collecting debts from dispossessed farmers. This motivates the assumption that the credit ration depends on land security, as in equation 12-3.

The farmer's objective is

$$(12-4) \quad \text{Max}_{C_o, T, k} U(C_o) + [1 - \phi] T [y(k) + P] - [1 + \tau] s(\phi) P T$$

subject to the budget constraint

$$(12-5) \quad W_o + s(\phi) P T = k T + P T + C_o$$

From equation 12-5, one obtains

$$(12-6) \quad C_o = W_o - k T - P T + s(\phi) P T$$

Thus, the objective function can be written

$$(12-7) \quad \text{Max}_{T, k} U(W_o - P T [1 - s] - k T) + [1 - \phi] T [y(k) + P] - [1 + \tau] s(\phi) P T$$

First-order conditions for a maximum are

$$(12-8) \quad [1 - \phi] [y + P] - U' \{P[1 - s] + k\} - [1 + \tau] s(\phi) P = 0$$

$$(12-9) \quad [1 - \phi] T y' - T U' = 0$$

The Hessian matrix is

$$(12-10) \quad [H] = \begin{bmatrix} U'' \{P[1 - s] + k\}^2 & U'' \{P[1 - s] + k\} T \\ U'' \{P[1 - s] + k\} T & T[1 - \phi] y'' + T^2 U'' \end{bmatrix}$$

Second-order conditions are clearly satisfied as the determinant is positive:

$$(12-11) \quad |H| \equiv \Delta = T[1 - \phi] U'' \{P[1 - s] P + k\}^2 y'' > 0. \\ \text{(because } U'' < 0, y'' < 0).$$

The impact of a change in the price of land is given by:

$$(12-12) \quad [H] \begin{bmatrix} \frac{dT}{dP} \\ \frac{dk}{dP} \end{bmatrix} = \begin{bmatrix} [1 - \phi] \frac{[y - y'k]}{P} - U''\{[1 - s]P + k\}[1 - s]T \\ - T^2 U''[1 - s] \end{bmatrix}$$

where use has been made of equations 12-8 and 12-9. The concavity of  $y$  implies  $y > y'k$ . Using Cramer's rule, one obtains:

$$(12-13) \quad \frac{dT}{dP} = \frac{1}{\Delta} \{ [1 - \phi][y - ky']/P \} [T[1 - \phi]y'' + T^2 U''] \\ - U'' \{ [1 - s]P + k \} T^2 [1 - s][1 - \phi]y'' < 0$$

That is, the demand for land is negatively related to its price, as intuitively expected. The sign can be established by noting the concavity of  $y$  and  $U$ . From 12-12 one also obtains

$$(12-14) \quad \frac{dk}{dP} = - [1 - \phi] \{ [y - ky']/P \} U'' \{ [1 - s]P + k \} T/\Delta > 0$$

That is, the capital-land ratio increases with land price. This is also intuitively expected, because with higher land prices, farmers will substitute capital for land in production.

Because the demand for land is monotonically and negatively related to the price of land, and given that the supply of land is fixed, there is a stable equilibrium price of land that depends on the parameter  $\phi$ , the risk to ownership. Intuition suggests that an increase in the probability of loss of land rights should reduce the demand for the risky asset (land) if land prices are fixed. This is confirmed by the following derivation:

$$(12-15) \quad [H] \begin{bmatrix} \frac{dT}{d\phi} \\ \frac{dk}{d\phi} \end{bmatrix} = \begin{bmatrix} y + P - \{ [1 - \phi]y' - [1 + r] \} P s' + T U'' \{ [1 - s]P + k \} P s' \\ T y' + T^2 U'' P s' \end{bmatrix}$$

Denote the first element in the vector on the right-hand side of equation 12-15 by  $\theta$ , and note  $\theta > 0$ , because  $[1 - \phi]y' - [1 + r] > 0$  if the credit constraint is binding. Then, using Cramer's rule and equations 12-8 and 12-9

$$(12-16) \quad \frac{dT}{d\phi} = \frac{1}{\Delta} \{ \theta T [1 - \phi]y'' + T^2 [1 + r] s P U''/[1 - \phi] \\ - T^2 U'' \{ [1 - \phi]y' - [1 + r] \} P s' \} < 0$$

$$(12-17) \quad \frac{dk}{d\phi} = \frac{1}{\Delta} \{ [(1-\phi)y' - [1+r]]Ps' - [1+r]sP/[1-\phi] \} TU'' > 0$$

Thus, an increase in the risk of land loss would increase the capital-land ratio if land price were held constant. This result obtains because the incentive to buy land due to its credit-enhancing role (aside from its productive contribution) has been diminished, and therefore the ratio of marginal contributions of land and capital has changed. If credit supply were not dependent on land, the optimal capital-land ratio would not change with risk as long as land price were held fixed, because the higher risk reduces the expected return on investment in capital. This can be verified by calculating

$$\frac{d(kT)}{d\phi} = \frac{Tdk}{d\phi} + \frac{kdT}{d\phi}$$

utilizing equations 12-16 and 12-17. While the capital-land ratio increases with risk when land price is fixed, the relation is reversed in equilibrium. An increase in ownership risk reduces the demand for land ( $dT/d\phi < 0$ ) while the supply of land is fixed, so that the price will decline to equate demand to the fixed supply. Using equations 12-13 and 12-16, one can show that the price of land in equilibrium will decline ( $dP/d\phi < 0$ ).

$$(12-18) \quad \frac{dP}{d\phi} = - \left\{ \begin{array}{l} \theta T [1-\phi] y'' + T^2 [1+r] s P U''/[1-\phi] \\ - T^2 U'' \{ [1-\phi] y' - [1+r] \} P s' \end{array} \right\} \\ \div \left\{ \begin{array}{l} [1-\phi] \{ [y - ky']/P \} \{ T [1-\phi] y'' + T^2 U'' \} \\ - U'' \{ [1-s] P + k \} T^2 [1-s] [1-\phi] y'' \end{array} \right\} < 0$$

In this model, in which credit availability depends on the riskiness of the land collateral, the impact of higher ownership on the price of land has two components. The first term on the right-hand side of equation 12-18 reflects the impact of risk on the farmer's resource allocation: as uncertainty increases, present consumption is preferred to future wealth accumulation, and the demand for land is reduced while the supply is fixed, requiring a price reduction to restore equilibrium. The second and third terms on the right-hand side of equation 12-18 reflect, respectively, the impact of land ownership risk on supply of credit: as uncertainty rises, the farmer's access to credit for land purchases or capital diminishes and the demand for land is reduced. If there were no credit (that is,  $s = 0$ ), or if credit supply were not affected by ownership risk (that is,  $s' = 0$ ), then these components would vanish, but land value would still be negatively affected by higher ownership risk. These results also demonstrate the link between land price and land's role as collateral. The price of land includes a premium reflecting the additional income due to the credit that can be acquired by pledging the land, and which in turn increases, at the margin, the farmer's utility.

The change in the equilibrium capital-land ratio following an increase in risk and the subsequent reduction in land price can be calculated (using equations 12-12, 12-14, 12-16, 12-17, and 12-18) as:

$$(12-19) \quad \frac{dk^*}{d\phi} = \frac{dk}{d\phi} + \frac{dk}{dP} \frac{dP}{d\phi} = \frac{dk}{d\phi} - \frac{dk}{dP} \frac{[dT/d\phi]}{[dT/dP]}$$

$$= \left\{ \begin{array}{l} T y' [1 - \phi] [y - y'k] / P + T^2 U'' [1 - s] \\ \{ P y' [1 - s] + y' k - y - P \} + T U'' [r + \phi] s' \end{array} \right\}$$

$$\div [dT/dP] \Delta < 0$$

where \* denotes equilibrium value after market adjustments have taken place. As equation 12-19 indicates, equilibrium capital-land ratios decline as a result of higher uncertainty. The intuition is that higher ownership uncertainty increases current consumption at the expense of demand both for land and capital goods. But the price of land declines to clear the market at the original level of land use as the supply of land is fixed. All of the decline in the purchase of investible resources is thus absorbed by the capital good, reducing capital-land ratios. The increase in uncertainty that thus causes a decline in output per unit of land.

**Valuation of Policies to Eliminate Uncertainty in Land Rights**

Suppose that whenever property rights are challenged, the production process is interrupted and one period's output is lost. Then the expected net benefit to society from a unit of land in one period is  $[1 - \phi]y - U'k$ , where the capital stock consumed in the process of production is evaluated in terms of its marginal welfare opportunity cost ( $U'$ ). Denote  $U' = 1 + \delta$ , where  $\delta$  may be viewed as a time preference premium, since one unit of second-period wealth yields  $U'$  units of utility if transferred to the first period. Then, rearranging equation 12-8, one obtains

$$(12-20) \quad [1 - \phi] y - [1 + \delta] k = \{ [r - \delta] s + \phi + \delta \} P$$

Define "net social benefits" as the value of the net addition to economic resources (that is, output less the real value of resources used in production). Integrating both sides of equation 12-20 over an infinite time horizon and using  $\delta$  as a discount factor, the total discounted net social benefits generated by a unit of land are

$$(12-21) \quad \int_{t=0}^{\infty} \{ [1 - \phi] y - [1 + \delta] k \} e^{-\delta t} dt = \{ 1 + (\phi/\delta) - [\delta - r] s/\delta \} P$$

When there is no risk and no credit market distortion (that is,  $\phi = 0$ ,  $\delta = r$ ), the right-hand side reduces to  $P$ . The price of land reflects exactly the

net social benefits it generates. In the presence of risk and distortions, the price of land differs from the net social benefits. One reason is that the possibility of asset ownership loss is a risk of capital loss to individuals, but not to society, which risks only one period's output. The second source of deviation comes from credit rationing. When credit is priced below the opportunity cost of capital (that is,  $U' > 1 + r$ ), the value of the subsidy is capitalized in the land value.

To evaluate private and social benefits from policies and institutions eliminating uncertainty in property rights, denote  $P_\phi$  as the price prevailing when the probability of land loss is  $\phi$ , while  $P_o$  is the price when there is no risk. Also, assume for simplicity that there are no credit market distortions (that is,  $r = \delta$ ). The benefit to an individual (per unit of land) from institutional arrangements that eliminate the risk of losing property rights can be expressed as the difference between land prices without and with risks ( $P_o - P_\phi$ ).

Denoting the left-hand side of equation 12-21 as  $B_\phi$ , the benefits to society (the discounted expected addition to resources) from elimination of risk to property rights in land are given by

$$(12-22) \quad B_o - B_\phi = [P_o - P_\phi] - \phi P_\phi / \delta$$

The net addition to society's resources is thus smaller than the benefits to property holders.

## Notes

The authors acknowledge the helpful comments of Clive Bell, John Bruce, Karla Hoff, Ravi Kanbur, and several anonymous referees.

1. For a discussion of the historical evolution of the concept of property, see Schlatter (1951).

2. The term common property is sometimes used to refer to property that is classified as communal in the system used here, but it is also used to refer to open access property. Generally, common property refers to resources where exclusion is difficult and utilization involves rivalry. To avoid confusion, resources under group ownership are therefore classified as communal rather than common property. For more on these distinctions, see Berkes and others (1989).

3. See Feeny (1988), Roumasset and LaCroix (1988), Libecap (1986), and Umbeck (1977) for examples of the process.

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## 13

*The Economics of Land  
and Titling in Thailand*

Gershon Feder

*This chapter compares land prices, yields, and capital investments on titled land and squatter land in Thailand. The evidence suggests that titling can create in land a form of collateral that relaxes the constraint that many farmers would otherwise face in the formal credit market.*

CHAPTER 12 SUGGESTED THE HYPOTHESIS that ownership insecurity causes lower farm productivity, and the related hypothesis that the market value of land that is not securely owned or not usable as collateral in credit transactions (for example, untitled land) will be less than that of an identical tract of land that has those properties. This chapter reviews the results of several studies undertaken in rural Thailand in 1984–86 on the economic implications of land rights.<sup>1</sup> These studies compare the performance of farmers on titled land to that of squatters on land reserves who lack land titles but face little risk of eviction. Although squatters have no formal claims to the land they farm, their claims are recognized informally: sale transactions of illegally occupied reserve land take place among farmers at the same frequency as in the case of titled land. Of a sample of 870 tracts located in forest reserve areas, 46 percent were reported to have been acquired through purchase (rather than by inheritance or by forest clearing). The comparable figure for a sample of 947 tracts in areas held legally under title was 42 percent (Feder, Onchan, Chalamwong, and Hongladarom 1988, p. 36). While in the past there has been discriminatory legislation that disallowed landownership by

certain ethnic groups, there are at present no prohibitions on land sales to Thai nationals. Squatters' land cannot officially be sold, but the prohibition is not enforceable, and there is no reason to believe that sales transactions on such lands are subject to limitations regarding the geographic or ethnic affiliation of the buyer. Transfers of land by sale or through informal mortgages are fairly common (Stifel 1976).

The evidence supports the hypotheses discussed in chapter 12:

- Titled farmers make greater investments in farm equipment and land improvements, use more inputs, and obtain more output per unit of land.
- Titled farmers have much greater access than squatters to institutional credit, but they have little advantage over squatters in access to non-institutional credit. Not surprisingly, differences in economic performance between titled and untitled farmers are smallest in areas where noninstitutional lenders are the dominant source of credit.
- Market values of titled land are significantly higher than those of untitled land.

We argue that the provision of full legal ownership to squatters would be a beneficial policy provided that environmental and equity concerns are addressed. At an aggregate level, land registration and titling of land held by squatters, complemented by appropriate credit policies, could provide an important boost to the performance of the agricultural sector in Thailand.

## Development of Land Rights in Thailand

In the early and mid-nineteenth century, Thailand was a land abundant, labor scarce economy. In theory, all land belonged to the king; in practice, there was a system of private usufruct land rights. Individuals were allowed to use the land for cultivation, sell it, and pass it on to their heirs as long as they paid taxes on the land and did not leave it fallow for longer than three consecutive years. Land was not in general used as collateral; instead, there was a well-developed system of property rights in humans who served as collateral (Feeny 1982).<sup>2</sup>

In the second half of the nineteenth century, the opening of Thailand to international trade and the increased commercialization of rice production spurred the evolution of more rigorously defined private ownership rights in land (Feeny 1982). A rice export boom induced a rapid expansion in the area under cultivation. As land became more valuable and frontier areas were brought under cultivation, land disputes became endemic.

The Thai government responded with a series of procedural and adminis-

trative changes. It established title documents for rice land in the main rice-producing areas in the 1860s through the 1880s. In 1892, it provided a more comprehensive framework and more standardization of procedures for documenting landownership rights. However, the lack of adequate surveys and record keeping inhibited the precise documentation of rights; land disputes continued. In 1896 the government responded by initiating a cadastral survey in an area in which important government officials were also landowners, and in 1901 created a formal system of land titling based on the Torrens system. Cadastral surveys covering most of the commercialized areas in the central plain followed. Surveys were not vigorously pursued in most other regions or in upland areas.

The system prevailing today is based on the Land Code of 1954, which defines the powers and duties of the minister of the interior and the Department of Lands regarding the allocation and acquisition of state land. It contains procedures for the issuance of documents recognizing title to land and the maintenance of the land register. However, limited budgets and inadequate administrative infrastructure inhibited the issuance of titles until recently. In 1984 the government undertook efforts to enhance the land titling capacity with funding from the World Bank and other aid agencies.

The 1954 Land Code represents a compromise between the traditional practice of allowing citizens to bring unoccupied forest land under cultivation as private property and the requirements of a cadastral survey-based land titling system. The existing system provides for two main types of secure land documents. These correspond to two phases of land acquisition, namely, legal utilization and possession. Legal possession is documented in a full unrestricted title deed called N.S.-4. This document enables the owner to sell, transfer, and legally mortgage the land. It is issued on the basis of an accurate ground survey and is registered in the provincial land register, with clear identification of the property by boundary mark stones.<sup>3</sup>

The documents related to the phase of utilization are N.S.-3 and N.S.-3K—"Certificate of Use" or "Exploitation Testimonial." These documents certify that the occupant has made use of the land for a prescribed period of time, and they can be converted to title deed with the completion of certain legal steps. There is very little difference between N.S.-3 and N.S.-3K documents for all practical purposes. Because these two documents facilitate legal transfers and mortgaging, they serve a function very similar to that of title documents (Kemp 1981). The main distinction is in the accuracy of the map on which the documents are based and in the process of adjudication preceding the issuance of the documents. In the study areas discussed below, the occurrence of full title deeds (N.S.-4) is practically nil, and the N.S.-3 and N.S.-3K documents are classified as "titled land" for purposes of the analysis.

A large number of farmers in Thailand occupy land illegally. Most of the squatters are settled in areas officially classified as forest reserves. It is estimated that at least 21 percent of the land under actual private use is located in official forest reserves. Squatters in forest reserves cannot obtain titles for the land they use regardless of the length of occupation.

### ***Areas Surveyed by the Studies***

Because squatter areas can be found side by side with the nonforest reserve areas (that is, they occupy the same agroclimatic and geographic areas), it was possible to apply a cross-sectional farm level analysis without facing the difficulty of measuring the influence of environmental and infrastructural differences. The studies reported in this chapter involve parts of four provinces: Lop-Buri in the Central Plain and Nakhon Ratchasima, Chaiyaphum, and Khon Kaen in the Northeast. In each province, farmers with secure landownership (outside forest reserves) and neighboring farmers with insecure ownership (inside forest reserves) were sampled.

The weather pattern in Lop-Buri is more stable, the transportation infrastructure better developed, and the soil more fertile than in the northeastern provinces, which are drought-prone. For these reasons the study area in Lop-Buri Province is more commercialized, with most farmers growing crops such as cotton, sorghum, maize, tobacco, and mung beans, in addition to rice. In the Northeast, farmers grow mostly rice and cassava. The latter is a commercial crop, but of low value and unstable market.

In the four provinces under study, eviction of squatters is not very common. This is indeed the pattern in most of Thailand, as a result of socio-political constraints and the large number of individuals concerned (over 6 million). A survey among farmers indicated that the most important benefit farmers perceive in titled ownership is improved access to credit (Feder, Onchan, Chalamwong, and Hongladarom 1988). In the nonforest reserve areas eligible for titling under this study, practically all farmers already had title by the time of the surveys. In the forest reserve areas no titles could be awarded. This implies that the causal direction of results in this study is from titles to economic effects, and the analysis is based on comparisons between titled and untitled farmers.

### **Landownership Security and Credit in Rural Thailand**

Compared with informal lenders, institutional lenders face very high transaction costs in acquiring borrower-specific information and, perhaps more

importantly, they have little ability to enforce debt claims except through foreclosure. They will therefore be more inclined to use land collateral as a device to reduce lending risk. The legal code contains procedures for foreclosures of land collateral in the case of a default on a loan, and foreclosures related to defaults on institutional loans are observed (Feder, Onchan, Chalamwong, and Hongladarom 1988, p. 49). Squatters in Thailand cannot obtain title to land that is formally state land, and they cannot therefore offer their land as a collateral for institutional credit. As a result, they do not have the same access as titled farmers to institutional credit, either in duration or magnitude. Data on loan magnitudes (per unit of land owned) indicate that in all provinces, institutional loans covered by land collateral were larger than loans without collateral or loans with group guarantee. An econometric analysis of credit supply and demand using a disequilibrium estimation framework<sup>4</sup> confirmed that farmers providing land collateral were offered larger amounts of institutional credit than those providing other security or no security, holding all other characteristics constant (Feder, Onchan, and Raparla 1988; Feder, Onchan, Chalamwong, and Hongladarom 1988).

Noninstitutional loans were typically granted without collateral, while institutional loans were typically covered by some type of loan security. Untitled farmers were obliged to use as loan security a group guarantee (see chapter 8). Titled farmers, however, provided their land as collateral in about half of the institutional loans in the northeastern provinces and in more than three-quarters of the institutional loans in Lop-Buri Province.

For all four provinces studied, most credit was short-term. Almost all loans with terms exceeding one year were provided by institutional lenders, and titled farmers received such loans more frequently than untitled farmers. In Lop-Buri, which is more commercialized, traders are the source of about half of all loans and provide the bulk of noninstitutional credit. The noninstitutional loan amount per unit of land in Lop-Buri is substantially higher than the mean institutional loan amount for comparable collateral categories. Similarly, unsecured noninstitutional loans in Lop-Buri were substantially higher than comparable loans in other provinces.

The role of traders in the informal credit market is less significant in the less commercialized northeastern provinces compared with Lop-Buri. The existence of many traders in Lop-Buri and their active involvement in the provision of credit is made possible by the favorable agroclimatic conditions and the prevalence of high-value cash crops in the province. The abundance of noninstitutional credit in Lop-Buri that can be obtained without land collateral suggests that the economic effect of legal land titles (and the better access to institutional credit they entail) will be less in this province than in the other provinces in the study.

## The Impact of Ownership Security on Land Values, Investment, Input Use, and Output

Theory suggests that titled land should have a higher price than untitled land of identical quality. Data for the four Thai provinces studied indeed show that the mean prices of titled land are substantially higher than the mean prices of untitled land (line 1 of table 13-1). The implication from the comparison of mean prices is strengthened by results from a hedonic price analysis (line 2 of table 13-1). In this analysis the title status of land is represented by a dummy variable that captures the effect of possessing a land title, holding constant soil type, slope, location, and so on. The prices that were used in the analysis reflect the farmer's own assessment of his land price. The number of actual sales transactions for a given cross-sectional sample would not suffice for the purpose of the present analysis. Professional land value assessors were not available in the study areas, but it is believed that farmers have a fairly accurate assessment of the value of their land, because they are well informed about transactions in their area and about the attributes of their land as compared to other lands. The estimates indicate that the price of untitled land is substantially lower than that of titled land in all provinces. It is notable that in Lop-Buri Province the value of the parameter is lower than in the other provinces. This is consistent with the data reported above on access to credit by titled and untitled farmers in the different provinces.

It is hypothesized that improved ownership security will increase investment in equipment and in land improvements, because of both better incentives and greater access to institutional credit. To test the effect of land title

Table 13-1. *Effect of Land Title on Land Value*

Item	Province			
	Lop-Buri	Nakhon Ratchasima	Khon Kaen	Chaiyaphum
1. Ratio of mean titled land price to mean untitled land price in sample	1.22	2.96	2.08	1.53
2. Ratio of titled land price to untitled land price calculated from hedonic price equation <sup>a</sup>	1.25 (5.48)	2.33 (14.29)	2.13 (11.10)	1.54 (8.52)
3. Sample size	431	536	447	464

a. Numbers in parentheses are *t*-statistics.

Sources: Line 1, Feder, Onchan, Chalamwong, and Hongladaram (1988); line 2, Chalamwong and Feder (1988); and Feder, Onchan, Chalamwong, and Hongladaram (1988).



Table 13-2. *Effect of Title on Investment, Input Use, and Output: Difference between Titled and Untitled Farmers with Other Attributes Held Constant*  
(percent)

Variable	Province			
	Lop-Buri	Nakhon Ratchasima	Khon Kaen	Chaiyaphum
1. Farm equipment owned	4.4	105.0 <sup>a</sup>	253.2 <sup>a</sup>	55.9 <sup>a</sup>
2. Land bunding	18.4	69.5 <sup>a</sup>	41.1 <sup>a</sup>	2.8
3. Clearing of stumps	12.3 <sup>a</sup>	47.4 <sup>a</sup>	29.3 <sup>a</sup>	0.005
4. Use of labor	14.7 <sup>a</sup>	14.7 <sup>a</sup>	8.2 <sup>a</sup>	n.a.
5. Use of draft power	-5.4	38.7 <sup>a</sup>	26.9 <sup>a</sup>	n.a.
6. Use of other inputs	18.4	24.6 <sup>a</sup>	34.8 <sup>a</sup>	n.a.
7. Output	4.5	11.8 <sup>a</sup>	26.7 <sup>a</sup>	n.a.

n.a. Not applicable.

a. Denotes significance at a 90 percent (one-tailed) confidence level.

Sources: Lines 1-3, Feder and Onchan (1987); lines 4-7, Feder (1987a).

on investment in equipment, a regression was run on a sample of titled and untitled farmers, controlling for the value of capital that farmers had when they became decisionmakers on the farm they worked, as well as for other attributes that affect capital formation. The impact of titles on capital formation, as estimated in these regressions, is reported in line 1 of table 13-2. The estimates for the northeastern provinces confirm that ownership security induces higher capital accumulation. In Lop-Buri Province, the coefficient for ownership security is positive, but not significantly different from zero. As in the analysis of land values, this result is compatible with the ample supply of noninstitutional credit available in that province.

In table 13-2, lines 2 and 3 report the effect of land titles on two types of land improvements: (a) bunding (dividing the field into subplots by raised earth walls, thus allowing better water control and moisture retention) and (b) clearing of stumps (increasing the productive surface area and facilitating better and faster soil preparation utilizing mechanized power). The results, translated into percentage equivalents, were estimated using a logit model, controlling for various farmer and land attributes and representing the impact of titles by a dummy variable. The probability that land will be improved by bunding is significantly higher on titled plots in two of the provinces. Possession of titles increases significantly the probability of stump-clearing in three of the provinces.

With higher capital intensity, variable input use per unit of land will be higher due to the complementarity between capital and other inputs. Furthermore, when short-term credit is a binding constraint, farmers with titled land are expected to use more variable inputs as a result of their better access

to cheaper short-term credit. With higher input use per unit of land, output will be higher on lands owned by titled farmers.

Evidence for these propositions is reported in lines 4-7 of table 13-2. The analysis controlled for differences in land quality and in farmer attributes. In Lop-Buri Province, as observed in the analysis of capital formation, differences between titled and untitled farmers tend to be small and not statistically significant. In the less commercial provinces, there are significant differences in input use and yields between titled and untitled farmers. The use of labor is 8-15 percent higher, draft power is 27-39 percent higher, and the use of other inputs is 25-35 percent higher. Output per unit of land is higher by 12-27 percent.

These results support the farmers' own assessment, noted above, that the most important advantage of land title was the improved access to institutional credit that it afforded. These results reflect the fact that in Thailand, most squatters do not face a high risk of eviction. In countries where eviction and land disputes among squatters are common, we would expect distribution of land titles to have a large effect on investment and output even where noninstitutional credit was abundant.

## Policy Implications

The analysis above demonstrates that possession of legal landownership documents in Thailand has a significant impact on farmers' agricultural performance. The results are strengthened by the findings elsewhere (Chalamwong and Feder 1988) that awarding title documents to squatters has a very high economic payoff in most of the areas studied: the benefits outweigh the costs of surveying, adjudicating, and certifying ownership by a wide margin.

Given the evidence that limited access to institutional credit is the main constraint affecting squatters' productivity in rural Thailand, some may argue that their problem can be resolved by enacting decrees forcing banks to relax their collateral policies. If such policies were enforceable, they would likely cause substantial costs in subsidization of banking operations, because noncollateralized loans' repayment performance is worse than that of collateralized loans.

Similarly, policies that provide Thai squatters with limited formal status (for example, a nontransferable lease from the state or a usufruct certificate), yet restrict their ability to transfer or mortgage land, will not significantly improve the performance of squatters. Such policies do not alter access to institutional credit for squatters. Feder, Onchan, and Chalamwong (1988) studied areas in Thailand where squatters were provided with nontransferable usufruct certificates. It was shown that award of such certificates to

squatters in areas where they were well established is not an effective policy for improving their economic performance. The situation may be quite different in other countries, where squatters face significant ownership insecurity due to eviction risk and land disputes. In such areas, even limited formal status may enhance ownership security and induce farmers to increase investment and land conservation efforts.

Some of the opposition to granting full ownership rights to squatters in Thailand stems from concern that it would encourage further encroachment on the remaining forest lands. Forest depletion is a serious problem in Thailand, and this argument needs to be examined. However, the root cause of the steady decline in forest areas is population growth in rural areas and insufficient enforcement of restrictions on the use of forest lands. This dynamic process will not be affected much unless strict enforcement of forest conservation and protection measures becomes a priority, with adequate budgetary allocations and political backing.

A logical policy in a situation such as the one in Thailand would be to provide full ownership rights to squatters in agriculturally suitable areas that are not expected to be reforested. As chapter 8 argued, high information and enforcement costs limit the expansion of institutional credit in Thailand's rural areas. It is therefore expected that titling would increase the supply of credit to agriculture, although some complementary government policy changes (such as relaxation of interest rate ceilings) may also be required. Due care needs to be taken so as not to introduce additional distortions in credit markets through government interventions.

Environmental and distributional effects also need to be considered. Some squatters have settled in areas where continuing cultivation causes environmental damage; in these areas control of the land may be better left to the state. Also, experience in other countries indicates that when squatters are provided with opportunities for legal ownership, or when the land rights system is being changed by government intervention, the wealthy and powerful grab large chunks of the land, and many smaller farmers are made landless. The design and implementation of policies providing titles and formal recognition of land rights should contain safeguards, including limits on the amount of land that can be claimed and provision of inputs by local grassroots institutions (farmers' associations).

## Notes

1. Feder, Onchan, and Chalamwong (1988); Feder, Onchan, Chalamwong, and Hongladarom (1988); Feder, Onchan, and Raparla (1988); Feder (1987a, 1987b); Feder and Onchan (1987); and Chalamwong and Feder (1988).

2. Slavery and obligatory labor services by the lower classes were features of Thai society at that time.

3. More recently, title deed registration was transferred to district-level offices.
4. The analysis employed switching regressions, thus avoiding the assumption of supply and demand equality, as is appropriate when credit rationing is present.

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## 14

*Indigenous Land Rights Systems  
in Sub-Saharan Africa:  
A Constraint on Productivity?*

*Shem Migot-Adholla, Peter B. Hazell, Benoit Blarel,  
and Frank Place*

*This study is an empirical analysis of the relationship between indigenous land tenure systems and agricultural productivity in Sub-Saharan Africa. Data were collected from farming households in several regions of Ghana, Kenya, and Rwanda during 1987–88. We find that, in general, agricultural productivity is unresponsive to the individual rights held over land, suggesting that factors other than land tenure are more constraining for agricultural development. Therefore, ambitious land registration programs would appear to be inappropriate at this time for the surveyed regions in Sub-Saharan Africa.*

WITHIN THE CONTEXT OF AFRICA'S rapid population growth and the need for increased productivity of land, there is a growing debate about whether the indigenous land tenure systems are a constraint on agricultural transformation. Some authors, such as Dorner (1972), World Bank (1974), and Harrison (1987), see the indigenous tenure systems as static constraints on agricultural development, providing insufficient tenure security to induce farmers to make necessary land-improving investments. Others, however, such as Cohen (1980), Boserup (1981), Noronha (1985), and Bruce (1988), have countered that the indigenous tenure arrangements are dynamic in nature and evolve in response to changes in factor prices. In particular, it is

argued that there is a spontaneous individualization of land rights over time, whereby farm households acquire a broader and more powerful set of transfer and exclusion rights over their land as population pressure and agricultural commercialization proceed.

The issue is far from academic, because it brings into question the very need for expensive land registration and titling programs at this stage in the economic development of Sub-Saharan Africa. If the indigenous tenure systems are dynamic, then it is relevant to ask if there are more useful things that governments can do to facilitate the process of adaptation.

Up to now, the debate has been carried out without benefit of empirical tests of the performance of indigenous land tenure systems. This chapter takes a first step in providing empirical testing of the relationship between indigenous tenure arrangements and agricultural productivity. New data are presented from a recently completed study of land rights systems in Ghana, Kenya, and Rwanda. We use the results from that study, together with historical evidence, to argue that, at least in rainfed cropping areas, indigenous African tenure systems have so far been flexible and responsive to changing economic circumstances. Where population pressure and commercialization have increased, the indigenous tenure systems have autonomously evolved from a system of communal property rights toward one of individualized rights. Controlling for differences in land quality and farmer characteristics, there is at best a weak relationship between individualization of land rights and land yields in the regions surveyed.

The chapter is organized as follows. The next two sections describe the characteristics and evolution of indigenous land rights systems in Sub-Saharan Africa. The third section presents results from our cross-sectional study in Kenya, Ghana, and Rwanda. The fourth section discusses government interventions in land tenure systems, and the conclusion considers directions for policy.

## The Nature of Indigenous Tenure

Africa has a wide variety of ecological conditions, cultural systems, and political structures. It is therefore somewhat dangerous to make general assertions about the nature of indigenous land rights systems. But some common features may still be discerned. Several interrelated themes have influenced the standard conceptualization of African land tenure systems and will be summarized here.

Until recently, indigenous African land rights systems have been incorrectly presented by most foreign anthropologists, colonial administrators, and nationalist idealists as static polar contrasts to Western property rights

systems. It is asserted that indigenous tenure systems assign land rights to the community, and that communal control discourages long-term investment in land improvements. The argument is that individual farmers, not having secure private rights to the land, may not be able to claim fully the returns on their investment. To the extent that investments are required for conservation purposes, indigenous tenure arrangements will also potentially promote land degradation.

Furthermore, it is asserted that because land is an integral part of the social system and legitimate use is determined by birth, affinity, common residence, and social status or some combination of these, transactions are limited to the members of the lineage. This encumbers the emergence of market transactions in land in which access would be determined by supply and demand factors and entrepreneurial ability. Contrasted to this picture is the idea that "modern" (implicitly Western) property rights systems should be founded on principles of contractual law and economic efficiency.

But often ignored is the fact that, except in very isolated cases, communal control over land under indigenous tenure systems today occurs mainly in areas characterized by relative land abundance and low intensification; but even then, farmers typically have secure use and inheritance rights. Historical records suggest that indigenous tenure had demonstrated remarkable flexibility in adapting to new farming technology or methods of exchange long before the colonial period (Bates 1986; Hill 1963; Jones 1980; Morgan 1969).

The contrast between indigenous African tenure and Western property rights systems should be perceived not in terms of polar extremes but as points along a continuum, the particular location of which is determined by population pressure and the degree of commercialization of agriculture. Evidence from different locations in Africa confirms instances of autonomous intensification and privatization of rights in land since the beginning of the century (Lagemann 1977; Netting 1968; Ruthenberg 1985). The third section of this chapter presents new cross-sectional evidence of evolution of indigenous land rights systems in Ghana, Kenya, and Rwanda.

### **Agricultural Intensification and the Evolution of Indigenous Land Rights Systems**

Reduced to its bare essentials, agricultural intensification entails a multi-dimensional process of response to increasing population density, technological change, and commercialization, or to any combination of these. It is characterized by substitution of labor for land in the initial stages and a shift from forest fallow through bush and grassland fallow. This is followed by

more continuous cropping and systems of crop rotation and soil improvement (including green and animal manures and compost), followed by additional modern yield-enhancing inputs such as chemical fertilizers, insecticides, and high-yielding seed varieties (Boserup 1965; Geertz 1963; Netting 1968; Pingali and Binswanger 1987; Waddell 1972).

Agricultural intensification has often occurred in response to the creation of new markets following the separation of consumption and reproductive objectives from those relating to production. In the context of African development, this process, which was described in *The Great Transformation* by Polanyi (1944), may be identified with the transformation of land, labor, and capital into commercial commodities, particularly after the introduction of colonial rule. Although the onset of these transformations may have predated formal colonial rule in some parts of Africa and were probably autonomous, later changes during the colonial and post-colonial periods were either directly or indirectly the outcome of state intervention.

Historically, African agrarian systems have been characterized by relative abundance of land and critical seasonal scarcities of labor. The relative abundance of land, and the need to shift the location of farm plots in order to regenerate soil fertility naturally, implied less concern at the collective level with guaranteeing rights over specific pieces of land and more emphasis upon control over large unutilized areas. It is still true of many areas today that individuals gain use rights by initial clearing or inheritance and maintain such rights through continuous exploitation, making allowance for suitable fallow periods. Thus, households and individuals are able to claim perpetual interests in farming land and improvements in which they have invested labor or capital. These interests are inheritable and may be bequeathed to the next generation. Provided farmland is not under crops, it is also subject to secondary use (for example, for grazing) by members of the social group even though it is clearly not perceived to belong in the same category of common property as uncultivable pastureland, forests, or fisheries. Although investment of labor or capital in land legitimately acquired is often necessary to deny others the right to cultivate it, the right to exclude others from secondary use is generally conditioned by the seasonality of farming operations. Agricultural intensification, which typically involves more continuous use of land, thus enhances the process of privatization of rights over land.

One implication of social determination of rights to land is that, even during long periods of absence, eligible individuals retain claims to land within the territorial areas occupied by their kinship or residential groups. The ability of African urban labor migrants to fall back on the kinship network as a source of security may have contributed to relatively low formal sector wages and poor job security for many urban workers, which in turn perpetuate the need to maintain claims over rural land. So long as land



is abundant and the technology of production remains land-extensive, claims of rights to rural land by absentee migrant workers need not result in production inefficiencies. But as land becomes scarce and absentee claimants seek to assert their rights through intermittent cultivation, it is likely that their plots would be farmed less intensively than others. However, this may not always be the case. By investing cash remittances from household members engaged in urban employment into agriculture, households with non-farm income sources can experience higher levels of productivity.

The earliest individualization of a broad range of transfer and exclusion rights over land in Africa arose largely in response to the cultivation of commercial crops, primarily oil palm, cocoa, groundnuts, cotton, and coffee (Hill 1963; Jones 1980; Moore 1986). After initial hesitation concerning the suitability of plantation farming, the colonial powers did not undertake any direct intervention to restructure indigenous land tenure arrangements in order to accommodate these developments, except where there was significant white settlement. In Angola, Kenya, Mozambique, eastern Zaire, and Zimbabwe, for instance, land tenure legislation was enacted to provide freehold rights to individual European farmers and corporations involved in plantation agriculture. In addition, as was the case in Kenya until the mid-1950s, cultivation of certain profitable crops by Africans was prohibited or severely restricted. This, combined with other policy instruments such as forced labor or the imposition of head tax payable in cash, helped to guarantee cheap labor to white farmers.<sup>1</sup>

Elsewhere, the most important policy support to agricultural commercialization, and unintentionally to the individualization of land rights, was the construction of communications and transportation infrastructure. Later, other instruments such as price support, credit, and extension were used with fairly significant results in promoting agricultural commercialization.

Based on the simplified sketch of the process of intensification as a result of the interplay among population pressure, technological changes, and agricultural commercialization outlined above, three broad categories of tenure regimes may be identified. At the earliest stage, characterized by the predominance of pastoral and sylvan economies, all land is communally owned, the group of authorized users is clearly defined, and there are rules specifying their rights and obligations to the land and its resources. Such common (that is, communal) property regimes should not be confused with open access, a regime of unrestricted privilege but no duties (see chapter 12). The latter appears to represent the breakdown of rules governing group management of common property resources.

As population pressure increases, the period of fallow shortens and shifting cultivation is replaced by systems of rotation and soil improvement. These changes may also be precipitated by the introduction of commercial tree-crop production, which tends to enhance rights of exclusion of individ-

uals even though the basic control over outsiders' access to the land continues to be exercised by the community. Voluntary transfers of land to nonmembers are virtually nonexistent. It is prescribed that transfers are only to members of the landowning group and may be made only by bequests, gifts, or rent. But the latter two remain relatively rare, becoming significant mainly in areas of extreme land shortage or where there is high demand for land of particular types. Even then, prior approval may be required from leaders of the lineage or community.

As increased intensification leads to virtual exclusion by farmers of other individuals, there may be localized exchanges in productive factors leading to land or labor tenancies and credit markets. But only rarely do individuals acquire the untrammelled right of disposal of land. This partly relates to the significance of land as a source of security for all members of the lineage, even for those who spend extended periods working elsewhere. The distinguishing feature of different tenure regimes may thus be said to revolve around restrictions on the individual holder's ability to transfer land (only among family members, within the lineage or community, or to outsiders; and with or without approval from other lineage or community members), which also tends to coincide with the mode of transmittal (inheritance, gifts or bequests, and sale).

### **Land Rights, Population Pressure, Commercialization, and Agricultural Productivity: Empirical Evidence**

The historical overview above suggests two key hypotheses that need to be tested. The first is that land rights do evolve toward full privatization in the presence of increasing commercialization and population pressure. The second is that as long as the evolution of land rights remains unrestricted, then, except in short-run situations of dramatic economic or social change, indigenous land tenure systems are not likely to be a constraint on agricultural productivity.

#### ***Survey Profile***

To test these hypotheses, we undertook farm surveys in 1987-88 in a total of ten regions in Ghana, Kenya, and Rwanda. Ghana was chosen to represent a situation of relative land abundance, whereas Rwanda represents a case of land scarcity. Within Ghana, we have chosen a highly commercialized shallot growing region with a dense, homogeneous population (Anloga), a land-abundant, cocoa-growing area with a significant migrant population (Wassa), and a land-abundant, food-growing area with a significant migrant

population (Ejura). All three Rwandan regions are densely populated, and each produces a similar mix of crops (predominantly coffee, sorghum, and beans). However, the commercial activity of farmers is noticeably greater in Ruhengeri than in either Butare or Gitarama.

We included Kenya in the survey because it is the only Sub-Saharan African country with more than thirty years of experience of a national land registration program and thus provides a test case for land tenure reform. Within Kenya, two traditional and densely populated African areas were chosen, the maize-producing region of Madzu and the commercialized area of Kianjogu (coffee). Two post-independence resettlement areas (where farmers received about five hectares of land) were also selected. Lumakanda exhibits more commercial activity than does the other resettlement area of Mweiga. Each of the ten regions is dominated by agriculture, and few off-farm income-earning opportunities exist.

More than 100 households were surveyed in each of the Ghanaian and Kenyan regions and about 80 in each of the Rwandan areas. Among the variables measured were characteristics of the household (for example, number, age, education, and occupation of all individuals, number of regular workers, nonfarm income, wealth, use of credit, and so on), characteristics of the household head (for example, farming experience, place of birth, and office-holding in local organizations), characteristics of the farm (for example, farm size or number of parcels), and characteristics of the parcel (mode of acquisition, soil fertility, parcel size, rights of transfer and use, land improvements made, type of document held, incidence of dispute, crops grown, inputs used, and output in the last season).

To provide an overview of tenure regimes predominant in our study regions, table 14-1 displays the percentage of parcels acquired through various methods. In the Rwandan regions and in Wassa and Ejura, numerous methods of acquisition are common. In Anloga and the Kenyan regions, nearly all parcels are acquired by three or fewer methods. The majority of parcels in all regions are acquired through nonmarket channels such as inheritance, gift, government allocation, and appropriation (initial clearing and use of part of the pool of communal land). Inheritance is by far the most common, whereas appropriation is becoming rare as unused land disappears. Purchases of land are much less common but account for at least 17 percent of operated parcels in Madzu, Lumakanda, Wassa, and Ruhengeri. Markets for leaseholds (fixed rentals, sharecropping arrangements, and pledges) are relatively rare in all regions except the Anloga region of Ghana.<sup>2</sup> Although one would perhaps expect more land transactions, especially given that in many of the regions commercial crops are produced and land is relatively scarce, the lack of off-farm income opportunities greatly reduces the willingness of households to alienate land.

Table 14-1. *Percentage of Operated Parcels of Land Acquired by Various Means*

Mode of acquisition	Ghana			Rwanda			Kenya			
	Anloga	Wassa	Ejura	Ruhengeri	Butare	Gitarama	Madzu	Luma-kanda	Kianjogu	Mweiga
Purchased	0.9	18.0	6.3	17.4	3.2	8.1	28.6	26.0	13.2	6.0
Inherited	57.5	6.3	22.1	46.6	43.4	49.5	68.3	31.3	82.1	35.0
Given	0.8	44.2	43.1	8.3	5.6	4.1	0.0	0.0	0.0	1.0
Appropriated	0.0	22.1	14.7	0.5	3.7	1.5	0.0	0.0	0.0	0.0
Allocated from government	0.0	0.0	0.0	4.0	4.9	15.6	0.0	33.6	1.9	58.0
Other permanent acquisitions	0.0	1.7	0.4	6.3	4.1	0.2	0.8	1.6	0.0	0.0
Rented	21.5	7.0	9.6	7.4	15.7	7.9	1.5	7.6	1.9	0.0
Pledged	19.3	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Borrowed	0.0	0.1	0.0	9.5	19.4	13.2	0.8	0.0	0.9	0.0
Squatter land	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: Survey data.

***Effect of Population Pressure, Commercialization, and Government Intervention on the Individualization of Land Rights***

Data were collected on whether a head of household could exercise numerous rights over particular parcels of land and whether, to exercise some of these rights, prior approval from another individual or institution was required.<sup>3</sup> The specific land rights enumerated for each parcel included use rights (rights to grow annual crops, to grow perennial crops, to be buried, to make permanent improvements, and to collect firewood, among others) and transfer rights (rights to lend, rent, pledge, mortgage, give, bequeath, and sell). The first three rows of table 14-2 categorize land parcels according to the breadth of accompanying transfer rights. The first group, "limited transfer" land, includes those parcels for which the farmer has no permanent transfer or alienation rights, but may have some temporary transfer privileges. Second, the "preferential transfer" category describes parcels that may be permanently transferred but only within the family or lineage (that is, through gift or bequest). Third, "complete transfer" lands are those that may be alienated outside the lineage through the right to sell.<sup>4</sup> This simple classification scheme produced mutually exclusive groups, each comprising parcels that were very homogeneous with respect to the breadth of rights, with more land rights found on "complete transfer" parcels.

The data in table 14-2 provide the basis for simple tests of the effect of population pressure and agricultural commercialization on the individualization of land rights. The effect of population pressure is best tested by comparing regions in Ghana. Although each Ghanaian region is fairly commercialized (Anloga, shallots; Wassa, cocoa; and Ejura, large food-crop farms), only Anloga experiences high population pressure. From the sum of the fifth and sixth rows of table 14-2, we see that for permanently held land, the percentage of "complete transfer" parcels is 76.7 percent in Anloga, 70.3 percent in Wassa, and 82.5 percent in Ejura. If the necessity of approval is also taken into account, however, the results change considerably. The percentage of permanently held parcels that may be sold without approval is much higher in Anloga (62.7 percent) than in either Wassa (14.7 percent) or Ejura (9.0 percent). If the ability to transfer land without approval is indeed the paramount measure of the individualization of land rights, then the Ghanaian data strongly support the notion that increased population pressure brings forth a higher degree of privatization of land rights.

Our best basis for testing the effect of commercialization on the privatization of land rights is Rwanda. In Rwanda each of the three regions is characterized by high population density, but Ruhengeri is the most commercialized and Butare is the least. In Ruhengeri 97.5 percent of permanently held parcels are "complete transfer" lands as opposed to 77.6 percent

Table 14-2. *The Prevalence of Land Rights across Study Regions*  
(percent)

<i>Land right</i>	<i>Ghana</i>			<i>Rwanda</i>			<i>Kenya</i>			
	<i>Anloga</i>	<i>Wassa</i>	<i>Ejura</i>	<i>Ruhengeri</i>	<i>Butare</i>	<i>Gitarama</i>	<i>Madzu</i>	<i>Luma-kanda</i>	<i>Kianjogu</i>	<i>Mweiga</i>
<i>All parcels</i>										
Limited transfer	52.4	6.0	21.0	15.5	36.7	21.1	26.2	9.9	23.6	53.0
Preferential transfer	2.1	29.1	6.6	3.1	16.5	21.3	6.3	14.5	67.9	10.0
Complete transfer	45.4	64.9	72.4	81.5	46.7	57.6	67.5	75.6	8.5	37.0
<i>Permanently held parcels</i>										
No right to sell	23.3	29.7	17.5	2.4	28.2	22.4	30.9	18.2	91.3	63.0
Right to sell with approval	14.0	55.6	73.5	19.7	37.3	10.6	39.0	51.2	4.9	4.0
Right to sell without approval	62.7	14.7	9.0	77.8	34.5	67.0	30.1	30.6	3.9	33.0

Source: Survey data.

in Gitarama and 71.8 percent in Butare. If approval to sell is considered, the Butare region exhibits by far the lowest percentage of freely salable parcels. These patterns provide support for the argument that increased commercialization hastens the individualization of land rights.

Our Kenyan regions do not provide the basis for such controlled tests. Madzu and Kianjogu differ somewhat both in population density and in degree of commercialization, with Madzu being denser and less commercialized.<sup>5</sup> Because land rights are more individualized in Madzu, if all else were equal, it suggests that population pressure may have been more influential than commercialization on land rights.

The Kenyan regions of Madzu and Kianjogu can also be used to test the effectiveness of government land policies, in this case a land registration and titling program, on the individualization of land rights. Of the 97 parcels with land titles in the two regions, only 23 can be sold by the current operator (23.7 percent) and only 24.5 percent of 94 parcels that may be sold are also titled. The apparent persistence of indigenous control over land transfers demonstrates the difficulty in altering custom by government decree. Another example of the ineffectiveness of government intervention is in Rwanda, where despite laws forbidding land sales without government authorization, farmers claim the right of sale over most of the sampled parcels.

### ***Land Rights and Agricultural Productivity***

Following Feder and others (1988), the relationship between land rights and productivity is hypothesized to proceed as follows. Increased individualization of rights improves farmers' abilities to reap returns from investments on land. This leads to a greater demand for land improvements as well as for complementary inputs. Increased individualization of rights may also improve the creditworthiness of the farmer and enhance his chances of receiving formal credit. Both of these demand- and supply-side mechanisms interact to increase investments in land and input use, which in turn lead to greater land productivity.

*Credit.* The use of formal credit is limited in the study regions, reflecting the poor development of formal rural banking institutions. Table 14-3 shows that less than 13 percent of the farms received formal credit during 1987-88 in nine of the ten study regions. The Anloga region of Ghana was the only exception—37.4 percent of households received formal credit there. Furthermore, in Ghana and Rwanda all formal credit loans were short-term, none being extended for more than one year. It is therefore not surprising to find a weak relationship between land rights and the use of formal credit. For instance, we did not find any significant relationships between the use of formal credit and the proportion of land held with "complete transfer" rights.

Table 14-3. *Aspects of Credit Markets in the Study Regions*

<i>Country and region</i>	<i>Percentage of households</i>		<i>Formal sector loans</i>	
	<i>Receiving any credit</i>	<i>Receiving formal credit</i>	<i>Number</i>	<i>Percent secured with land</i>
<i>Ghana</i>				
Anloga	47.8	37.4	43	19.5 <sup>a</sup>
Wassa	22.0	12.7	19	26.3
Ejura	5.7	4.4	7	0.0
<i>Rwanda</i>				
Ruhengeri	41.0	0.0	0	n.a
Butare	12.7	0.0	0	n.a
Gitarama	13.8	8.8	12	41.7
<i>Kenya</i>				
Madzu	—	4.0	5	50.0 <sup>a</sup>
Lumakanda	—	10.7	13	69.2
Kianjogu	—	8.7	9	0.0
Mweiga	—	1.0	1	100.0

— Not available.

n.a. Not applicable.

Note: The figures for Ghana are for 1987; for Rwanda and Kenya, they cover 1987-88.

a. The type of collateral was not reported by the respondents for all loans.

Source: Survey data.

Given the low incidence of formal borrowing, the absolute number of cases in which land is used to secure loans is very low (see table 14-3); in fact, none were reported in four of the regions. Group loans, where a group of borrowers is jointly responsible for repayment in lieu of collateral, are common in obtaining formal credit in Anloga. In each region, loan maturities averaged under one year. Although this may be partly influenced by lack of formal collateral, it is characteristic of banks not to favor long-term lending.

The case of Kenya differs considerably from that of Ghana or Rwanda in that formal titles to land are held by many farmers and could be obtained by countless others. However, we did not find a significant relationship between the possession of title and use of formal credit. The use of land titles also did not imply an increase in loan maturity or loan size. For instance, among all formal sector loans, the average maturity of loans secured by land was 24.1 months, but those secured by other means (cosignatory, group guaranty, and agricultural produce) averaged 31.5 months in length (the difference is not statistically significant). In light of these findings, we conclude that there is little relationship between land rights or land title and the use of formal credit. The low incidence of formal credit in Kenya also suggests that land titles alone will not lead to the development of active rural credit markets.

*Land improvements.* In terms of their effect on investment in land



improvements, land rights have mixed results.<sup>6</sup> The ability to bequeath land is the important distinguishing right in each Rwandan prefecture. Parcels that cannot be bequeathed (“limited transfer” parcels) are much less likely to be improved by farmers in any manner.<sup>7</sup> For example, 78.7 percent of parcels that could be bequeathed were improved, as opposed to 26.7 percent for those that could not be bequeathed. Among permanently held parcels, there is no difference in the incidence of land improvements between “preferential transfer” and “complete transfer” land, nor does the requirement of prior approval matter. In Anloga (only permanently held parcels were surveyed for investments), 61.8 percent of “complete transfer” parcels were improved (by drainage, mulching, or excavation) as opposed to only 5.4 percent of “limited transfer” parcels. Moreover, the parcels that could be transferred freely were more likely to have been improved than those requiring prior approval. In Ejura and in Wassa the incidence of investment was not related to land rights. A lack of relationship was also found for each Kenyan region. From these varied findings, it is not possible to make any general assertions regarding the effect of land rights on land improvements.<sup>8</sup>

*Productivity.* To test the relationship between land rights and land productivity, we estimated reduced-form yield equations using parcel level data for selected crops.<sup>9</sup>

In general form, the equation is:  $Y = f(\mathbf{X}_h, \mathbf{X}_p, S) + e$ , where  $Y$  = yield, measured as the gross value per hectare of all crops harvested on the parcel;  $\mathbf{X}_h$  = a vector of household characteristics (to capture resource and skill levels);  $\mathbf{X}_p$  = a vector of parcel characteristics (to capture size and land quality differences);  $S$  = a set of dummy variables for the land rights categories; and  $e$  = an error term.

In estimating this equation, we need to be sure that  $\mathbf{X}_p$  and the land rights  $S$  are not correlated with the error term; otherwise the estimated coefficients would be biased and inconsistent. There are two possibilities to worry about. The first is that the choice of land parcels (and hence  $\mathbf{X}_p$  and  $S$ ) are determined simultaneously with yields. Given that most parcels were acquired many years ago and that transfer rights, which are the basis of our land rights categories, are virtually predetermined by the mode of acquisition,<sup>10</sup> there is little argument for a causal relationship from  $Y$  to  $S$  or  $\mathbf{X}_p$ . It is more appropriate to view farmers' decisions as recursive; first they select parcels and then they farm them.

A more worrying possibility is that there may be unobservable variables that affect both the choice of parcels and current yields, even though decisions are made at different points in time (this will lead to the collapse of the recursive framework). These unobservables may be household effects (for example, managerial skill) or parcel effects (for example, quality of soil).

Because we have several parcel observations (plot observations in Rwanda and Kenya) for each household, we are able to correct for unobservable

household effects using either dummy variables (fixed household effects) or an error components model. Thus, the error term will be free of farmer effects that may influence land rights or  $X_p$ . Unfortunately, we do not have multiple observations on each parcel and cannot treat parcel effects in the same way. But we are able to control for a number of parcel characteristics, including soil fertility, that are included in  $X_p$ . Given the numerous observable parcel quality controls, it is doubtful that unobservable parcel quality is significant in either the determination of yields or the choice of land rights and  $X_p$ .<sup>11</sup>

We found no relationship between land rights and plot yields in Kenya and Ghana (see table 14-4). This is true in both the fixed effects (where feasible) and error component models. In additional regressions, we also found that the mode of acquisition had no effect on plot yields. But this is to be expected because there are strong correlations between the mode of acquisition and the land rights held.

In Gitarama and the pooled Rwandan sample, we found that "short-term use rights" parcels were more productive than parcels in all other land rights categories.<sup>12</sup> This perverse result can be explained as a multicollinearity problem. Land rights categories are highly related to the year of acquisition in Rwanda, primarily because short-term use rights parcels are almost always rented and hence have been held for much less time than parcels acquired in other ways. Moreover, the variable of time since acquisition is positively and significantly related to yield, and when this variable is dropped in a separate regression, the results show that the more secure land rights categories are no longer significantly less productive than short-term use rights parcels. The negative but insignificant coefficients remain, but they might be explained by differences in households who rent in land. Farmers who rent in land may generally be in dire need of land resources and apply greater amounts of labor in order to provide subsistence for their families.

We also tested the effect of land title on productivity in Kenya by including it alongside the land rights variables and by itself in separate regressions. In all cases, the possession of land title was not significantly related to yields. This is likely explained by the limited use of credit in the Kenyan study regions.

## **Impact of Recent Government Interventions in Land Tenure**

### ***Individual Tenure***

Perhaps the most comprehensive case of land tenure change aimed at establishing alienable individual rights is that initiated in Kenya during the 1950s

Table 14-4. Summary of Parcel Yield Regression Results

<i>Regional regression</i>	<i>Preferential transfer</i>	<i>Complete transfer</i>	<i>Complete transfer with approval</i>	<i>Complete transfer without approval</i>	<i>Other</i>
<i>Ghana</i>					
<i>Error component</i>					
Anloga			-0.35	-0.01	
Wassa			0.21	-0.11	
Ejura	0.44	-0.08			
<i>Fixed dummy</i>					
Ejura	0.30	-0.20			
<i>Rwanda*</i>					
<i>Error component</i>					
Pooled Rwanda	-0.21	-0.36**			-0.23*
Ruhengeri		-0.15			
Butare	-0.24	-0.32			-0.29
Gitarama	0.00	-0.68**			
<i>Fixed dummy</i>					
Pooled Rwanda	-0.31	-0.53**			-0.32*
Ruhengeri		-0.12			
Butare	-0.33	-0.38			-0.34
Gitarama	0.16	-0.85**			
<i>Kenya</i>					
<i>Error component</i>					
Madzu			0.15	0.05	0.28
Lumakanda			-0.13	-0.15	-0.14
Kianjogu	0.13	0.34			0.16
Mweiga	0.58	0.22			-0.17

\* Significant at a 10 percent level.

\*\* Significant at a 5 percent level.

Note: The most limited land rights group (that is, "limited transfer rights") is omitted from the regression and is the base against which all included land rights variables are compared.

Other explanatory variables included in the regressions but not reported here are (1) parcel characteristics: size, fertility, topographical location, slope, distance to house, year acquired, prior improvements, documents held, and cropping pattern; (2) household characteristics: age, education, occupation, gender, and farming experience of the household head; (3) farm characteristics: size, level of fragmentation, wealth, size of household, nonfarm income, and village where household resides.

a. The Rwandan results are from the model containing the years-since-acquisition variable. See the text for a discussion of the results for the land rights variables once years-since-acquisition is removed.

b. The land title coefficients are from separate regressions that exclude the land rights variables.

Source: Survey data.

and continued to the present date with some modifications. Although there is agreement that Kenya has enjoyed among the highest productivity increases in Africa during this period, the causal relationships between individual tenure and increased agricultural output have been seriously questioned. Many believe that the removal of prohibitions against Africans to produce high-value commodities (tea, coffee, and dairy products), coupled with substantial investment in communication and transport infrastructure during the 1950s and 1960s, improvements in extension services, and establishment of credit institutions, have been more important than changes in land tenure arrangements (Heyer, Maihta, and Senga 1976; Anthony and others 1979; Migot-Adholla 1985). Indeed, this appears plausible when account is taken of the substantial increase in the production of these crops (cocoa, coffee, tea, and oil palm) in countries such as Cameroon, Côte d'Ivoire, and Ghana, which have not undertaken any fundamental legal tenure change.

Critics of the Kenyan tenure reform have faulted it on grounds of increased landlessness. It should be realized, though, that an important objective of the program was concentration of land in the hands of the more efficient producers (Swynnerton 1954). Given Kenya's failure to industrialize and its very limited land resources, the current level of landlessness is as much a product of the exceptionally high rates of population growth as it is a reflection of the existing land tenure system.

Paradoxically, one consequence of the emergence of the nation-state in Africa, and particularly colonial and post-colonial reinterpretations of tribal authority and "indigenous" tenure, has been the freezing of ethnic boundaries, which has restricted opportunities for expansion of extensive land use. Where marginal land has already been utilized, output may be increased only by intensification. In such situations, we have argued that individualized transferable rights of land use will have evolved, even without introduction of formal registration.

But given the centrality of ethnicity in national politics, it is inconceivable that a national land market would evolve merely as a result of the introduction of a privatized tenure system. Evidence from other studies of Kenya indicates that although there is a weak market in land nationally, it is more severely restricted in the former African reserve (nonscheduled areas), where it operates mainly among members of the same ethnic group. In contrast, a significant level of transactions in land occurs in the former white-settled (scheduled) areas and in urban peripheries, where individuals are not bound by strong kinship identity. The consequence is that titles to agricultural land are perceived to have a greater commercial value within the urban periphery and former scheduled areas than in the former African reserves, largely because of difficulties in enforcing contracts. For although some banks have accepted titled land as collateral and auctioned it off in cases of default, in

some cases purchasers were not able to take occupation of the land for fear of reprisals. Thus, rather than stimulating a land market in which more efficient farmers acquired land, this situation created a market in land titles that were often used to secure loans for nonagricultural investment (Okoth-Ogendo 1986). But this development has been complicated even further by recent legislative amendments that require that disputes over land be referred to elders in the first instance—a condition that underlines official ambivalence toward full implementation of the provisions of the Registered Land Act for fear of promoting dispossession of poor peasants by their richer neighbors.

More generally, our results on credit access and productivity, as well as those from parallel studies undertaken by the Land Tenure Center of the University of Wisconsin (1990), suggest that large-scale land registration and titling programs are unlikely to be economically worthwhile for much of Sub-Saharan Africa at this stage of its economic development. But there are circumstances when titling might be worthwhile, for example:

- *When the indigenous tenure systems are absent or very weak.* This is frequently the case in land settlement areas, but it can also arise elsewhere following periods of major economic or political upheaval, particularly if traditional lines of authority have been severed.
- *In areas where the incidence of land disputes is high.* This may occur in areas where large numbers of migrants or strangers have settled and established rival claims to land owned by indigenous groups.
- *Where major project interventions are planned that either require full privatization of land rights for their success, or are likely to weaken the land rights of some vulnerable groups.* Some irrigation and tree-crop projects provide good examples.

Where tenure reform through land registration is to be undertaken, it is important to recognize the possibly overlapping rights of different individuals on the same piece of land. For example, herdsmen may have dry-season grazing rights on land that is cropped by others. If some of these rights are lost without adequate compensation, vulnerable groups may lose an important source of livelihood. The rights of access to land by all lineage members, even when working or resident elsewhere, has also been shown to provide an important element of security, particularly in old age, as well as being an important factor in explaining the low incidence of landlessness in many heavily populated rural areas of Sub-Saharan Africa. Again, loss of these rights without adequate compensation could prove economically disastrous for some vulnerable groups. Land registration programs that attempt to record and protect the full range of customary rights run the risk of ossifying land tenure institutions and reducing their ability to evolve with economic circumstances. Where titling is required, it seems better to seek full privatiza-

tion of land rights, but within the context of an adequate system of compensation for those who lose some or all of their rights over land.

### ***Strengthening Indigenous Land Tenure***

The indigenous land tenure systems appear to be adapting efficiently to changes in relative factor scarcities. This is reflected in the emergence of markets for the sale and rental of land and in the trend toward increased privatization of land rights. For this process to continue, it is important that governments not impose unnecessary restrictions on the ownership or transfer of land. For example, restrictions on land sales and rentals are often legislated in the belief that this will prevent excessive concentration of land among the rich and the dispossession of the poor. In practice, this concern is rarely justified, and it might anyway be more easily addressed through ceilings on farm size without inhibiting land markets and preventing more efficient allocations of land among farmers with different management skills or factor endowments. Some governments (for example, those of Botswana, Nigeria, and Swaziland) are also unnecessarily restricting land transactions through policies that seek to "retribalize" land in the pursuit of rather nostalgic idealizations of African rural society (Cohen 1980; Bruce 1988).

Rather than restricting land markets, governments should create an "enabling" legal and institutional environment for more efficient transactions. This might entail establishing a voluntary system to simply record the details of land transactions and the interests of the different parties, and providing or reinforcing channels for the enforcement of all duly recorded contractual arrangements. These kinds of interventions could go a long way toward resolving many of the disputes that arise over land, particularly in areas where significant migrant or stranger farmers have settled, yet would be much cheaper than formal registration and titling programs.

### **Conclusions**

We have argued that the contrast between indigenous African tenure and Western property rights systems should be perceived not in terms of opposite extremes but as points along a continuum between communal rights systems and privatized rights systems. In response to population pressure, agricultural commercialization, and technological change, indigenous African tenure systems have moved along that continuum in the direction of greater individualization of land rights. This conclusion is supported not only by historical evidence, but also by our cross-sectional study of land rights in Ghana, Kenya, and Rwanda.

Controlling for differences in land quality and household characteristics,

our regression analysis indicates no relationship between cross-sectional variations in land rights and productivity. Thus, they undermine the conventional view that land rights are a constraint on productivity.

Our results do not invalidate the theoretical model linking privatized land rights to agricultural productivity. Rather they suggest that this relationship is obscured or suppressed because of other constraints on agricultural development: poor rural health and education, lack of infrastructure, imperfect markets for materials, outputs and risk, and overall low level of technology. It may be that the individualization of land rights becomes more important to agricultural productivity once these more urgent development needs are met.

Our study also indicates that land titling is not sufficient to increase access to formal credit. Land as collateral is of little value in the study areas of Kenya, primarily because land transfers to outsiders through sale (or foreclosure) are not always recognized as legitimate. Moreover, in the absence of better nonfarm opportunities, farmers are reluctant to mortgage land.

We are unable to determine precisely the degree of efficiency with which indigenous systems in our study regions have evolved. We do find some success stories associated with indigenous tenure systems: multiple cropping and high use of inputs in Anloga, adoption of cocoa production in Wassa, use of mechanization in Ejura, and adoption of some high-yielding varieties and soil conservation improvements in Rwanda. However, it is difficult to judge whether the pace of these changes could have been hastened by government intervention in land tenure arrangements. Evidence from Boserup (1981) and Pingali, Binswanger, and Bigot (1987) suggests that without accompanying improvements in infrastructure and rural health and education, agricultural intensification and technological change would be slow under any tenure regime.

Needless to say, our results are subject to some qualifications. The most important is that our study regions are, like much of Sub-Saharan Africa, poorly endowed with physical infrastructure and effective credit and marketing institutions. Factor markets for land, labor, and capital are also poorly developed and the available technologies have mostly been stagnant for quite some time. Within this context, one should not expect to find much new investment in land improvements or much use of modern inputs, even when full land rights are assured. Not only will the demand for investments and modern inputs be muted, but even where it exists, it may not be realized because of failures on the supply side for credit and inputs. As new technologies become available, as credit, input, and product markets improve, and as rural infrastructure is developed, then more significant relationships between tenure security and land productivity may begin to emerge.

A second limitation of the study is that we covered only areas of rainfed agriculture. Questions remain about the suitability of indigenous land rights

for irrigated farming, extensive pastoral and livestock systems, and communal forestry areas.

A third, more subtle limitation of our argument is that it extrapolates from past performance of indigenous land rights to future evolution. These systems are predicated on the solidarity of small-scale social entities. These entities may cease to function if national institutions or national and international mobility of labor destroy their legitimacy, or if loyalties to lineage and communal groups become weak.

Given the wide variety of African rural economies and politics and differences in resource endowments, a pragmatic approach that promotes the adaptability of existing land tenure institutions appears preferable to radical reform of either an individualist or collectivist type. But this is not to argue for the reinvention of an idealized African past. Rather, it suggests intervention only where demand for change has been proven genuine. In the case of land registration, such a demand should arise following increased commercial agricultural opportunities and the acceptance of the legitimacy of impersonal forms of land transfers. In the meantime, governments have much to do in providing rural infrastructure, promoting market efficiency, and improving production technology, which are the real constraints on agricultural productivity.

## Notes

1. Because African farmers were allowed to cultivate mainly subsistence crops, the head tax forced many to obtain cash through wage labor on white settler farms.

2. Pledges are possessory mortgages in which the lender of cash takes possession of the land for a specified period and earns, as interest, the proceeds from the land. They are described as usufruct loans in chapter 8.

3. Farmers' perceptions about whom they must clear land transfers with often do not correspond with legal requirements, but the data we report here are respondents' perceptions of their rights.

4. There may still be restrictions on transferring land to members from other tribes or cultural groups, but these are much less constraining than restrictions on other transfers at the family or immediate lineage level.

5. The Lumakanda and Mweiga regions are less useful for testing purposes because we do not know whether settlement loans have been repaid and, thus, whether farmers are able to claim rights over allocated parcels.

6. In Rwanda, numerous types of land improvements were classified as either boundary, short-term, or long-term. In Kenya, only terracing, drainage, and tree crop improvements were examined. In Anloga, the improvements were drainage, mulching, and excavation. In Wassa, the only improvements made by farmers were tree crops. Finally, in Ejura, tree crops and destumping investments were analyzed.

7. The difference is most marked when the improvements made by the current operators are compared. But land that cannot be bequeathed by the current operators also has less accumulation of improvements, irrespective of who made them.



8. For a more sophisticated analyses of these relationships, see Place and Hazell (1993).

9. Yield regressions were confined to the more important crops in each region, and we tried to avoid crops that were extensively intercropped. Production was physically measured at harvest in Rwanda but was obtained by farmer recall elsewhere. Because the major crops were mostly cash crops (for example, cocoa and shallots in Ghana), farmers also had less trouble recalling the amounts produced.

10. Although not reported here, cross-tabulations of land rights categories against mode of acquisition show a high correlation. This is not to deny that land rights evolve over time, but the changes probably occur when land changes hands. Moreover, evolutionary changes will not quickly lead to the reclassification of parcels from one of our broad land rights categories to another.

11. We also find no evidence of any relationship between parcel quality variables and the land rights categories.

12. Short-term use rights parcels are those limited transfer parcels with use rights restricted to a specified number of seasons (mainly rented parcels).

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## 15

*Kasugpong in the Philippine Rice Bowl:  
The Emergence of New Labor  
Institutions after the Land Reform*

*Yujiro Hayami and Keijiro Otsuka*

*The 1972 land reform in the Philippines redistributed property rights in land, regulated land rents, and thereby transferred substantial wealth to former share tenants. The reform denied land reform beneficiaries the right to lease their land to tenants. This chapter documents the appearance of new forms of permanent labor contracts (kasugpong) as substitutes for tenancy. We argue that as a result of these new forms of labor contracts, the irrigated rice sector in the Philippines is gradually bifurcating between noncultivating well-to-do leaseholders and landlords, and landless agricultural laborers.*

THE LAND REFORM PROGRAM carried out under the Philippine Presidential Decrees of 1972 converted share tenants into leaseholders or amortizing owners. For leaseholders, land rent was fixed at 25 percent of the average rice yield that had been obtained in the three normal years immediately preceding the land reform. For those who became amortizing owners, the amortization fee was based on an interest rate of 6 percent and on the price of land valued at two and a half times the average rice yield. The fee was payable in equal installments for fifteen years.

Since then, dramatic increases in rice yields have occurred. In the Central Luzon region, much of the rice area in the Nueva Ecija and Bulacan provinces became irrigated and shifted from single to double cropping in the

1970s, especially after the completion of Pantabangan Dam in 1974. Based on the improved irrigation infrastructure, sharp increases in rice yields have resulted from the diffusion of modern rice varieties and the increased application of fertilizer and chemicals. Typically, paddy yields more than doubled, from less than two tons in the early 1970s to a level of four tons per hectare in the mid-1980s (Herdt 1987).

With both land rents and amortization payments fixed at the time of land reform operations, the yield increases have resulted in major gains to land reform beneficiaries, that is, leaseholders and amortizing owners (Otsuka 1991). As their incomes have risen, their supply of agricultural labor has decreased. Some of them have initiated nonfarm businesses, such as small trades and manufacturing based on capital saved from increased farm incomes. Naturally, preferences for leisure and urban occupations have become greater for their children, who have received a better education than their parents. Thus, high demands have developed to substitute hired labor for family labor in rice farming operations.

But under the terms of the land reform, the beneficiaries were prohibited from leasing their land to others. The purpose of this chapter is to provide evidence from Central Luzon of the emergence of two new forms of labor contract that sidestep the restrictions of the land reform law. These new types of labor, which we call the semi-attached and semi-tenant laborer, resemble the permanent landless laborer class in India in that their chance of ascending the agricultural ladder via sharecropping is closed by the land reform laws (Otsuka, Chuma, and Hayami 1992). This laborer class emerged in the 1970s in the irrigated rice-growing regions of Central Luzon (Bulacan, Nueva Ecija, and parts of Pampanga). Here, the wealth transfer to ex-share tenants under the land reform was especially large. In contrast, the new classes of landless laborer were not observed in rainfed areas in Pampanga characterized by low yields.

### **Historical Overview of the Use of Hired Labor in the Philippines**

Rice farming in the Philippines is known for its high dependency on hired labor (Barker and Cordova 1978). However, the hired labor contracts used have usually been short term, mostly for tasks that can be accomplished within a day. Permanent laborers employed for a year or a crop season, although relatively common in South Asian countries, such as India and Nepal, have seldom been found in the rice sector of the Philippines or most other countries in Southeast Asia, except on plantations of cash crops—for example, *dumaan* in sugar haciendas in the Island of Negros. Indeed, socio-

logical and economic investigations into the agrarian structure of rice villages in the Philippines before 1980 do not report any significant incidence of permanent labor contracts (Anderson 1964; Hayami and others 1978; Hayami and Kikuchi 1981; Hester and Mabun 1924; Ledesma 1982; Rivera and McMillian 1954; Takahashi 1969; Umehara 1974).

Traditionally, both rice transplanting and harvesting were performed by short-term hired labor. The former was contracted out on a daily wage basis to a crew of transplanters organized by a labor drafter called *kabisilya*; harvesting was usually done by a harvest-sharing contract called *hunusan* in which anybody is allowed to participate and receive a certain share of the harvested crop. As the need for weeding increased with the introduction of short-statured modern varieties, hired labor for weeding increased either on a daily wage basis or in a new contractual arrangement called *gama*. In *gama*, workers conduct weeding in certain plots without receiving wages in order to establish an exclusive right to harvest the rice crop from those plots and receive harvest shares (Hayami and Kikuchi 1981, chapters 4 and 5).

Land preparation had traditionally been the major task that owner-cultivators or tenants performed themselves because it requires due care in plowing and harrowing to avoid harm to the draft animals. Recently, however, plowing has increasingly been contracted out to custom services that use small tractors in Central Luzon.

Remaining tasks for the labor of farm operators (owner-cultivators or tenants) and family members are those that require care and judgment and, therefore, are more difficult to monitor, such as water control and fertilizer and chemical applications. Unlike transplanting and harvesting labor, demands for those tasks are spread thinly over a crop season in an unpredictable manner. Therefore, transaction costs associated with the use of casual labor for these tasks tend to exceed those associated with the use of a few workers with whom an employer can develop a strong patron-client relationship in order to reduce the monitoring cost.

If a well-to-do land reform beneficiary in a well-irrigated area wanted to minimize his own farm work, including labor supervision, it would be most efficient to have a tenancy contract with a worker that left all the tasks to him for a fixed or share rent. In fact, some new leaseholders have opted to have subtenancy contracts with landless workers (Hayami and Kikuchi 1981, chapters 5 and 6). However, the subtenancy arrangements are highly hazardous, because if the lessee dares to appeal to the Agrarian Reform Office, the lessor's tenancy title would be forfeited and transferred to the lessee if the lessee proves himself to be the real "tiller of the land." Therefore, subtenancy arrangements are bound to be limited to a narrow circle of relatives and close friends.

The *kasugpong* arrangements of the semi-tenant type can be considered an institutional innovation to fill the demand of well-to-do land reform bene-

ficiaries in irrigated areas who want to withdraw from farm work while keeping their titles to land. It plays a role similar to tenancy contracts, while it can easily be disguised as a labor employment contract. It is, however, an imperfect substitute for tenancy because the payment of a fixed wage or 10 percent of output to laborers does not provide adequate work incentives. A recent study by Otsuka, Chumo, and Hayami (forthcoming) found significantly lower output and residual profits on farms with *kasugpong* than on those without.

A typical example of a contract was found in the case of a large farmer holding three hectares of leasehold land and two hectares of amortizing land in the municipality of Muñoz, Nueva Ecija. While he operated a small rice mill and a grocery store (*sari-sari*), he left almost all the farm tasks, including land preparation except transplanting, weeding, and harvesting, to a family with three working males (father and two sons). For their service, this *kasugpong* family received 10 percent of gross paddy output from this farm. They lived in a shanty in the farmer's residential quarter, but neither food nor clothing was provided by the master. They were entitled to receive daily wages when they engaged in transplanting, weeding, and harvesting activities. In addition, they supplemented their income by making the *kasugpong* contract with another farmer for one hectare.

The use of *kasugpong* as a substitute for tenancy contracts has not been limited to land reform beneficiaries. It has also been used by large landlords who still maintain large tracts of land under their direct administration, because nontenanted lands were exempt from land reform programs. Such a case was also found in Muñoz. The widow of a former owner of a rice hacienda of 200 hectares has been managing a farm of 30 hectares (presumably through tenant eviction to a large extent); the rest of the land was taken away by the reform programs. She is managing this farm with ten *kasugpongs*, each assigned 2-4 hectares of land, under the supervision of one overseer (*katiwala*). While those workers receive 10 percent of gross output, the overseer receives a 5 percent share. In addition, the overseer is allowed to cultivate 1.5 hectares under a fifty-fifty share tenancy contract.

An interesting aspect of this case is that the landlord forced the workers to sign written contracts indicating that they are laborers but not tenants. In fact, an appeal of one worker to the Agrarian Reform Office to establish a tenancy title was turned down because of this document.

### Geographical Distribution of *Kasugpong* Contracts

To examine the incidence and nature of *kasugpong* arrangements in or near Central Luzon, we undertook a survey in August 1987 covering thirty-six municipalities in six provinces (see figure 15-1 and table 15-1). Farmers or

Table 15-1. Observations of Kasugpong Arrangements by Site and Type

Province and municipality	Village	Kasugpong			Irrigation status <sup>c</sup>
		Observed	Type <sup>a</sup>	Payment <sup>b</sup>	
<i>Bulacan</i>					
Guiguinto	Santa Rita	Yes	ST/SA	F	I
Pulilan	Cutcot	Yes	ST/SA	F	I
San Ildefonso	Malipampang	Yes	ST/SA	F/S	R
Plaridel	Santa Ines	Yes	ST/SA	F/S	I
<i>Nueva Ecija</i>					
San Leonardo	Tabuating	Yes	ST	S/F	I
Santo Domingo	San Francisco	Yes	ST	S/F	R
Muñoz	Maligaya	Yes	ST	S/F	I
	Maragol	Yes	ST	S/F	I
Nampicuan	Gabalidon	Yes	ST	S/F	R/P
	Poblacion	Yes	FS	F	R
<i>Pangasinan</i>					
Villasis	Baraca	Yes	FS	F	R
Rosales	Tomana East	Yes	FS	F	I
Santa Maria	Pilar	Yes	FS	F	R
Urdaneta	Nancayasan	Yes	FS	F	R
Pozorrubio	Cablong	No			R
	Villegas	No			R
Calasiao	Mancup	No			R
San Jacinto	Magsaysay	No			I
<i>Tarlac</i>					
Moncada	Poblacion	Yes	FS	F	R
	Anao	Yes	FS	F	R
Mayantoc	San Bartolome	Yes	FS	F	I
San Manuel	San Miguel	Yes	FS	F	R
Tarlac	Sapang Tagalog	No			I
La Paz	Carumutan	No			I
Concepcion	Santo Cristo	No			I
Capas	Santo Domingo II	No			R
<i>Pampanga</i>					
Apalit	Sucat	Yes	SA/ST	F	R/P
Minalin	San Francisco	No			R
San Simon	Santo Niño	Yes	SA/ST	F	R/P
Guagua	San Anton	Yes	SA/ST	F	I
Lubao	San Agustin	No			I
	San Nicolas II	No			I
Santa Ana	San Bartolome	Yes	SA/ST	F	I
<i>Laguna</i>					
Pila	Tubuan	No			I
Calauan	Dayap	No			I
Bay	Santo Domingo	No			I



Table 15-1. (continued)

Province and municipality	Village	Kasugpong			Irrigation status <sup>c</sup>
		Observed	Type <sup>a</sup>	Payment <sup>b</sup>	
Los Baños	San Antonio	No			I
Calamba	Parian	No			I
Cabuyao	Niugan	No			R
Santa Rosa	Tagapo	No			I
Biñan	Platero	No			I

a. FS = farm servant (usually single young male, living in an employer's house with food and clothing provided and working exclusively at the employer's farm). SA = semi-attached laborer (single or married, living in a shanty inside or outside an employer's quarter and working on certain preassigned tasks at the employer's farm while being allowed to work for other employers). ST = semi-tenant laborer (similar to SA but assigned a more comprehensive coverage of farm tasks and given greater autonomy).

b. F = fixed in paddy. S = share of paddy output.

c. I = irrigated. R = rainfed. R/P = rainfed, supplemented by pump irrigation.

Source: Authors' survey.

groups of farmers randomly met along the survey trip were interviewed with a simple questionnaire about the scope and the nature of *kasugpong* arrangements in their surroundings.

One major finding from the survey is that *kasugpong* contracts are not uniform and that the different types are distributed in a specific area in Central Luzon. The incidence of *kasugpong* varies widely but lies mostly within a range from 10 to 20 percent of farmers in a village (*barangay*), and seldom reaches 50 percent.

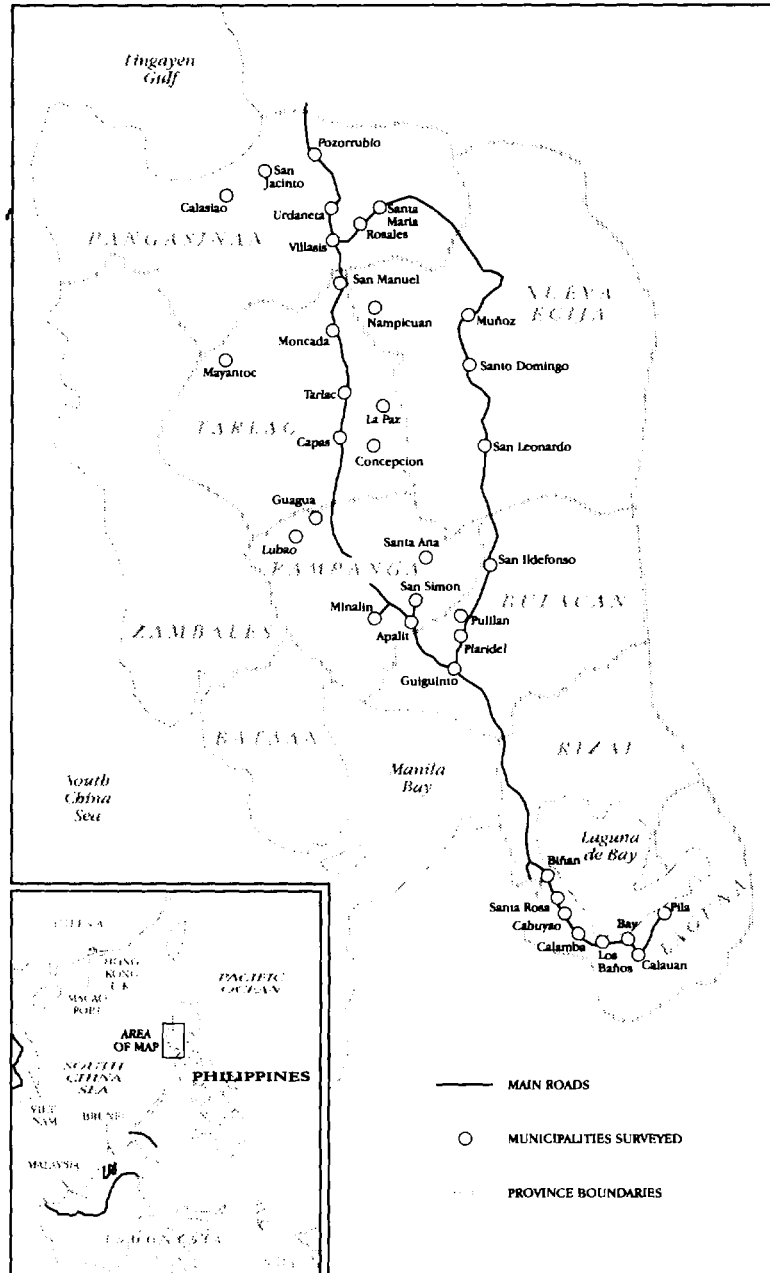
### Three Types of Kasugpong

We found that *kasugpong* arrangements can be grouped into three categories. A *kasugpong* of the farm servant is usually a young single male who lives on an employer's farm helping all of his master's operations. In fact, the *Ilocano* word *kasugpong* means "helpers within the family circle" (McLennan 1982, p. 65).

The second type of *kasugpong* may be called semi-attached laborer. He is either single or married with a family, and he lives in a shanty either inside or outside the employer's residential quarter. He has preassigned tasks and is allowed to work outside his master's farm as a casual worker to supplement his income.

In both the first and the second types of arrangements, workers receive fixed wages in paddy ranging from ten to thirty cavans (one cavan = fifty kilograms) depending on their experience and skill as well as the scope of tasks assigned to them.

Figure 15-1. *The Survey Route and the Municipalities Covered by the Survey, 1987*



The third type, which may be called semi-tenant laborer, differs from the semi-attached laborer only in that his assignment of farm tasks is more comprehensive and he has greater autonomy to allocate his labor on the assigned parcel of land. Payments are either in the fixed sum of paddy or a share of output (usually 10 percent). Clearly, the latter case resembles share tenancy.

Usually, the second and third types of *kasugpong* coexist in the same municipalities. These two types are difficult to distinguish because they lie on a continuous spectrum. For all three types, the contract covers only one crop season but is usually renewed continuously.

Figure 15-2, as well as table 15-1, shows the geographical distribution of the three types of *kasugpong* observed during our survey trip. In this figure, each municipality is characterized by the dominant type of *kasugpong* arrangements.

According to our observations, arrangements of the farm servant type are clustered in a rainfed area lying from the Nueva Ecija-Tarlac border to the southern part of Pangasinan. According to survey respondents, *kasugpong* as an institution in this area predates World War II, and its incidence has recently declined slightly because the workers have tended to migrate out to irrigated areas.

In contrast, the *kasugpong* of the semi-tenant laborer type is commonly observed in the irrigated area of Nueva Ecija. In this area, *kasugpong* is a new system. It has become common only since the late 1970s or the early 1980s. (Though some villagers argued that this system has existed since long past, it has rarely been practiced and its arrangement has been of the form of the semi-attached laborer type until recently.) The dominant mode of payment to workers in this area is a 10 percent share of paddy output. Some workers are migrants from rainfed areas; the arrangement is often called *porcientuhan*, as distinct from other types of *kasugpong*.

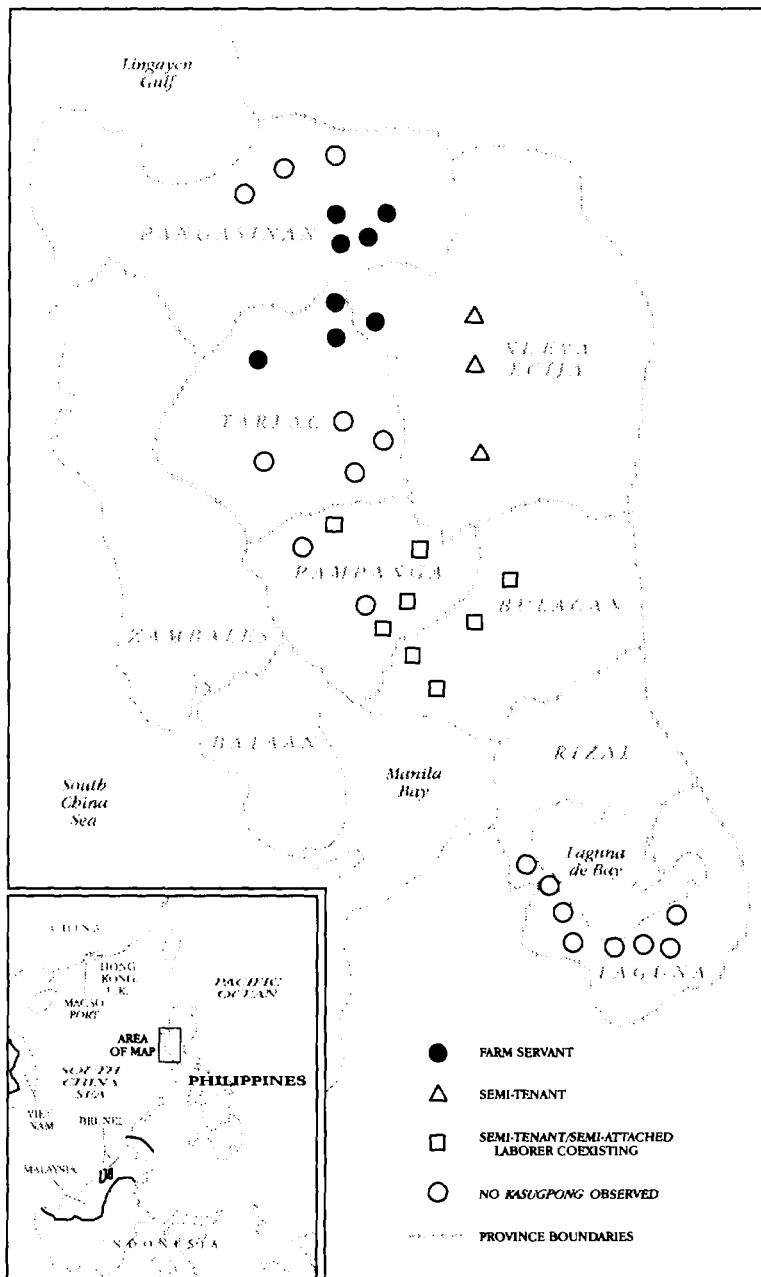
In both Bulacan and Pampanga, the semi-attached laborer and the semi-tenant types seem to coexist. Discussions with respondents suggest that these arrangements, especially of the semi-tenant type, have recently become common in Bulacan, even though the wage payment is mostly fixed in kind. At least in some villages in Pampanga, *kasugpong* appears to be a relatively old institution, though its incidence seems to have increased recently.

Areas in which *kasugpong* was not observed are along the coasts of Laguna de Bay, Manila Bay, and Lingayen Gulf, and a relatively small rice area in the midst of sugar lands in Southern Tarlac.

## Land Reform, New Rice Technology, and *Kasugpong*

Historical studies suggest that the *kasugpong* arrangement of the farm servant type located in the rainfed area from the Nueva Ecija-Tarlac border to

Figure 15-2. Geographical Distribution of Different Types of Kasugpong Arrangements in Central Luzon and Laguna Municipalities, 1987



southern Pangasinan was brought in by migrants from the Ilocos region in the north when inner Central Luzon was opened up for rice production in the late nineteenth century (McLennan 1969, 1982).

In sparsely populated frontier lands in which peace and order had not been established (for example, where a high incidence of theft of draft animals occurred), settlers would have found it convenient to have young male helpers living together on their farms. At the same time, the *kasugpong* arrangement of the farm servant type would have provided to the young boys a step to ascend the "agricultural ladder" (Spillman 1919) from agricultural wage workers to tenant farmers, because it enabled them to acquire farming skills and savings for becoming tenant farmers. Savings were needed for the purchase of draft animals, among other things.

However, as the frontier closed, it became more difficult for the *kasugpong* workers to ascend the agricultural ladder. With the land reform programs under the Marcos regime that strongly protected tenancy titles and controlled land rent, landowners have become reluctant to rent out their land, and therefore the ladder for the workers to ascend to tenants has almost completely closed unless they are fortunate enough to inherit landownership or tenancy titles from their parents. Today, after marriage, they either continue to live in the same village as casual farm laborers or migrate out for better opportunities. One such opportunity is to become the *kasugpong* worker of the semi-tenant type in irrigated areas.

Why did the *kasugpong* of the farm servant type not become common in the Nueva Ecija side of Central Luzon? A tentative hypothesis is that this form of labor contract had traditionally been practiced among the Ilocano population who migrated to Pangasinan and Tarlac, whereas such a tradition had not existed among the Tagalog population who migrated to Nueva Ecija from the south. This hypothesis is partially supported by the finding that no case of *kasugpong* was found in the province of Laguna, the heartland of southern Tagalog.

### ***Emergence of the Semi-Tenant and Semi-Attached Laborer: Migration of Labor and of Institutions***

Why did the *kasugpong* arrangements of the semi-attached laborer and the semi-tenant laborer types begin to spread out in recent years rather suddenly over the irrigated areas of Nueva Ecija and Bulacan?

Many *kasugpong* workers observed in well-irrigated areas of Nueva Ecija and northern Bulacan were migrants from rainfed areas within Central Luzon, though some came from other regions, as far as Bicol and Visayas. A fairly common pattern appears to be that landless laborers in the rainfed areas first migrate seasonally to the irrigated areas for transplanting and harvesting, and then settle there permanently as they find patrons for *kasugpong* contracts.

It is hypothesized that the institutional concept of *kasugpong* was brought by the migrant laborers from the Ilocano settlement in the northwestern part of Central Luzon down to the Tagalog settlement in the eastern part. The original *kasugpong* contract of the farm servant type in the Ilocano settlement has been transformed into those of the semi-attached and the semi-tenant laborer types so as to conform to both the different economic demand following the land reform and the different sociocultural environments of the Tagalog settlement.

Why have the *kasugpong* contracts *not* spread into the rice belt of Laguna, characterized by well-developed irrigation infrastructure? One reason might be because metropolitan Manila, segregating Laguna from Central Luzon, has blocked the labor migration that carries the *kasugpong* concept. Another reason might be that the closer community ties have the effect of lowering labor transaction costs associated with short-term casual labor contracts even for tasks that require care and judgment, such as repairing dikes and applying fertilizers and pesticides. However, more recent investigations have revealed that the semi-attached and the semi-tenant laborer contracts have begun to be used in some villages in Laguna, also.

It is highly interesting to observe that the *kasugpong* system that originated in Central Luzon has not made major inroads in Laguna, whereas the *gama* system (described on page 294) that originated in Laguna has not spread into Central Luzon (Hayami and Kikuchi 1981, chapter 4). Further investigations are necessary to identify factors underlying regional specificities of those institutional arrangements.

### A Suggested Direction of Agrarian Change

The observed pattern of diffusion of *kasugpong* contracts in Central Luzon suggests a new agrarian structure that the irrigated rice sector in the Philippines is now moving toward.

Before land reform and new rice technology, the rice sector of the Philippines was essentially bifurcated between wealthy landlords and poor share tenants/agricultural laborers. In general, share tenants and agricultural laborers made a continuous social spectrum and were linked by the agricultural ladder. With the land reform, not only land assets but also incomes from lands were redistributed in favor of the tenants through regulations on land rent and tenancy form. Since then, the incomes of land reform beneficiaries have increased rapidly with improvements in irrigation systems and rice technology. The large benefits have been limited to *ex-share* tenants and almost completely bypassed landless agricultural laborers.

Moreover, the agricultural ladder has been closed for agricultural laborers, because land reform beneficiaries and landlords who still administer sizable

areas have lost their incentive to rent out their land under the present land reform regulations. While the possibility has been lost to climb up the agricultural ladder, the possibility to drop down has been left open. It is common to observe small leaseholders and amortizing owners who are forced to sell or mortgage out their titles to large wealthy farmers or landlords for urgently needed cash, and who thereby drop down to the landless laborer class.

Thus, the irrigated rice sector in the Philippines has been bifurcating between nonworking farmers and landless agricultural laborers. While the increasing disutility of labor and the increasing preference for nonfarm economic activities has been inducing large wealthy farmers to reduce their family labor input in farm work, the option to rent out their land to landless laborers has been closed under the land reform regulations. Landless laborers have been forced to stake out a meager living from *kasugpong* contracts, at best, and from unstable casual farm work alone, at worst.

The emerging agrarian structure in the Philippine rice sector resembles that of India, in which farmers in upper castes do not do work themselves but only supervise the work of laborers in lower castes, with no agricultural ladder bridging them. While such a system might still be better than the old structure of bifurcation between large *hacenderos* and poor tenants/laborers, one might fear that further progress in the "Indianization" of the Philippine rice bowl could become a major source of rural unrest.

## Note

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## 16

*Path-Dependent Policy Reforms:  
From Land Reform  
to Rural Development in Colombia*

*Alain de Janvry and Elisabeth Sadoulet*

*Even though land reform has been on the political agenda in Colombia since the 1930s, effective land redistribution has not happened. Using the theory of public choice and the concept of path dependency, we propose an interpretation of this deadlock in policy reform. Because the first phases of land reform sought to modernize large farms under the threat of expropriation, the rise in political power of the modernized landlords who adopted Green Revolution technology allowed them to block subsequent attempts at redistribution. This was done by effectively using rent-seeking to raise land values on large farms, through public subsidies, above levels at which compensation by family farms could be achieved.*

A PARADOX OF LAND REFORM IN COLOMBIA is that, while existence of an inverse relation between total social factor productivity (TSFP) and farm size has been convincingly established (Berry and Cline 1979) and while land reform has been on the policy agenda since the 1930s, no significant land redistribution has occurred. We propose an interpretation of this policy failure by looking at the particular sequence of reforms that were introduced, using the concept of path-dependency. Because of the changes early reforms induced in the political economy of Colombia, this sequence blocked the possibility of capturing the efficiency gains potentially offered by redistributive land reform and enhanced social tensions in the rural areas.

Path-dependent policy reforms thus ultimately resulted in socially inefficient resource use and often explosive rural poverty. Persistence of the current highly unequal land tenure system consequently does not reflect superior social efficiency, but rather a political settlement in a context of highly unequally distributed political power that was the product of past reforms.

We first retrace the historical sequence of reforms in Colombia, from modernizing land reform under the threat of expropriation in the 1930s, to failed attempts at redistributive land reform and effective rent-seeking by large farmers in the 1960s, and to abandoning land reform for rural development in the 1970s. We then explain this sequence of reforms in terms of a critical path of changes in the distribution of political power induced by the reforms themselves, technological change, and evolving international pressures. Finally, we extract implications for feasible policies to induce growth and equity in Colombian agriculture.

### **The Conflict Between Redistributive and Modernizing Forces in Land Reform**

To conceptualize the determinants of the sequence of agricultural reforms in Colombia, we use the Zusman (1976) and Becker (1983) framework where the political economic process is endogenously determined by specification of the pressure groups with their objective functions, a set of feasible policy instruments, the influence functions of the pressure groups on the state, and the constraints imposed by the economic system. The outcome is the policy that maximizes a weighted average of the objectives of the different groups, where the weights are the marginal influences that each group has over policymakers. Extending this framework to an intertemporal problem, we keep invariant through the whole period the set of feasible policies and the groups, while focusing on the endogenous changes in their demands and on the evolution of their influence weights. A key issue is how past reforms affect the distribution of political power and hence the political feasibility of further reforms. In analyzing each period of reformism, we consequently stress how reforms have changed the configuration of the political economy for the subsequent period—that is, the demands of each group and the weights of their demands on the state.

The social actors who influence agrarian reformism are (a) the landless and marginal or “subfamily” farmers ( $L + SF$ ); (b) the family farmers, initially the tenants of the haciendas who subsequently became independent households ( $F$ ); (c) the large farmers, referred to as landlords ( $Ll$ ); and (d) the urban interests, both consumers and employers ( $U$ ). The policy instruments are all the policies that have been implemented, attempted, or advocated during

that period: (a) modernizing land reform where threats of expropriation are used if minimum productivity levels are not reached after a predetermined time lapse and where guarantees of nonexpropriation are given if modernization occurs; (b) modernizing land reform with expropriation if productivity is below that attained on family farms and where compensation is paid at the current land price if expropriation occurs; (c) public goods support to modernization (principally subsidies for the adoption of Green Revolution technology); (d) redistributive land reform whereby large farms are carved into family farms; and (e) rural development to increase the productivity of family farms.

### ***Modernization under Threat of Expropriation with Guarantees, 1936–57***

The first decades of this century saw rising pressures on agriculture to improve its economic performance. Industry was emerging under import substitution policies and public works programs swelled employment. Both sets of policies increased the urban demands on agriculture for staple foods. Serious crises of food availability, leading to recurrent emergency food imports, made increasingly evident the bottleneck that an archaic hacienda system imposed on the economy. Pressures for social change also arose from within the agricultural sector. The sharecroppers and tenants of the haciendas, often bound by extraeconomic coercion and personal service obligations, were pressing for their transformation into pure tenants or free workers.

It is in this context that Colombia passed its first land reform law in 1936 (Law 200). The objective was economic: to use the threat of expropriation of lands that were abandoned or insufficiently productive to induce landlords to modernize their farming practices. However, the heavy influence of the landlords on the state allowed them to set the policy agenda that agriculture was to respond to for the pressures of modernization. This allowed them to make the guarantees of nonexpropriation-if-modernization credible and to set relatively low minimum productivity standards (a requirement that productive use be made of no less than half of the farm area and a fifteen-year grace period to reach these standards before expropriation could be considered). A politically feasible response was thus possible to the multiplicity of demands for agrarian change if the landlords would satisfy the modernizing demands of both the *F* and *U* sectors.

While there were very few expropriations and minimal land redistribution, the threats of expropriation were highly effective in increasing agricultural productivity. Yet these achievements proved to be insufficient to end the land reform at that stage. The modernization of agriculture could not accommodate the rapidly rising urban demands on agriculture created

by post-World War II prosperity and industrial growth. This led to growing conflicts between landlords and the urban bourgeoisie that have been identified as an important cause of the (yet poorly explained) breakout of the "Violencia" period, a ten-year civil war between Liberals and Conservatives that left some 200,000 dead, principally in the countryside (Moncayo 1986).

The social impact of this process of modernization under threat was disastrous. Agricultural modernization transformed traditional social relations in the hacienda and led to widespread eviction of tenants. The regressive effects of the reform contributed to rootlessness and the social tensions of the Violencia. The civil war itself reinforced the process of social modernization initiated by the land reform: many old-style tenants fled to the cities, a new class of entrepreneurs appropriated abandoned lands, and the decline in land rents allowed entry of a group of large farm tenants. The civil war ended in 1957 with the National Front agreement between Conservatives and Liberals to share power during a period of sixteen years, with alternation of government control every four years.

The dynamic carryovers from this first phase of reformism into the next phase of reforms to be initiated by the National Front were (a) the emergence of a new *Ll* class of modern, large-scale entrepreneurs, replacing the old agrarian oligarchy, with considerable ability to exercise economic and political influence over the state and to use this influence to pursue modernization; and (b) increasing social inequities that in the aftermath of the civil war reinforced the weight of the *L+SF* in policymaking. To this was to be added, exogenously, international pressures for redistributive land reform as a response of the Alliance for Progress to the shock of the Cuban Revolution in 1959.

### ***Modernization under Threat of Expropriation with Compensation, 1958-73***

Under the National Front, the demands of the different social actors had changed relative to the previous period of reformism. The *L+SF* were pressing for land redistribution. The *Ll* were demanding the protection of private property and full compensation in case of expropriation. And the *U* were requesting both a more rapid modernization of agriculture and the reduction of conflicts in the rural areas. A harmonious response to this variety of demands was not possible because the demands of the *L+SF* were incompatible with the *Ll*'s demands. A political solution was, however, possible through a coalition between *Ll* and *U* to assist the *Ll* in sufficiently modernizing to escape expropriation by making compensation no longer possible. The coalition had to exclude the *L+SF* and *F*, thus reproducing the social problem in the next phase.

The initial policy response to rising social tensions was the enactment of a

Table 16-1. *The Effects of Technological Change on Rice Production*  
(percent)

	<i>Upland sector</i>	<i>Irrigated sector</i>
<i>Average annual growth in yields</i>		
1954-56 to 1965-67	1.8	1.5
1965-67 to 1973-75	1.8	6.7
<i>Distribution of rice production</i>		
1959	43	57
1970	26	74
1975	9	91
<i>Change in the number of farms with rice as a principal crop, 1959-70</i>		
Farms of 0-5 hectares	-55	-40
Farms of 5-50 hectares	-59	-23
Farms of more than 50 hectares	-52	19

Source: Scobie and Posada (1977).

redistributive land reform (Law 135 of 1961) aimed at creating a family farm sector and thus at capturing both the equity and efficiency gains that redistribution promised. The redistributive line won politically during the Liberals' turn in power (under Presidents Camargo and Lleras Restrepo), but implementation of the law was dominated by the *LI-U* alliance. It undermined Law 135 by rent-seeking that resulted in government benefits being channeled disproportionately to large farmers, making expropriation with compensation impossible.

Modernization of large-scale farming was to a large extent achieved through institutional distortions in the delivery of public goods and services to large farms. This is the period when local adaptation of the rice varieties responsible for the Green Revolution in Asia was completed and these varieties released. Their adoption required irrigation (mainly the privilege of large farms), access to credit (subsidized institutional credit is exclusively monopolized by large farms), and market organization (Federación Nacional de Arroceros, FEDEARROZ, a large farmers' professional organization). While the technology itself was neutral to scale, the institutional and policy environment where it was released was not. As a result, these new varieties spread very rapidly between 1966 and 1974, concentrating production in the irrigated large farm sector (from 57 percent of total production in 1959 to 91 percent in 1975), while small upland farms correspondingly lost ground (see table 16-1). A whole set of policies was also introduced to support modernization in the large farm sector while price controls were applied to the staple foods principally produced by peasants. As the data in table 16-2 show, the

Table 16-2. *Percentage of Land in Intensive and Extensive Use, by Farm Size, 1960-70*

Farm size (hectares)	Intensive use						Extensive use (pastures, fallows, and others)		
	Temporary crops			Permanent crops			1960	1970	Percentage change
	1960	1970	Percentage change	1960	1970	Percentage change			
0-5	35.9	29.1	-18.9	23.9	29.5	23.4	40.2	41.4	3.0
5-50	16.0	13.5	-15.6	14.9	18.5	24.2	69.1	68	-1.6
50 or more	3.1	4.2	35.5	2.0	3.9	95.0	92.7	91.9	-0.9
All farms	7.1	6.8	-4.2	5.5	7.6	38.2	87.4	87.7	0.3

Source: Agricultural censuses, 1960 and 1970.

share of land in intensive use increased by 59 percent in the large farms (above fifty hectares) while it was stagnant in the small farms. With yields and per acre incomes higher in large than in small farms, land values made expropriation with compensation impossible thanks to the distorted institutional framework that allowed large farms to externalize part of the costs of modernization. The *LI-U* alliance was thus able to pervert the legislative victory of the redistributive line. Instead, the *LI-U* policies induced an unprecedented boom in the production of commercial and export crops (Kalmanovitz 1978).

Census data show the extent to which the redistributive intent of the law was frustrated. Land concentration actually increased between the agricultural censuses of 1960 and 1971—the share of land in farms smaller than fifty hectares fell by 8 percent while that in farms larger than fifty hectares increased by 3 percent. Rapid expropriation of sharecroppers and tenants continued—the number of farms in fixed and share rents declined by 41 percent. The few lands expropriated were generally of inferior quality and in marginal locations. In the first year only 2,340 families received land, instead of the projected 10,000. By the end of the phase of redistributive land reform in 1972, Instituto Colombiano de Reforma Agraria (INCORA), the land reform agency, had granted 123,000 titles out of the 935,000 families that had been declared eligible in 1970 alone. Only 1.5 percent of the land in large farms had been redistributed. The social tensions created by exclusion of the *L+SF+F* interests pushed them into open opposition to the government. This was in a sense the logical consequence of a system of power sharing between the two dominant parties that left no room for the expression of dissent except by insurgency. The peasant union created by government in 1967 to mobilize support for the land reform process, Asociación Nacional de Usuarios Campesinos (ANUC), thus openly turned into opposition, and insecurity in the rural areas escalated.

The dynamic carry overs from this second phase of reformism were consequently (a) heavy investment in large farms, many of which have the characteristic of sunk costs, thus sealing the continuation of an *L-U* alliance to protect the gains of agricultural modernization in large farms, and (b) frustrated expectations for the *L*, *SF*, and *F* households, leading to growing intensity of rural conflicts. At the same time, international influences were moving away from the redistributive philosophy of the Alliance for Progress toward use of the instrument of rural development to modernize family farming.

### ***Rural Development and Counterinsurgency, 1973 to the Present***

In this third period of reformism which opened in the last years of the National Front, the demands of the *L + SF* continued to be for redistributive land reform. The *F* were pressing for modernization specifically targeted at their type of farming, and their demands were supported by the international movement toward integrated rural development championed by the World Bank and the U.S. Agency for International Development. The *Ll* wanted to protect not only private property, as in all previous periods, but also the large investments made with public support to adopt the technologies of the Green Revolution. Finally, the *U* wanted not only to consolidate the productivity gains achieved in agriculture by modernization of the large farms, but also to modernize staple food production in the family farm sector. The reason for focusing on family farming to promote food production was the fact that price interventions on food products made their production generally unattractive to large farmers (Reinhardt 1988). There consequently existed the basis for a broad coalition that sought rural development, which included not only the *Ll* and *U*, as in period 2, but also the *F*. The *F* saw in rural development a source of welfare gains, while the *Ll* saw the possibility of reducing rural conflicts and pressure on the land, and the *U* saw both social stability and continued productivity gains in agriculture. The heavy influence of this coalition, together with the resources made available by international support, overwhelmed the political agenda and marginalized again the *L + SF* into insurgent opposition.

Policy response thus consisted of a new social accord between Liberals and Conservatives. The 1972 Chicoral Pact declared the end of redistributive land reform and thereby eliminated the threat of land invasions that it fomented (no less than 2,000 land invasions were recorded in 1972). Under Law 4 of 1973, expropriations were confined to abandoned and unproductive lands, just as they were under Law 200 of 1936. An ambitious program of integrated rural development (RD) was introduced in the 1975-78 development plan "To Close the Gap," at the same time as new laws (Law 5 of 1973,

in particular) were introduced to further support the modernization of commercial and export-oriented large farm agriculture. Rural development programs were organized by the Colombian Agricultural Institute (ICA) and the National Planning Ministry, giving priority to the areas of peasant concentration and guerrilla activity. From the outset, but gradually more so as the marginalization of *L + SF* and the radicalization of the ANUC increased guerrilla warfare, rural development was closely integrated with counterinsurgency initiatives (Bejarano 1985).

The achievements of sixteen years of integrated rural development are not insignificant. The approach allowed the reduction of some of the historical, institutional, and public goods biases against peasant agriculture. Research on peasant farming systems was promoted, credit was made available to the chosen family farms, and in some cases incomes of family farmers increased. Yet these gains applied only to a small fringe of family farms, the few with enough land and enough proximity to markets to effectively use the support provided by the state to modernize agricultural production (Valencia González 1982). For the majority of the rural poor—both *L* and *SF* who derive the bulk of their household income from off-farm activities because of lack of land—not only did a production-oriented program not have much to offer, but increased competition by modernized *F* farms eventually enhanced displacement. Evaluation of the first eight years of the *RD* program thus led to a redefinition of its target clientele from “peasants” in general to “viable peasant” producers, explicitly confirming marginalization from the program of the *L* and *SF* and refusal to address their problem of access to land.

By 1984 more than five decades of agrarian reformism had failed to change the concentration of landownership. The Gini coefficient of farm distribution by size, which was 83 percent in 1960, was still 82 percent in 1984. The annual rates of growth in the number of farms and the distribution of land by farm size between 1960 and 1984 are given in table 16-3. The *L1* (20 to 200 hectares) were the clear beneficiaries of this process, while the *L + SF* (0 to 5 hectares) were in the same situation as in 1960. While a buffer class of modernized family farms (5 to 20 hectares) had been consolidated, the social consequences of ending redistributive land reform and of fomenting rural development were disastrous. The 1980s witnessed a rapid growth of armed movements, primarily with a rural base and sometimes associated with indigenous organizations. Reported armed assaults increased from 958 in 1972, to 1,895 in 1980, and to 3,682 in 1984 (Bejarano 1985). Many of these conflicts occurred in areas of frontier colonization to which peasant households were pushed. Peasants had lost access to land and to employment opportunities in areas of traditional settlement due to a combination of labor-saving technological change and the spread of extensive livestock operations associated with the modernization of large farms.

The social failure of agricultural reforms contributed, in turn, to the



Table 16-3. Number of Farms, Distribution, Average Size, and Area Covered, 1960, 1970, and 1984

Year	Total farms	Distribution (percentage of total farms)				Average farm size (hectares)	Area covered (percentage of total farm area)			
		Farms of 0-5 hectares	Farms of 5-20 hectares	Farms of 20-50 hectares	Farms of 50-200 hectares		Farms of 0-5 hectares	Farms of 5-20 hectares	Farms of 20-50 hectares	Farms of 50-200 hectares
1960	765,300	60.1	24.7	13.4	1.8	15.9	4.8	11.5	36.0	47.6
1970	738,900	57.1	24.9	15.8	2.1	17.4	4.0	10.3	37.4	48.4
1984	978,600	56.6	25.2	16.5	1.7	22.2	4.2	11.2	43.1	41.6

Source: Lorente, Salazar, and Gallo (1985).

undermining of agricultural modernization in the large farm sector. After 1982 the growth rate of agriculture slowed down markedly. While the average annual growth rate of agriculture was 3.7 percent between 1970 and 1982, it fell to 1.4 percent between 1982 and 1986. There are, of course, a number of other reasons that explain this poor performance of agriculture: an appreciated real exchange rate associated with the coffee boom and the influx of foreign exchange from drugs, reduction of public expenditures in agriculture, and sharply rising real interest rates have all reduced the relative profitability of agriculture and induced a displacement of capital from agriculture to the financial and nontradables sectors. Yet widespread violence also bears negatively on agricultural investment. Many lands are again being abandoned, and the productivity of large farms is declining. It is this social climate of violence, associated with the political marginalization of the  $L+SF$ , that is the intertemporal carryover into the future definition of agrarian reforms.

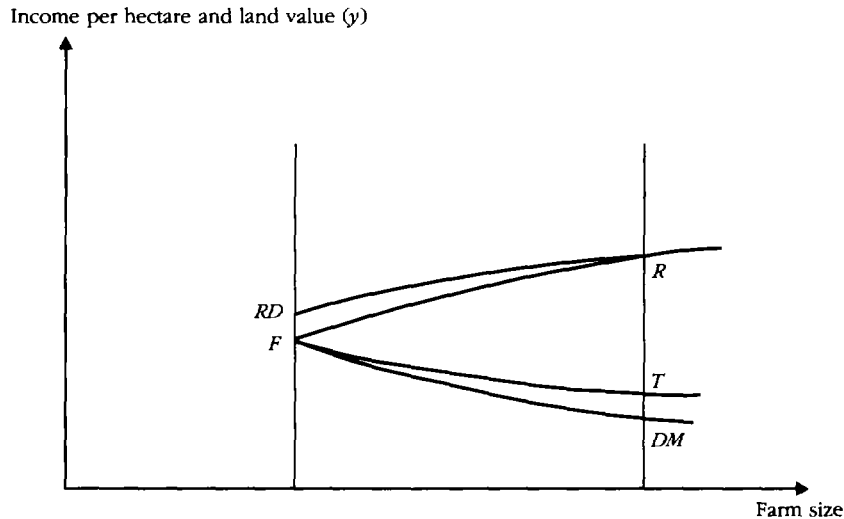
### The Political Economy of Path-Dependent Reformism

This historical sequence of reforms can be conceptualized in figures 16-1, 16-2, and 16-3 with the aid of three indicators: (a)  $TSFP$ , which gives the social criterion in assessing reforms; (b) income per hectare and land value ( $y$ ), which indicate the possibility of compensation at market prices; and (c) yield or total factor productivity at farm prices ( $TFP$ ), which is the observable criterion for political debate and for the setting of modernization thresholds.

The inverse relation between  $TSFP$  and farm size (represented by curve  $FT$  in figure 16-1) before the Green Revolution in Colombia was due to the widespread existence of two market imperfections: moral hazard in the use of hired labor, and lack of a rental market or constraints in access to credit for land rental (Eswaran and Kotwal 1986). This inverse relation underlies the expectation that both efficiency and equity gains could be achieved by a redistributive land reform.

In addition to these two market imperfections, there exists a third prevalent distortion resulting from the highly unequal credit and public goods across farm sizes. In Colombia, as a result of successful rent-seeking, institutional credit is typically monopolized by large farmers, and public goods are heavily biased in their favor. Once technological change sharply increased the capital-labor ratio in agriculture, the capital market advantage of large farms eventually helped them achieve higher yields and higher per acre incomes than small farmers (curve  $FR$  in figure 16-1). If expropriated landlords must be compensated at the pre-reform level of income per acre (that is, at the level  $R$  of land values in large farms with privileged access to credit and public goods), Pareto-optimal reform is no longer possible. Either

Figure 16-1. *Phases of Agrarian Reformism in Colombia: Feasibility of Compensation*



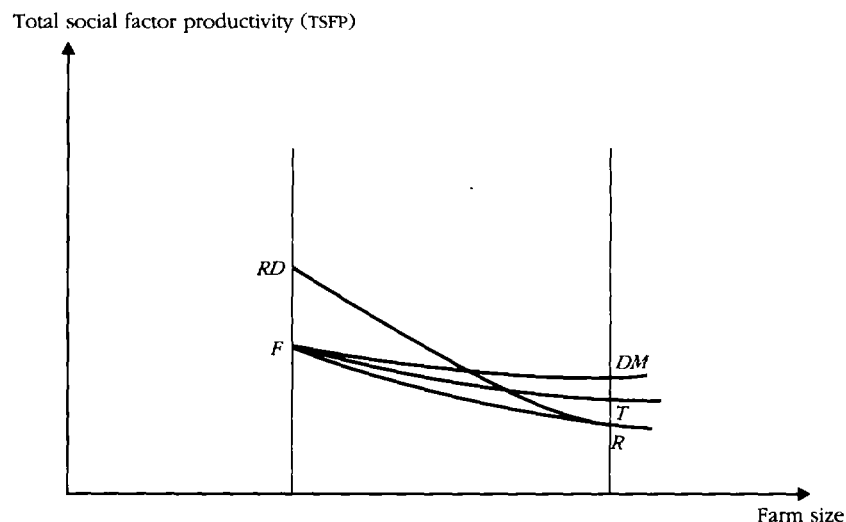
Note: *T* = traditional large farm; *DM* = defensive modernization; *R* = rent seeking; *F* = traditional family farm; *RD* = family farm with rural development.

the landlord has to lose or a grant from a third party has to be transferred to the beneficiary to make compensation feasible (Adelman and Morris 1974; Binswanger and Elgin 1989).

As the Colombian experience has shown, a state with urgent needs to increase agricultural production and under heavy influence of the agrarian oligarchy will be pressed to first induce modernization in the large farm sector before seeking expropriation. An effective instrument for that purpose is the threat of expropriation by land reform to coerce landlords into modernizing above some established productivity threshold. This is what we called "modernizing land reform" as opposed to redistributive land reform. The efficiency gains of a modernizing land reform are thus sought in the nonreform sector, while the creation of a reform sector serves as a threat (de Janvry 1981). If the landlord modernization thus induced is insufficient to exceed  $\tau_{SFP}$  on small farms (as was the case in Colombia and as illustrated in figure 16-2), land reform remains justified on an efficiency basis. Other defensive strategies must then be used by landlords.

The political power that the landlord class achieves from enhanced economic power derived from modernization under threat can be applied to two strategies for blocking a potential subsequent redistributive land reform, depending on whether expropriation is announced without or with compen-

Figure 16-2. *Phases of Agrarian Reformism in Colombia: Social Criterion*

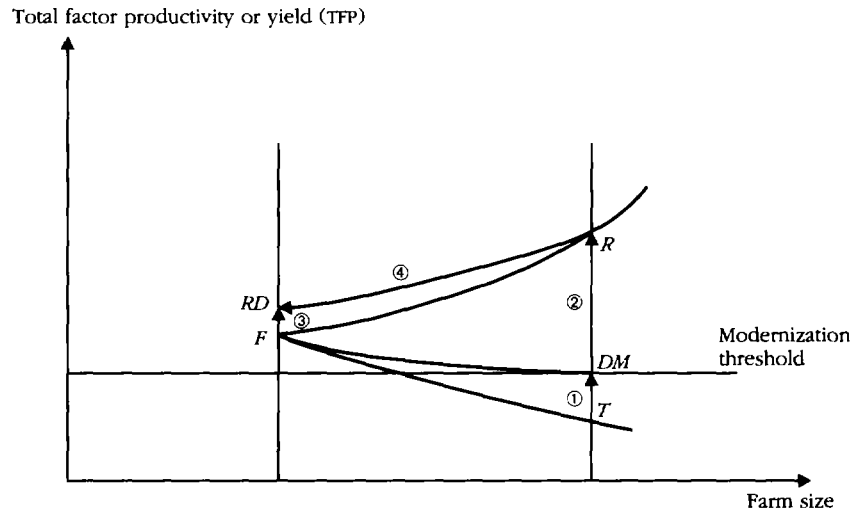


Note: *T* = traditional large farm; *DM* = defensive modernization; *R* = rent seeking; *F* = traditional family farm; *RD* = family farm with rural development.

sation. If expropriation occurs without compensation, the only possibility to avoid expropriation is to gain sufficient control over the state to obtain credible guarantees of nonexpropriation if an observable minimum productivity ( $\tau_{FP}$ ) standard has been achieved (*DM* in figure 16-3). In this latter case, the cost of avoiding expropriation is a loss in income per acre relative to *T*, since *T* was an economic optimum (see figure 16-1), while  $\tau_{FP}$  increases to the established threshold level. While compensation of expropriated landlords would remain feasible because income per hectare at *DM* is lower than at *F*, expropriation of these modernized elites is no longer politically feasible. This was the outcome of phase 1 of Colombian agrarian reformism (figure 16-3).

If expropriation is done with compensation at the pre-expropriation level of income per acre (which sets the price of land), the defensive strategy that landlords can follow is to use their power over the state, reinforced by the outcome of phase 1, to effectively rent seek through collective action and to socialize part of the cost of raising  $\tau_{FP}$  and land prices in large farms above the levels achieved in family farming. In figure 16-1, this is represented by strategy *R*. As observed in many areas where capital-intensive modernization has occurred, there is today a positive relation between yields and farm size. Since the cost of modernization has been achieved by a bias in the

Figure 16-3. *Phases of Agrarian Reformism in Colombia: Historical Sequence*



Note: *T* = traditional large farm; *DM* = defensive modernization; *R* = rent seeking; *F* = traditional family farm; *RD* = family farm with rural development; ① = modernizing land reform with guarantees; ② = modernizing land reform with compensation; ③ = rural development; ④ = potential redistributive land reform.

definition and social allocation of public goods—roads, irrigation, technology, and subsidized credit—toward large farms, private modernization has been achieved at the cost of social efficiency.  $\tau$ SFP on large farms is, consequently, at its lowest level (figure 16-2). While compensation is made impossible by the level of land prices in large farms, redistribution toward family farms remains socially more desirable than ever. Yet redistributive land reform has again been effectively held in check. This was the outcome of phase 2 of Colombian agrarian history, as shown in figure 16-3.

With the end of land reform and the perpetuation of the social problems created by rural poverty, rural development has been used as an alternative instrument to raise the productivity and income levels of peasants (*RD* in figure 16-1). While the strategy leaves behind many subfamily farmers and landless workers for whom the approach has no benefits, it can raise TFP and incomes on family farms. Since rent-seeking by large farmers continues to succeed, the positive relation between  $\tau$ FP and farm size is likely to remain in spite of the labor cost advantage of family farms. The same is true for land values, still holding in check the possibility of land reform with compensation. Yet it is well established that family farms have been operating under strong institutional biases in the definition and access to publicly provided

goods. Modernization under rural development is thus quite distinct from modernization by rent-seeking. If rural development removes some of the effective constraints on and institutional biases against peasants, TSFP is increased to RD on family farms in figure 16-3. This was the outcome of phase 3 of Colombian agrarian history. While still economically impossible with compensation, land reform becomes all the more socially desirable. It is in that sense that rural development should have been used as a complement to redistributive land reform, occurring after redistribution had occurred, and not as a substitute for the failure of redistributive land reform. This is, however, the unwritten phase 4 of potential agrarian reformism in Colombia.

### The Future of Agricultural Policy Reforms in Colombia

Today the demands of  $L+SF$  continue to be for redistributive land reform, while the alliance ( $L+I+F+U$ ) seeks preservation of the status quo. Yet this status quo is increasingly difficult to maintain. While possible solutions to this conflict include stepped-up counterinsurgency and an urban-industrial solution to rural poverty, they are unlikely to succeed. Redistributive land reform consequently remains the potentially most effective approach.

What has been learned from the fifty-three years of agrarian reformism analyzed in this chapter is that economically successful and politically feasible redistributive land reform will require the following two prerequisite measures.

First, the elimination of distortions created by rent-seeking that result in extensive public subsidies to the large farms and that raise land values in these farms above the levels that permit compensation by family farmers. Removing these subsidies may be easier in a period of fiscal crisis that imposes overall fiscal austerity. A good place to start a stabilization program is thus with the elimination of subsidies to the large farm sector. In addition, a land tax based on land values is necessary to erase residual benefits to large farms. A tax reform is consequently an essential preliminary to land reform with compensation. Its political feasibility can also be enhanced by conditionality lending in the context of stabilization.

Second, renewed support to rural development, in spite of the many failures that were denounced worldwide, to restore the productivity advantage that small farms can derive from their low labor costs, even in post-Green Revolution agriculture. Competitive access to credit, technology, information, and markets is essential for that purpose. Rural development thus remains more important than ever as a complement to redistributive land reform. Here again, depreciation of the real exchange rate associated with the necessary adjustments to the debt crisis, and the resulting possi-

bility of import substitution in the production of staple foods, would create the economic context to make rural development and redistributive land reform an attractive strategy of economic development.

Path-dependent agricultural policy reforms have led Colombian agriculture into a course that is neither economically efficient nor socially tenable. The large farms derive their yield advantages from socially costly government subsidies; the family farms remain few in number and under-provisioned in infrastructure and services; and the potential gains from the combination of rural development and redistributive land reform with compensation have been blocked. Social tensions require the growing use of force, and extensive rural poverty is perpetuated. Since this path of reforms was endogenous to the Colombian political economy, it cannot be attributed to policy mistakes given the information that was available to the different actors of the policymaking process. Yet it is certain that the design of agrarian reformism has not been based on a clear understanding of the nature of the transactions costs that characterize different types of farming organizations, of the politics of influence in the making of agricultural policy, and of path dependency in policy reforms. One can only hope that development of such new understanding will allow to better account, in the future making of policy, for not only the direct economic effects of policy choices but also for their indirect effects through the changes they may induce in future government policies.

## Note

The authors are indebted to Clive Bell for his useful suggestions.

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*Part III*

***Agricultural Taxation and  
Income Redistribution***

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*Consequences of Limited Risk Markets  
and Imperfect Information  
for the Design of Taxes and Transfers:  
An Overview*

*Karla Hoff and Joseph E. Stiglitz*

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PART III, LIKE THE BOOK AS A WHOLE, has two central theses. First, sound policies for the rural sector of developing countries must be based on an understanding of rural organization; and second, rural organization can be interpreted as partly the consequence of limitations on information and imperfections in risk markets. Part I developed theories of rural credit markets, theories that help inform us concerning the consequences of various government interventions in that area. Part II examined land rights systems and the consequences of government policies—such as titling and land reforms—for the land, credit, and labor markets.

We observed that institutions respond to the economic environment. Customary law regarding land transfers changes when cash crops become available. New tenancy institutions develop after a land reform. In general, what happens in one market can give rise to institutional changes in other markets, and these interactions across markets go well beyond the price and income interactions captured in Walrasian general equilibrium models.

This part of the book is about taxation, transfers, and government pricing policies in developing countries. In almost all countries governments intervene in the markets for agricultural goods. The intervention may take the form of producer taxes, subsidies to urban consumers, or trade taxes or

quotas. The effects on prices are more hidden when government exercises a monopoly on marketing rights over a product. In such cases government marketing boards buy the farmers' output and sell it either to the urban sector or for export. The wedge between the buying and selling prices is equivalent to a tax or subsidy, but it may not be visible.

There are many rationales for government interventions in markets. Most obviously, the rural sector is the largest sector of most developing countries, and so it is a natural source of tax revenue.

The rationale for government marketing boards in many countries has been to eliminate the monopoly power of middlemen (who frequently were of different ethnic backgrounds than the producers). But inefficiency and corruption within government marketing boards has sometimes resulted in wedges between producer and consumer prices that are at least as high as those of the displaced middlemen.

Other kinds of market failure that provide a justification for government interventions are the absence of risk markets and imperfections in credit markets. In addition, concern about the distribution of income generated by the free market provides a justification for redistribution programs through, for example, food subsidies in the urban sector, public works projects, or regional targeting of public investment.

But in many of the official explanations for government interventions, there is more rhetoric than rationality. As Newbery comments in chapter 21, government programs ostensibly designed to alleviate the consequences of imperfect risk markets are often far different from those that would be designed if that were really their main objective. Many programs justified as measures to reduce income inequality would also be designed differently, if that were really their objective. On standard egalitarian criteria, it makes little sense to take money from poor farmers to give it to less poor urban dwellers, or to subsidize grains consumed disproportionately by relatively high-income urban dwellers. A surprising finding reported in chapter 22 is that the ad hoc policies of price stabilization implemented by Brazil in the 1970s had little effect in reducing the instability of consumer prices that would have occurred in a free market.

Still, the fact remains that there is a potential role for government in correcting market failures. When markets are incomplete and information is imperfect, there is no presumption that market allocations will be constrained Pareto-efficient, that is, Pareto-efficient relative to the set of allocations that can be achieved through the existing market structure. Thus there is a potential role for corrective taxation. Some governments, moreover, do exhibit a genuine dissatisfaction with the distribution of income yielded by the market process and a corresponding concern for redistributing income. An understanding of the theory of rural organization, and the theories of imperfect information and imperfect markets on which it rests, can help governments attain their objectives.

## Some Principles of Optimal Tax Design

Constraints on government policy have been a very active research area over the past decade. Here, we do not wish to dwell on the political economy constraints—the complex of forces that lead governments to undertake policies that, in the name of redistributing income from the rich to the poor or of increasing economic efficiency, do just the opposite. Rather, we wish to focus on another set of limitations: those that arise out of the limited powers and limited information of government.

Since Ramsey's 1927 classic paper, public finance economists have been concerned with the optimal design of tax systems when the government cannot impose individualized lump sum taxes.<sup>1</sup> Two basic lessons emerged from the earlier literature: (a) the design of the tax system is highly dependent on the set of instruments that the government has at its disposal; (b) the set of instruments at its disposal should be viewed endogenously. Let us illustrate each proposition. First, if government can use income taxes to redistribute income—as it can and does in most developed countries—then there will be much less need to rely on excise taxes to redistribute income. In some cases, there will be absolutely no need for redistributive excise taxes, as Atkinson and Stiglitz (1976) showed. Second, what instruments the government has at its disposal depends, among other things, on the country's history of taxation, its infrastructure, its dependence on world trade, its level of commercialization, its literacy rate, and the availability of a skilled work force to draw on to administer taxes. Expanding the set of instruments in use is often feasible at some administrative cost, as described by Besley in chapter 20.

More recently, attention has focused on a third principle of tax design that perhaps should have been obvious, but has seemingly been missed in much of the earlier literature: *The design of tax structures should be sensitive to many more elements in the economic environment than are summarized by income levels and elasticities of demand and supply.* Earlier work on optimal tax theory focused on economic environments in which there was full employment and no market distortions. The sole concern of tax policy was to raise revenue and redistribute income in such a way as to minimize the distortions caused by the tax subsidy system. It was not designed to correct preexisting distortions. Corlett and Hague's 1953 paper showed that one could interpret the optimal tax system as one that was designed to offset the distortions induced on the supply of labor. Income taxes lead to too small a supply of labor; and commodity taxes, by taxing complements of leisure and subsidizing substitutes, could reduce this distortion.<sup>2</sup> But surely the central problem in developing countries with high unemployment rates is not that taxes will reduce the supply of labor. To address the problems of developing countries, optimal tax models must be extended to take account of missing and imperfect markets, the nature of nonmarket institutions within the econ-

omy, and the large scope for inequities arising from the administration of the tax system.

It is here that the theory of rural organization in developing countries becomes particularly relevant. Earlier work (see Sah and Stiglitz 1992 and references therein) showed how optimal pricing policies depend on the nature of labor markets and urban-rural migration. The chapters in part III show how standard prescriptions with regard to agricultural tax policy change when account is taken of imperfections in risk and credit markets, the nature of land tenure, and the effect that tax and price policies may have on rural organization in the long run. Institutions cannot be treated simply as immutable.

### Consequences of Limited Risk Markets for Tax Policy

Limitations on risk markets provide a telling example of the importance of an understanding of rural organization for the design of tax policy. Just as economists have had a longstanding preference for lump sum taxes, land taxes have been a subject of veneration at least since Henry George. Land taxes are nondistortionary and, in some cases, may even raise all the revenue required to pay for public goods and services (Stiglitz 1977). Since land is generally held by richer individuals, such taxes were viewed as desirable on equity grounds as well. The failure of governments to institute land taxes was seen as evidence of perversity on the part of government—or at least evidence that government was in the control of landed elites.

But if there are imperfect risk markets, then land taxes have the disadvantage that the tax liabilities they impose do not vary with farmers' output; they are not "state-contingent." The tenants and the landlords must bear all the risk. There may be high costs associated with making the rural sector bear this risk—in terms of not only reduced welfare but, in some cases, reduced output as well. Taxes that are related to output represent a sharing and pooling of risks.

An analogy may be useful. Sharecropping contracts are often preferred to rental contracts because rental contracts are not state-contingent. In a rental contract, the payment from tenant to landlord does not depend at all on the level of output. If workers and landlords decide to use state-contingent contracts (sharecropping) in the agreements they arrive at voluntarily, shouldn't that be an indication that in the "contract" between the government and its citizens, a state-contingent contract might be desirable? In particular, the government is arguably in an even better position to absorb risk than are landlords, since it can spread and pool risk over the entire population.

Hoff formalizes this argument in chapter 18. She shows that a mix of

output taxes and land taxes is preferable to a pure land tax regime, thus reversing the longstanding presumption in favor of land taxes only. This is true whether the output tax is on production, marketed output, or exports, and whether farms are cultivated by owners, hired labor, or sharecroppers.

In addition to missing markets, tax policy needs to take into account non-market institutions. A distinctive institution in some peasant societies is a reciprocal credit system. Participants who have suffered misfortune obtain loans from those with a surplus above subsistence, with the timing and amount of the repayment dependent on the future income of the borrower and lender. Moreover, if the borrower later earns a surplus above subsistence, he is obligated to lend to other participants in the system who are in need. In effect, a participant pays a tax on his surplus in exchange for hunger insurance. That “tax” may be constrained Pareto-efficient—given the absence of alternative risk-sharing mechanisms—but nonetheless it has real consequences. Deadweight losses from taxes increase with the square of the tax, so that government-imposed taxes in that context may be particularly distortionary. By contrast, a policy that increases the wealth of the poor will tend to induce individuals to withdraw from the reciprocal credit system and will thereby remove the distortionary “tax” on their incomes (Hoff 1992).

### Commodity Price Stabilization

Concern about the absence of risk markets provides the explicit rationale for another set of government programs, commodity price stabilization schemes. Such schemes are considered in chapter 21 by Newbery and in chapter 22 by Braverman and others. Newbery suggests that a closer look at these schemes raises questions about the extent to which price stabilization is really their objective. In practice, such schemes often seem a way not so much to stabilize incomes as to transfer income across groups.

Governments rely on commodity taxes for a large part of their revenue. This raises the following question: How should government’s dual concern to stabilize prices and to reduce income inequality be reflected in the adjustment of the tax rates to fluctuations in commodity prices? Newbery explores the tradeoffs that some governments face between price stabilization and income distribution. Price stabilization would require a reduction in excise tax revenues in years of low prices. To make up the shortfall in revenues, which may last over several years in the case of tree crops such as cocoa, government would have to increase taxes on nontraded goods, and such a shift in the tax structure might be regressive.

Futures markets in the private sector might be developed and encouraged by public policy in order to provide farmers an alternative way to reduce their risks. Futures markets would presumably not be vulnerable to political

and fiscal pressures, as public price stabilization programs are. They would also have the great advantage that the individual can decide how much he wants to have his income stabilized—that is, how much of his crop he wants to sell forward. So long as there is uncertainty about the size of the farmer's crop, futures markets cannot eliminate all risk—they may not be able to do as good a job at stabilizing incomes as an appropriately designed commodity price stabilization program—but they can do a far better job than many, perhaps most, currently employed stabilization programs.<sup>3</sup>

But the absence of futures markets should not be taken as a happenstance. Even in the United States, only limited use of futures markets is made by farmers. The reason is that asymmetries of information among traders contribute to a high degree of imperfection of competition in futures markets. U.S. markets for grains, for instance, are dominated by five or fewer firms. Small farmers are much less informed than these large traders concerning future market conditions. They worry that the large traders will take advantage of their lack of information.

Thus one market failure—imperfect competition—gives rise to another—the limited scope of futures markets. Government policies aimed at alleviating the second market failure must take into account the forces that give rise to it.

### Consequences of Credit Rationing

The absence of a complete set of risk markets is the market imperfection whose consequences for tax policy are the main focus of this part. However, the general point that taking account of preexisting economic distortions can overturn standard results in tax policy can also be illustrated by an example involving credit markets and fertilizer subsidies. Economists have had a longstanding presumption against such subsidies, which seem to interfere with economic efficiency. The traditional argument is that only if there is some externality associated with the use of fertilizer would a subsidy be called for. In those terms, a tax is more likely to be desirable than a subsidy, since water runoff from fertilized fields can pollute water supplies in the long run. The efficiency arguments are strengthened by an equity argument: those farmers most likely to take advantage of the subsidy are rich farmers.

But these arguments may need to be qualified in the presence of credit rationing. Assume that small, relatively poor farmers can obtain only a limited amount of credit with which to buy fertilizer. The marginal value of fertilizer to them is much higher than to rich farmers. Lowering the price of fertilizer is of greater value to poor farmers than to rich. Though they buy less fertilizer, the credit constraint binds more tightly for poor farmers. The subsidy therefore might increase equity and reduce distortions in the use of



fertilizer. Finally, the net cost to government of the subsidy will be lower than the initial outlay if government recaptures a share of the increased output through its excise tax system.

### Limitations on Government's Information

The examples above showed how taking into account rural institutions changes the design of optimal tax and price policies. We now consider the implications of limitations on government's information and administrative capacity.

The most basic limit on government is that on its information. Skinner (chapter 19) analyzes the importance that this has for land taxation in a formal model of the costs of errors in administration. As mentioned in note 1, the reason that government does not impose lump sum taxes is that it lacks the information required to differentiate the taxes according to ability to pay, or according to any other "fair" criterion. A uniform lump sum tax would be viewed as unfair. Just as government lacks the information necessary to differentiate taxes on individuals, government also lacks the information necessary to fairly differentiate taxes on land. Land parcels are of different quality. In well-functioning markets, land prices would reflect those differences in quality, just as wage differences would reflect differences in individuals' abilities. But in developing countries, markets for land are notoriously imperfect. Markets are thin, with the result that government cannot rely on transaction prices to value land. And leaving land valuation to government officials—in the absence of strong checks provided by the market—is an invitation to corruption. In the United States in the nineteenth century, the property tax became greatly vilified because of the seeming capriciousness, or corruption, of assessors. These information limitations thus provide a second reason, beyond that provided by Hoff, for looking askance at heavy reliance on a land tax.

The limitation on government's information has strong implications for the design of transfers as well as taxes, which is the subject of chapter 20 by Besley. Government may seek to target its limited funds where the funds are most valuable, that is, to those persons whose real incomes are lowest. In the design of transfer systems, most economists have until recently argued that redistributions should take place through cash expenditures or tax policies, not through in-kind payments. The disadvantage of transfers in the form of goods or services (when resale is difficult or impossible) is that they distort consumption. Recently, economists have recognized that the efficiency cost of consumption distortions may be outweighed by the advantages of in-kind transfers in targeting the needy (Blackorby and Donaldson 1988; Besley and Coate 1992). If the poor are offered transfers of cash, everyone has an

interest in representing himself as poor. But if food-for-work programs are provided instead, only the intended beneficiaries may be interested in the transfers. In that case, the transfers have the property that they are *self-targeting*. Such transfers may eliminate the need for costly (and generally imperfect) certification of eligibility.

Another approach to transfer policy when information about individuals is very costly to obtain is to use an indirect indicator of poverty—such as region of residence, age, or ethnicity. This approach is called *statistical targeting*. Many developed countries have implemented statistical targeting for the aged, and many developing countries have implemented it on the basis of region. In chapter 23, Ravallion simulates the effect on poverty in Indonesia of substituting a set of regional-based transfers for Indonesia's current system of transfers from the federal to the provincial governments. He finds that such targeting would help reduce poverty more than Indonesia's current set of transfers, but its impact on total poverty would be small. Regional targeting would, however, greatly mitigate the adverse effects on poverty of macroeconomic contractions.

Limitations on information also provide part of the explanation for why it is so difficult for government to implement an effective commodity price stabilization program, as Newbery emphasizes in chapter 21. Government has a difficult time knowing which price shocks are permanent (have persistent effects) and which are not. When there is a permanent price shock, the government needs to adjust the price it pays farmers to reflect the new level of prices. The objective of stabilization programs is to buffer farmers against *temporary* price shocks. But only *after the fact* can it really be told whether a particular shock was permanent or temporary. The best that government can do is to use historical data on price movements to make statistical inferences about the long-run trend in prices, and base stabilization measures on those inferences. But there are strong political pressures to treat price declines as “temporary”—inducing the government to pay farmers higher prices—and to treat price increases as “permanent”—passing on the benefits of the higher prices to farmers. The combination of such political pressures with imperfect information may make price stabilization programs unsustainable.

## Notes

1. A government can, of course, impose uniform lump sum taxes. But the government does not have the information required to undertake redistributive lump sum taxes between the rich and the poor. To judge who should be taxed or who should receive subsidies, the government must look to observable variables, like income, and these are almost inevitably under the control of the individual. Basing taxes and transfers on such variables distorts behavior.

2. Atkinson and Stiglitz (1972) showed that their interpretation could be extended beyond the three-commodity example that they had investigated.

3. What farmers are concerned with is, of course, the variability of their income, not the variability of prices per se. Where price and quantity move in opposite directions, stabilizing prices may actually increase the variability of income.

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*Land Taxes, Output Taxes,  
and Sharecropping:  
Was Henry George Right?*

*Karla Hoff*

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*Economists have generally argued that if a land tax is administratively feasible, then to increase efficiency it should be used to the exclusion of output taxes. This chapter shows that underlying this policy prescription is the assumption that institutions for pooling and spreading production risks are perfect. When the imperfections in those institutions are taken into account, some use of output taxes will be Pareto-superior to a pure land tax regime and may induce higher output as well. This counterintuitive (and counter to Henry George) result arises because the increased risk sharing from output taxes more than compensates for the diminution of incentives due to the output taxes. This result applies whether land is tilled by owners, wage-earners, or sharecroppers. In general, it applies even if the land tax is a variable levy indexed to regional output.*

ECONOMISTS HAVE LONG ARGUED that a tax on unimproved land is, on efficiency grounds, an ideal tax. In developing countries where land rents are an important source of rural income, a standard recommendation for increasing efficiency is thus to use a land tax to the exclusion of agricultural output taxes.<sup>1</sup>

This chapter will show that lying behind this policy prescription is an assumption that landowners have sufficient access to market or nonmarket institutions for the exchange of risks that they maximize their expected profits from production, independent of risk aversion. For most developing

countries this is an extraordinary assumption. Rural financial markets generally provide only limited spreading and pooling of production risks (see, for example, chapters 5 and 8). Many studies attest to the role of nonmarket institutions—marriage, remittances, patron-client relationships, and tenancy—in spreading and reducing risk; but despite such arrangements, farmers' production decisions reflect risk aversion (see Rosenzweig 1988 and citations therein).

The main result of this chapter (proposition 1 below) is that some use of output taxes will be Pareto-superior to a pure land tax regime if institutions for sharing production risks are imperfect.<sup>2</sup> The result here is an application of the theory of the second best: that is, if some of the marginal conditions required for efficiency cannot be met in an economy, then the other marginal conditions may no longer be desirable.<sup>3</sup> Unlike the model economy in which the classical economists analyzed the effect of land and output taxes, a developing country is hobbled by a limited set of institutions for risk sharing. An output tax alleviates the consumption and production distortions that arise in the absence of a perfect insurance market. For that reason introduction of a small output tax will increase welfare. Henry George was wrong!<sup>4</sup>

A second result of this chapter (proposition 2 below) is that there exist reasonable conditions under which an increase in output taxes, compensated by a decrease in land taxes that keeps the farmer's welfare unchanged, increases his labor supply. Under these conditions, the farmer's supply response to the decrease in risk will more than offset his supply response to the decrease in expected return.

In an economy with imperfect insurance markets, an output tax provides a financial intermediation service. But why doesn't the market provide such services? And what advantage does government have that enables it to provide insurance—via output taxation—that other institutions cannot? Four responses can be offered.

First, the random factors generating income risk are likely to be correlated across farmers in a given region, so that rural financial markets that operate over small geographical areas can provide only limited risk reduction. But if the cost of monitoring and enforcement rises sufficiently steeply with distance, financial markets that operate over large regions will not be profitable. Empirical evidence from Africa and Asia suggests a high degree of geographical segmentation in rural financial markets, even when government intervenes directly in those markets (see chapters 5, 6, and 8).

Second, adverse selection impedes private insurance. If private crop insurance were offered, landowners that had low quality land, with land quality being unknown to insurance agents, would buy the insurance in disproportionate numbers, drive up premiums, and make the insurance unattractive

to the average farmer (Rothschild and Stiglitz 1976). A tax policy that affects all farmers avoids the selection problem.

Third, a low output tax plays less havoc with incentives than does a general crop insurance program. Because it is so difficult to monitor farmers' care of their crops and because of very high administrative costs, general crop insurance has not been successful (Hazell, Pomareda, and Valdés 1986, epilogue). An anecdote regarding an Indian cotton insurance program, cited in Newbery (1989, p. 288) illustrates one of the incentive problems:

It was further alleged by villagers that some of the participants [in the crop insurance program] had avoided interculturing, weeding, application of the last dose of fertilizers, etc., when they realized that they would not obtain the expected [and insured for] yield.

Fourth, government is usually in a better position than private insurers to insure collective risks, such as drought, that directly affect a large proportion of the rural sector. Through tax and debt policy and privileged access to international capital markets, the scope of borrowing and lending that governments can undertake across time periods is, in principle, much greater than that available to a private insurer.

This chapter begins with a proof of propositions 1 and 2 for the case of owner-operated farms. Then the chapter extends proposition 1 to cover a land tax indexed to the value of a region's aggregate harvest: it demonstrates that the Pareto-efficient mix of an output tax and an *indexed* land tax will include an output tax, provided that farmers' output risks are not perfectly correlated. Finally the chapter extends proposition 1 to farms under sharecropping. Here taxes will affect contractual relations between landlords and sharecroppers, but the Pareto efficiency of a mix of low output taxes with the land tax remains robust.

## A Model of Owner-Operated Farms

Consider a family farm with acreage  $T$ . Its output depends on  $T$ ; the number of family workers,  $L$ ; the level of effort,  $e$ , supplied by each worker; and the realization of a random variable,  $\epsilon$ , that reflects weather, pests, and other shocks. Define units so that the expected value of the random variable,  $E\epsilon$ , is 1. The production function of the agricultural good is

$$Q = \epsilon F(eL, T)$$

Assuming constant returns to scale, output per unit of land, denoted by the function  $f(\cdot)$ , will depend only on the labor-land ratio:

$$(18-1) \quad Q/T = \epsilon F(eL/T, 1) \equiv \epsilon f(eL/T)$$

with  $f' > 0$ ,  $f'' < 0$ ,  $f(0) = 0$ .

The family seeks maximize its joint expected utility,  $U$ . Define units so that  $L$ , the number of family workers, is unity; and let output be the numeraire. Output is taxed at rate  $\tau$  and land is taxed at the per acre rate  $\Gamma$ . Thus family income after taxes is

$$y = T\{\epsilon f(e/T) [1 - \tau] - \Gamma\}.$$

Assume, for simplicity, that the disutility of labor effort,  $v(e)$ , is independent of income. The family thus chooses its labor effort to solve

$$\text{Max}_e U = Eu(y) - v(e) \quad (u' > 0, u'' < 0, v' > 0, v'' > 0)$$

with first-order condition for an interior solution

$$(18-2) \quad \partial U / \partial e = E(u'\epsilon) [1 - \tau] f' - v'(e) = 0$$

and second-order condition

$$(18-3) \quad \Delta \equiv E(u'\epsilon) [1 - \tau] f'' / T - E\{u''[(1 - \tau)\epsilon f']^2\} - v'' < 0.$$

This model of the family farm abstracts from the household's decisions other than its labor-leisure choice, and also from all avenues that the household might have to insure itself against output risk. Obviously households do engage in consumption smoothing through hoarding and through credit markets (Deaton 1990). My qualitative results will depend only on the assumption that the opening of a perfect insurance market would not be redundant, an assumption that I formalize below.

### ***The Pareto-Efficient Mix of Land and Output Taxes***

A simple way to test the Pareto efficiency of a tax regime is to ask whether there exists a set of tax changes that would increase the social value of government revenues and leave taxpayer expected utility unchanged at some initial level,  $U$ . Results of such a test would be unaffected and the notation simplified, if we treat the case of  $N$  farm households, each with land area  $T$  and identically distributed shocks  $\epsilon_i$ . In this case government revenues from the agricultural sector are

$$G = T \left[ \tau \sum_{i=1}^N \epsilon_i f\left(\frac{e}{T}\right) + N\Gamma \right].$$

Let the social value of government revenues be  $W(G)$ , with  $W' > 0$  and  $W'' \leq 0$ . The  $W(G)$  function is intended to capture the notion that ultimately individuals are the beneficiaries of government expenditures, and that those individuals are risk-averse.

If a pure land tax regime is Pareto-efficient, then the maximization of  $EW(G)$ ,

$$(18-4) \quad \text{Max}_{\tau} EW \left( T \left[ \tau \sum_{i=1}^N \epsilon_i f \left( \frac{e}{T} \right) + N \Gamma \right] \right)$$

subject to

$$(18-5) \quad U = \bar{U}$$

will have a solution at a point of no output taxes:  $\tau = 0$ .

Note that along the constraint equation 18-5 we have

$$dU = \frac{\partial U}{\partial \tau} d\tau + \frac{\partial U}{\partial \Gamma} d\Gamma + \frac{\partial U}{\partial e} de = 0.$$

The value of the term  $\partial U / \partial e$  is zero since each household is optimizing with respect to its effort choice (equation 18-2). Rearranging the above (and writing out the partial derivatives of utility with respect to the two tax rates) yields the expected-utility-neutral tax changes:

$$(18-6) \quad - \left[ \frac{d\Gamma}{f d\tau} \right]_0 = E(u' \epsilon_i) / Eu' < 1.$$

This means that to keep each household's welfare unchanged after raising the expected output tax burden by, say, one dollar, it suffices to reduce the land tax by less than one dollar. This is because an output tax, falling most heavily on the household when its income is greatest and least heavily when it is lowest, provides the household an insurance benefit. But is such insurance Pareto-efficient? It will be if such a change in the mix of output and land taxes increases the social value of government revenues,  $EW(G)$ .

Differentiating  $EW(G)$  in equation 18-4 with respect to  $\tau$  and using equation 18-6 to keep the farmer's welfare constant yields<sup>5</sup>

$$(18-7) \quad \left[ \frac{dEW}{d\tau} \right]_0 = N T f EW' \left[ \sum_{i=1}^N \epsilon_i / N - E(u' \epsilon_i) / Eu' \right] \\ + \tau f' \left[ \frac{de}{d\tau} \right]_0 E \left\{ W' \sum_{i=1}^N \epsilon_i \right\}$$

The right-hand side above is the sum of two terms. The first term is the effect of the transfer of risk. To see this, rearrange it as

$$(18-8) \quad N T f EW' \left[ \frac{E \left\{ W' \sum_{i=1}^N \epsilon_i / N \right\}}{EW'} - \frac{E(u' \epsilon_i)}{Eu'} \right]$$



The expression in brackets is the difference between the marginal social value of the pooled risk and the marginal private value of each household's risk. The difference would be zero if a perfect market for production risks existed or if the opening of such a market would be redundant (as when remittances among members of extended families provided perfect risk pooling and sharing).

But as long as the government's insurance opportunities exceed those of individuals and  $\tau < 1$ , I will argue that the condition

$$\frac{E\{W' \sum_{i=1}^N \epsilon_i / N\}}{EW'} \geq \frac{E(W' \epsilon_i)}{EW'} > \frac{E(u' \epsilon_i)}{Eu'}$$

will hold. Note that a single strict inequality in this condition will make the term in 18-8 strictly positive.

The first inequality above is strict if individual risks are less than perfectly correlated. In that case, output taxes enable the rural sector to pool risks not pooled in the market. Output taxation serves, in part, the need that would be met by a crop insurance program, while avoiding the information problems intrinsic to the operation of a private insurance market.

The second inequality above incorporates the presumption that government (a) has privileged access to international financial markets, (b) can spread rural risks to the urban sector by domestic spending policy, or (c) can spread risk across time through domestic debt and tax policy. The government resource constraint for the rural sector is not its revenues from the rural sector in any year, but an amount that reflects the tax capacity of both rural and urban sectors over the medium or long term. Thus, the benefit function  $W(G)$  should display significantly less risk aversion than the farmer's utility of income function,  $u(y)$ .

Finally, the role of government in financing public investment goods would also tend to ensure that the second inequality is strict. To see this, let  $K$  represent public investment. Most simply, suppose that farmer's welfare is

$$U(y, e, K) = Eu(y) - v(e) + \phi(K), \text{ with } \phi' > 0 \text{ and } \phi'' < 0$$

and assume that  $W(G)$  depends linearly on the  $\phi(K)$  functions of the agents in the economy. The capital stock in any period depends on the stock in the previous period plus the change arising from new government spending. If this change is a small part of the total, then the social benefit function  $W(G)$  will be approximately risk-neutral.

While the first term on the right-hand side of equation 18-7 reflects the direct benefits of risk pooling and risk spreading, the second term reflects the incentive effects of the output tax. Government is concerned with how a change in output tax rate will affect effort and, hence, output tax revenues.

Starting from a pure land tax regime, the government initially is collecting no money from output taxes and therefore is not concerned with the change in effort. The second term vanishes. Hence,  $dEW(G)/d\tau|_{U,\tau=0} > 0$ , which proves

*Proposition 1.* If farms are operated by landowners and the opening of a perfect risk market would not be redundant, then the Pareto-efficient tax structure will entail a strictly positive output tax.

Proposition 1 holds independent of the level of government revenues,  $G$ . It applies equally to a tax on marketed, exported, or total output, since in any of these cases the insurance benefit of the tax (the first term on the right-hand side of equation 18-7) is the only first-order effect at  $\tau = 0$ . It also applies where effort is provided by hired labor, as can be easily verified.

It is tempting to call the second term on the right-hand side of equation 18-7 the “distortion” in the effort-leisure tradeoff caused by the output tax. In general this is not correct. The sign of the second term is the same as the sign of  $\tau[de/d\tau]_U$ . As I show in the next section, there exists a set of reasonable conditions under which this term is strictly positive—which means that an increase in the output tax rate increases labor effort. Under those conditions, incremental substitution of an output tax for a land tax will reduce not only distortions in the allocation of consumption, but also distortions in the labor-leisure tradeoff arising from imperfections in the risk market.

In a set of simulations that take into account the benefits from risk pooling on the allocation of consumption but not on the allocation of labor effort, Skinner finds that a *pure* output tax regime Pareto-dominates a *pure* land tax regime for sufficiently highly risk-averse taxpayers (see chapter 19).

Equation 18-7 provides a simple condition characterizing the optimal mix of land and output taxes. Since  $[dEW/d\tau]_U = 0$  is necessary for Pareto efficiency, the Pareto-efficient tax mix has the property that

$$(18-9) \quad -\tau \frac{f' \left[ \frac{de}{d\tau} \right]_U}{Tf \left[ \frac{de}{d\tau} \right]_U} = 1 - \frac{\frac{E(u' \epsilon_i)}{Eu'}}{E \left\{ W' \sum_{i=1}^N \frac{\epsilon_i}{N} \right\} / EW'}$$

We know from our analysis of the term in 18-8 that the right-hand side of equation 18-9 is strictly positive for  $\tau < 1$ . Hence equation 18-9 implies that to achieve the optimal mix of output and land taxes, a government will set the output tax sufficiently high to make  $\tau[de/d\tau]_U < 0$ . At the optimum, the insurance benefits of an increase in the output tax (the right-hand side of equation 18-9) are just offset by the loss in government revenues arising from the discouragement of effort (the left-hand side of equation 18-9). There is a tradeoff between insurance and incentives, which is familiar from the principal-agent literature.

### The Supply Effect of Changing the Mix of Land and Output Taxes

I suggested above that a compensated increase in the output tax can increase effort because the reduction in the household's risk under the output tax more than compensates for the diminution of incentives due to the output tax. This section discusses that result informally and then proves it.

The household equates its marginal rate of substitution between income and effort ( $MRS_{y,e}$ ) to the expected return to effort after taxes less an amount that depends on risk and risk aversion. To see this, write the first-order condition for effort in equation 18-2 as

$$(18-10) \quad MRS_{y,e} \equiv \frac{v'}{Eu'} = [1 - \tau]f' - [1 - \tau]f' \left[ \frac{-\text{cov}(u', \epsilon)}{Eu'} \right].$$

The last term above is the household's *marginal risk premium* with respect to effort:<sup>6</sup> it is the reduction in the value of the household's marginal productivity arising from the randomness in the production function (see the appendix to this chapter for a proof). Intuition suggests (and theory proves) that the effect of a decrease in risk on effort is ambiguous.<sup>7</sup> A decrease in risk might increase effort because it lowers the marginal risk premium. Or a decrease in risk might reduce effort because it lowers the probability that the household's income will fall below some minimum standard, which lowers the shadow value of income,  $Eu'$ . (From equation 18-10, as  $Eu'$  falls, the marginal rate of substitution rises by more than the risk-adjusted marginal rate of transformation does.)

To derive conditions under which effort will increase with a shift from land to output taxes, differentiate the first-order condition, equation 18-2, with respect to the output tax rate, to obtain (using equations 18-3 and 18-6)

$$(18-11) \quad \left[ \frac{de}{d\tau} \right]_U = \frac{f'}{-\Delta} E \left\{ -u'\epsilon + Tu'A[1 - \tau]f \left[ \epsilon^2 - \frac{\epsilon E(u'\epsilon)}{Eu'} \right] \right\}$$

where  $A$  is the absolute risk aversion function,  $-u''/u'$ . This equation shows the change in effort in response to an increase in the output tax and a fall in the land tax that keeps the farmer's expected utility constant. The direction of change (the sign of equation 18-11) will be the same as the sign of the expression in curly brackets.

The first term in curly brackets represents the farmer's valuation of the drop in the after-tax price of output: it is negative.

The change in tax regime also induces a decrease in risk. This effect is captured in the second term within curly brackets, which is ambiguous in sign. Consider three cases, which illustrate the response at different values of risk aversion and tax rates.

*Case 1.* As output taxes approach 100 percent ( $\tau \approx 1$ ), the farmer's welfare

becomes independent of his output fluctuations. The second term within curly brackets drops out, so that  $[de/d\tau]_U$  is negative.

*Case 2.* If relative risk aversion,  $-u''y/u'$ , denoted by  $R$ , is constant and land taxes approach zero, then the second term within curly brackets again vanishes:

$$RE \left( u' \left[ \epsilon - \frac{E(u'\epsilon)}{Eu'} \right] \right) = 0.$$

This means that investment in effort depends only on the mean return, not its riskiness, so  $[de/d\tau]_U$  is negative.

Thus, in cases 1 and 2, a compensated increase in the output tax will reduce effort, just as in the perfect markets models analyzed by the classical economists. Let  $(\tau_o, \Gamma_o)$  represent the original tax regime in figure 18-1, and let  $e(\tau_o, \Gamma_o)$  represent the farmer's effort choice at that tax regime. The change in tax mix toward a higher output tax rate,  $\tau_1$ , and a lower land tax rate induces a leftward shift in the expected utility function, illustrated in figure 18-1.

*Case 3.* If absolute risk aversion,  $A$ , is constant, the second term within the curly brackets in equation 18-11 can be rewritten as

$$(18-12) \quad T A [1 - \tau] f \left[ E(u'\epsilon^2) - \frac{[E(u'\epsilon)]^2}{Eu'} \right] > 0.$$

In this case, the insurance effect of a shift to output taxes will increase effort.

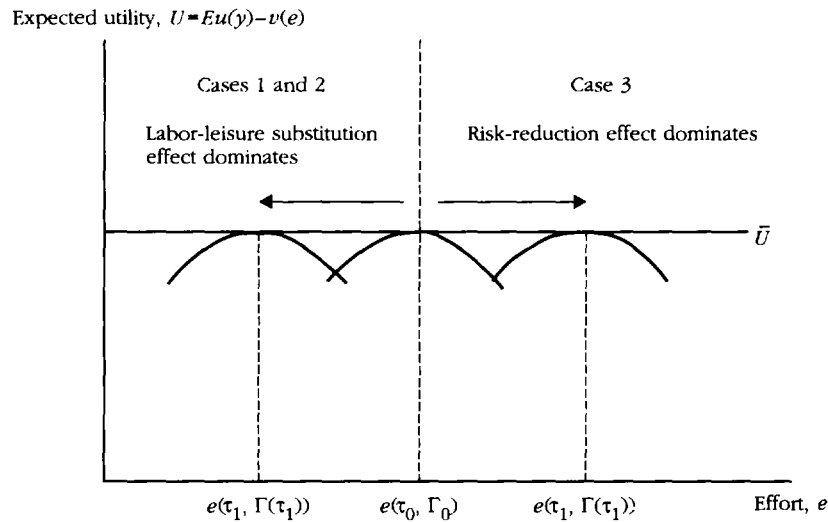
The sign condition in equation 18-12 follows from the Schwarz inequality, which states that for any two random variables  $X$  and  $Z$  defined on the same space,  $E(X^2)E(Z^2) \geq [E(XZ)]^2$ , with equality only if  $X$  is proportional to  $Z$ . Let  $X \equiv \sqrt{u'}$  and  $Z \equiv \sqrt{u'}\epsilon$ . As defined,  $X$  is proportional to  $Z$  only if production is riskless. Given risky production, the Schwarz inequality implies  $Eu'E(u'\epsilon^2) > [E(u'\epsilon)]^2$ , as was to be shown.

For sufficiently high levels of risk, absolute risk aversion, or after-tax expected output, the positive effect on effort of the reduction in income fluctuations captured in inequality 18-12 will exceed the negative substitution effect  $-E\{u'\epsilon\}$  in equation 18-11, and effort will be a rising function of the output tax. Thus, for some positive output tax  $\tau < 1$ , an increase in output tax compensated by a reduction in land tax will induce the rightward shift of the farmer's utility function illustrated in figure 18-1, the opposite of the shift that the classical economists would have predicted.

My results are summarized as follows:

*Proposition 2.* If farms are operated by landowners and the opening of a perfect risk market would not be redundant, then the output effects of changes in the mix of land and output taxes (holding the landowner's expected utility constant) are ambiguous. For example, if landowners have

Figure 18-1. *The Effect on Labor Effort of an Increase in Output Taxes and a Decline in the Land Tax that Keeps Expected Utility Constant*



Note:  $\Gamma$  = land tax per acre;  $\tau$  = output tax rate.  $\Gamma(\tau_1) - \Gamma_0$  is the decline in the land tax that keeps farmer welfare constant after the increase in the output tax from  $\tau_0$  to  $\tau_1$ . In case 1,  $\tau_0 = 1$ ; in case 2,  $\Gamma_0 = 0$  and relative risk aversion is constant; and in case 3, absolute risk aversion is constant and income risk is large.

constant *relative* risk aversion and the land tax is low, then a compensated increase in the output tax will reduce effort. And if landowners have constant *absolute* risk aversion, and risk and risk aversion are sufficiently great, then a higher output tax will increase effort over some range of output taxes,  $0 < \tau < 1$ .

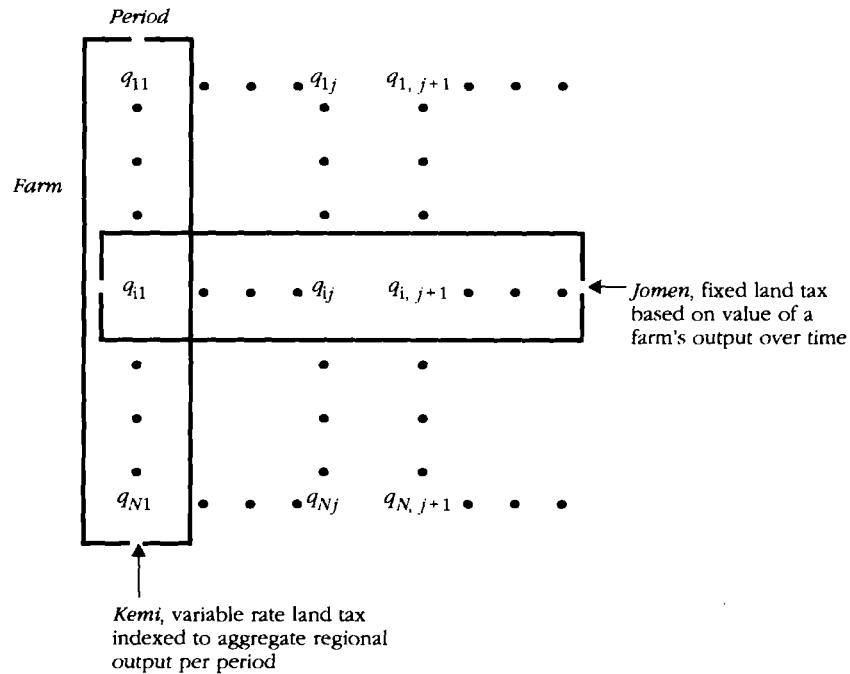
It is well known that the income effects of taxation also increase labor effort, since leisure is a normal good. It follows that the surprising ability of an output tax to increase effort is strengthened if the tax is not compensated. Reconsider, for example, case 2, in which relative risk aversion is constant and land taxes approach zero. Using equation 18-11:

$$\text{sign } de/d\tau = \text{sign } \{Eu'\epsilon[R - 1]\}$$

so that if  $R > 1$ , an uncompensated output tax always increases labor effort.

### The Jomen and the Kemi

Newbery (1987, p. 380) informally suggests that “the problem [posed for land taxation by] fluctuating income can be met by linking last year’s tax liability

Figure 18-2. *Matrix of Farm Outputs over Time and Space*

to the value of aggregate output throughout the country or region." An indexed land tax has been used in many countries. For instance, in Japan during most of the Tokugawa period, land taxes were collected as a variable levy, the so-called *kemi*, that was based on estimated aggregate crop yields prorated among landowners according to land quality and area. This variable levy was replaced by a lump sum tax on land value, the *jomen*, toward the end of the Tokugawa period (Otsuka, Chuma, and Hayami 1989, p. 20).

This section first compares the risk and incentive properties of the *jomen* and *kemi*. It then demonstrates that, in general, a Pareto-efficient mix of a *kemi* and a simple output tax will include a simple output tax, contrary to Newbery's informal suggestion.

Let subscript  $i$  index farms,  $i = 1, 2, \dots, N$ , and let subscript  $j$  index time periods. Farm outputs over space and time can be represented in a matrix, as in figure 18-2. With the simple technology of equation 18-1 and homogeneous land and labor, a *jomen* amounts to taxing the  $i$ th landlord on the discounted sum of the  $i$ th row adjusted for labor costs. The variable levy, the *kemi*, amounts to taxing the landlord on the sum of a column, adjusted for total labor costs within one period and prorated according to land quality and area. A simple output tax is a tax on the individual cells of the matrix.

A *kemi* permits new possibilities for risk sharing and incentives if farmers' risks in any period are positively correlated. Suppose that output per worker on farm  $i$  in period  $j$  is

$$q_{ij} = [g_j + \epsilon_{ij}] f(e/T) T$$

where  $g_j$  is a common random variable, normalized at mean one, and is uncorrelated with the independently distributed individual shocks,  $\epsilon_{ij}$ :

$$(18-13) \quad E\epsilon_{ij} = E(g_j\epsilon_{ij}) = E(\epsilon_{ij}i') = 0 \text{ for } i \neq i'.$$

Finally, suppose that there are a large number ( $N$ ) of identical family farms (with the number of workers on each normalized at one). All then have the same expected output,  $\bar{q}$ . Total output in period  $j$  (the sum of the elements of a column in the output matrix) is

$$\sum_{i=1}^N q_{ij} = \bar{q} [Ng_j + \sum_{i=1}^N \epsilon_{ij}].$$

Replacing a *jomen* by a *kemi* that yields the same expected tax revenue induces a mean income-preserving decrease in the landowner's risk:

$$q_{ij}^{\text{net of kemi}} = q_{ij}^{\text{net of jomen}} + k[1 - g_j] \bar{q}$$

where  $k$  is the rate of *kemi* tax expressed as a proportion of the aggregate harvest per unit of land  $\sum q_{ij}/NT$ .<sup>8</sup> A *kemi* is thus equivalent to a *jomen* plus an actuarially fair insurance plan. The farmer's insurance receipts are positive if the year is bad for the collective of farmers ( $g_j < 1$ ), and negative otherwise.

This discussion is not academic. After the *kemi* was replaced by the *jomen* at the end of the Togugawa period (as part of a general legal reform in Japanese property rights in land), bad crop years sometimes saw revolts against the tax (Dore 1959).

Under the assumption that the individual ( $\epsilon_{ij}$ ) and the common ( $g_j$ ) sources of risk are independently distributed (equation 18-13), the *kemi* provides risk pooling with nearly perfect incentives. The farmer's choice of effort solves

$$\text{Max}_e \quad Eu \left( [g_j + \epsilon_{ij}] f(e/T) T - Tkg_j\bar{q} \right) - v(e)$$

yielding the first-order condition

$$f'E(u' [g_j + \epsilon_{ij} - kTg_j d\bar{q}/dq_{ij}]) = v'.$$

Given many small farms, to an individual farmer the effect of an increase in his farm's output on the *kemi* tax will not be perceptible, so that each acts as a price-taker with respect to the *kemi*:  $d\bar{q}/dq_{ij} \approx 0$ , and so the risk advantage of the *kemi* comes without cost in incentives. It is apparent that a *kemi* dominates a *jomen* when equation 18-13 holds and administrative costs and problems are excluded.

A *kemi* that is levied on the individual farmer will have the further advantage, not captured in this model, of increasing the expected utility cost of poor farm management. Unlike a *jomen* or an output tax, the landowner under the *kemi* will bear increased risk if he fails to take reasonable care to make his land productive. The tax due under the *kemi* will be high in years in which agricultural conditions are generally favorable and low in unfavorable years, so the penalty for poor management will become a random variable.<sup>9</sup>

I return now to the question posed at the beginning of this section: does the land tax in the form of a *kemi* solve the problem of fluctuating incomes? Consider the Pareto-efficient mix of a *kemi* and a simple output tax. Using a proof virtually identical to that for proposition 1 leads to the following result:

*Proposition 3.* The Pareto-efficient mix of an output tax and a land tax at rate  $k$  that is indexed to the aggregate regional harvest will entail a strictly positive output tax if (a) individual risk is at least as great as the farmer's share of the common risk,  $[1 - k]g_j$ , and (b) the opening of a perfect risk market would not be redundant.

From the government's perspective, the risk properties of the simple output tax and the *kemi* are identical. But from the farmer's perspective, the simple output tax has the advantage that it absorbs his individual risk as well as the common risk. If his individual risk,  $\epsilon_{ij}$ , is at least as great in the sense of Diamond and Stiglitz (1974) as his share of the common risk,  $[1 - k]g_j$ , would be under an indexed land tax regime, then there is scope for Pareto improvements by substituting a simple output tax for part of the indexed land tax.

Note also that there are sharp limits to the ability of the *kemi* to reduce the farmer's risk if individual farm shocks are negatively correlated within a region. Dropping the assumption of equation 18-13, suppose that  $E\epsilon_i\epsilon_{i'} < 0$  for  $i \neq i'$ . This case would plausibly arise when inputs (such as tubewells, draft animals, and seed qualities) are heterogeneous across farms, so that some landowners cope well with dry weather, and others cope well with wet weather. Under a *kemi*, a farmer whose output covaries negatively with aggregate output can expect to pay in tax a *higher* share of his annual output the *lower* his output is. This strengthens the case for using a simple output tax in addition to the land tax if the land tax is indexed.

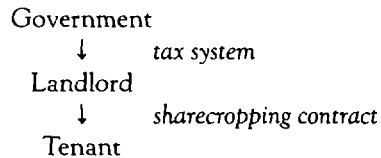
## Sharecropping Economies

Economies adapt to the absence of risk markets by developing institutions that perform the functions that would otherwise have been served by the



missing markets. Sharecropping is partly an adaptation to the absence of risk markets. Evidence suggests that in rural areas where the risk-sharing properties of tax instruments are most important, contracts between landowners and workers are likely to be characterized by sharecropping in lieu of simple rental and wage contracts.<sup>10</sup> Hence it is important to ask whether the central results of this chapter, proposition 1 and its corollary, proposition 3, extend to the case in which land is farmed under sharecropping. To highlight the main issues, I treat the linear sharecropping contract here. My qualitative results will also apply to a nonlinear sharecropping contract, which can be analyzed along the lines set forth in Hart and Holmstrom (1987, p. 78).

Taxation in the presence of sharecropping is a nested principal-agent problem. The landlord can be viewed as a local tax authority whose "tax system" will change to take advantage of changes in the government's tax regime. The government can be thought of as maximizing its expected value of revenues function  $EW(G)$  subject to the constraint that taxpayers achieve a given level of utility from private goods, while landowners choose a sharecropping contract subject to the constraint that sharecroppers achieve a reservation utility level. Diagrammatically, the relationship is:



### **Determination of the Linear Tenancy Contract**

Consider the determination of the equilibrium tenancy contract in the medium run, where the landlord is free to adjust the parameters of the contract but not the number of his tenants.<sup>11</sup> For simplicity, assume he has only one tenant, and normalize land units so that he owns  $T = 1$ . To induce the tenant to work on his land, the landlord must offer a contract that yields the tenant his reservation utility level,  $\bar{U}$ . The tenant has the same utility function as the independent farm household in section 1:  $U = Eu(y) - v(e)$ . The production function also is as in equation 18-1. With the normalization  $T = 1$  and the assumption that  $L = 1$ , the landlord's production function reduces to  $q = \epsilon f(e)$ .

The assumption of a fixed number of tenants simplifies the model and is inessential to the results, below, regarding the Pareto-efficient share contract. However, the assumption of a fixed reservation utility for the tenant, invariant to tax regime, is restrictive. In the long run, both the number of tenants per landlord and their "price"  $\bar{U}$  would be endogenous.<sup>12</sup> A fixed tenant reservation utility level is consistent with long-run competitive gen-

eral equilibrium only if other sectors in the economy can absorb workers at a fixed wage.

A linear tenancy contract provides payment to the sharecropper as some combination of an output share,  $\alpha$ , and a lump sum,  $\beta$ , yielding tenant after-tax income of:

$$y_w = \alpha[1 - \tau] \epsilon f(e) + \beta.$$

Notice some special cases:

$\beta = 0$	pure sharecropping
$\beta < 0, \alpha = 1$	lump sum rent
$\beta > 0, \alpha = 0$	lump sum wage

So long as  $0 < \alpha < 1$ , the contract will have a sharecropping element to it. Landlord income after tax is

$$y_r = [1 - \alpha][1 - \tau] \epsilon f(e) - \beta - \Gamma.$$

The landlord wishes to choose a contract that maximizes his own expected utility, denoted  $EV(y)$ , subject to the constraint of providing a reservation utility level to the sharecropper:

$$(18-14) \quad \underset{\alpha}{\text{Max}} EV([1 - \alpha][1 - \tau] \epsilon f(e) - \beta - \Gamma)$$

subject to  $U \geq \bar{U}$ . The landlord can observe tenant output, but we make the reasonable assumption that there is at least some dimension of effort that the landlord cannot monitor.

The structure of the landlord's problem in equation 18-14—his choice of a  $[1 - \alpha]$ th share in the tenant's output and the tenant's choice of an effort level—is an instance of the same principal-agent relationship as in equations 18-4 and 18-5, in which the government chose a  $\tau$ th share in farm output and the family chose its effort level. In this light, proposition 1 above can be seen as a straightforward extension of the well-known explanation of sharecropping as a Pareto-efficient contract between landlord and tenant when risk markets are absent and effort is difficult to monitor (Stiglitz 1974, p. 244, proposition 11).

Stiglitz' result and proposition 1 above can be summarized as follows: if risk markets are insufficiently developed to equate the marginal valuations of risk of landlord and tenant (or government and taxpayer), then the Pareto-efficient linear tenancy contract (or tax regime) must have a share element to it; that is,  $0 < \alpha < 1$  or  $0 < \tau < 1$ . The next section considers whether this result applies as well to the Pareto-efficient tax regime in the presence of sharecropping.

**The Pareto-Efficient Mix of Output and Land Taxes under Sharecropping**

Define the tenant's after-tax share in output,

$$\hat{\alpha} \equiv \alpha [1 - \tau]$$

and think of the landlord, given some output tax  $\tau$ , as choosing the variable  $\hat{\alpha}$  instead of  $\alpha$ . The tenant's effort can then be written as a function of  $\hat{\alpha}$ .

Government revenues from the landlord are

$$G = \tau \epsilon f(e(\hat{\alpha})) + \Gamma.$$

The effect of an increase in the output tax rate on the social value of government revenues,  $EW(G)$ , holding landowner expected utility unchanged, is

$$(18-15) \quad \frac{dEW(G)}{d\tau} \Big|_V = fE \left\{ W' \left[ \epsilon - \frac{E(V'\epsilon)}{EV'} \right] \right\} + \tau E(W'\epsilon) f'[de/d\hat{\alpha}] d\hat{\alpha}/d\tau.$$

The last term is ambiguous in sign, but vanishes at  $\tau = 0$ .

Proceeding as we did with equation 18-7, we can rewrite the first term on the right-hand side of equation 18-15 as the difference between the social marginal valuation of risk and the landlord's marginal valuation:

$$(18-16) \quad fEW' [E(W'\epsilon)/EW' - E(V'\epsilon)/EV'] > 0.$$

Recall that the landlord will choose to bear some risk; that is,  $0 < \alpha < 1$  for  $\tau < 1$ . If the opening of a perfect risk market would not be redundant, then equation 18-16 holds as before, because of the superior risk-spreading and risk-pooling opportunities available to the government. From this it follows that  $dEW(G)/d\tau \Big|_{V, \tau=0} > 0$ . This proves that proposition 1 extends to land under sharecropping:

*Proposition 1'.* If land is farmed by sharecroppers and the opening of a perfect risk market would not be redundant, then the Pareto-efficient tax structure will entail a strictly positive output tax.

Of course, if the landlord is risk neutral, then  $E(V'\epsilon)/EV'$  equals one, inequality 18-16 becomes nonpositive, and proposition 1' does not apply. From the perspective of a risk-neutral landlord, the opening of a perfect risk market would be redundant. From the perspective of the tenant, risk markets appear imperfect, but in fact the imperfection arises from moral hazard in the labor relationship between landlord and tenant. If the landlord could costlessly monitor the tenant's work, then a risk-neutral landlord would offer his tenant a fixed wage contract, so that the landlord himself bore all income risk.<sup>13</sup>

## Conclusion

This chapter has argued that there is a misconception in the pure theory of land taxation. In economies in which landowners are unable to obtain complete insurance against production risks—for practical purposes, all developing countries—the classical propositions on the efficiency of land taxes do not hold. Compared to a mix of land and output taxes, a land tax will exacerbate the distortions arising from missing risk markets. The right mix of output and land taxes will yield larger average government revenues (and higher social welfare) than a pure land tax, at a fixed cost in taxpayer utility.

Moreover, output taxes need not stifle economic activity. Under plausible conditions for a rural sector of small landowners, a small output tax and offsetting cut in land taxes will increase effort, not reduce it.

This chapter has not addressed administrative costs. Chapter 19 provides persuasive arguments that the inequities arising from administering a tax based on land quality are its critical economic deficiency. Since land quality is difficult to evaluate, some owners of low-quality land will be taxed as if they had high-quality land, while some owners of high-quality land will be taxed as if they had low-quality land. These errors can make the land tax regressive. Thus a second benefit of a movement away from the economist's traditional ideal—a pure land tax regime—to a mix of land and output taxes is that it may allocate the tax burden more fairly.

This chapter also has not considered the incidence on sharecroppers of changes in the mix of land and output taxes. Preliminary work indicates that landlords may not bear the entire burden of the land tax; thus, empirical research in this area would be important. The sharecropping model is a prototype for many agency relations where, because of missing markets and costly information, markets clear through contracts based on more than just a price. This suggests that analyses that take into account the nature of contracting in specific markets may overturn the standard results on tax incidence.

## Appendix: The Marginal Risk Premium with Respect to Effort

The *total risk premium* is the maximum amount that a farm household would pay for crop insurance. In the following identity, it appears as  $c$ :

$$u(T[1 - \tau]f(e/T) - T\Gamma - c) = Eu(T[1 - \tau]f(e/T) - T\Gamma)$$

in which  $u$  is farmer utility of income,  $T$  is the number of acres farmed,  $f$  is

output per unit of land,  $e$  is labor effort,  $\tau$  is the output tax,  $\Gamma$  is the per unit land tax, and  $\epsilon$  is a random variable with mean of one. Differentiating both sides with respect to effort and letting  $y$  denote after-tax income from farm production yields

$$u'(Ey - c)[(1 - \tau)f' - dc/de] = E(u'(y)\epsilon)[1 - \tau]f' \\ = [1 - \tau]f' [Eu'(y) + \text{cov}(u', \epsilon)].$$

But to a second-order approximation

$$(18-17) \quad u'(Ey - c) \approx Eu'(y)$$

so that the *marginal risk premium* with respect to effort can be written as:

$$(18-18) \quad \frac{dc}{de} \approx - [1 - \tau]f' \left[ \frac{\text{cov}(u', \epsilon)}{Eu'(y)} \right].$$

Equation 18-18 establishes that the marginal risk premium with respect to effort is approximately equal to the last term in equation 18-10 in the text.

Equation 18-17 and, therefore, equation 18-18 hold exactly if marginal utility is a linear function of utility. To see this, let  $y(u)$  be the inverse utility function and note that by construction,  $u(y(u))$  (the random utility obtained when income is risky) is a mean-utility-preserving spread of  $u(Ey - c)$  (the utility obtained at the riskless income  $Ey - c$ ). The condition that marginal utility is linear in utility is identical to the condition that preferences are characterized by constant absolute risk aversion ( $A \equiv -u''/u'$ ) since

$$\frac{d^2}{du^2} [u'(y(u))] = \frac{d}{du} \frac{u''}{u'} = - \frac{d}{du} A(y(u)) = \frac{-A'}{u'} \geq 0 \iff A'(y) \leq 0$$

Hence, 18-18 holds exactly if the farmer's degree of absolute risk aversion is independent of his income.

## Notes

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1. See, for instance, Newbery (1987, p. 381): "The obvious empirical question to ask is how desirable a crude land tax would be from an equity viewpoint (because its efficiency is not in doubt)."

2. Related results have been obtained for a wage tax in Eaton and Rosen (1980) and for an interest income tax in Varian (1980). This paper provides a proof that clarifies the basis for the kind of results obtained in their papers.

3. A famous early demonstration of this point in the context of the debate over direct versus indirect taxes is in Little (1951, pp. 580-84). The classic reference is Lipsey and Lancaster (1956).

4. Henry George devoted much of his career to arguing for limiting government to a single revenue source, namely, the taxation of pure economic surplus, which he identified in *Progress and Poverty* (1879) with the rent of unimproved land. He ran unsuccessfully for high political office on this single-tax platform.

5. The restrictions on preferences and on the density function of  $\epsilon$ , that guarantee that  $[de/dt]_{\bar{U}}$  defines the farmer's choice of effort and that equation 18-4 is everywhere concave in  $\tau$  are summarized in Hart and Holmstrom (1987, pp. 84-87).

6. Nothing essential is changed if the marginal unit of effort is provided by a hired hand. Let the utility function of the hired hand be  $U_w = u_w(y_w) + v_w(e_w)$ , and let  $u(y)$  still denote the landowner's utility of income. Then the analog to equation 18-10 is

$$\left. \frac{dy_w}{de_w} \right|_{\bar{U}_w} \equiv \frac{v'_w}{u'_w} = [1 - \tau]f' \left[ 1 + \frac{\text{COV}(u', \epsilon)}{Eu'} \right]$$

7. The general case of mean-utility-preserving changes in risk is treated in Diamond and Stiglitz (1974). They show that the effect of a decrease in risk on any action will be unambiguous only if the derivative of utility with respect to that action is strictly concave or convex in utility.

8. Under the *kemi*, each farmer's tax per unit of land is  $k\bar{q}[g_i + \sum \epsilon_{ij}/N]$ , whereas under the *jomen* it is  $k\bar{q}$ .

9. The *kemi*'s potential role in reducing slack among landowners is analogous to the role played by the competitive price system in reducing managerial slack. When environmental conditions are good so that output rises, the competitive market price falls and managers who did not take advantage of the good conditions may be forced into bankruptcy (Nalebuff and Stiglitz 1983).

10. See, for example Rosenzweig (1988, table 2). Stiglitz (1974) and Newbery (1977) show that the ability of share contracts to spread risk is redundant only in the special case that three conditions hold at the same time: (a) the labor market provides a riskless wage,  $w$ , and full employment, (b) productivity of workers paid a wage is the same as that of workers who are paid an output share, and (c) the farmer can divide his working time between working on rented land and working for a wage. Under these conditions, a farmer who spends a share  $\alpha$  of his time on land rented at rate  $r$  and the rest of his working time as a wage-earner, will earn income  $\alpha[q - r] + [1 - \alpha]w$ , which spans the space of linear sharecropping contracts.

11. The contract described here is based on Stiglitz (1974, part 2).

12. The general equilibrium problem yields a matrix equation. The variables entering into the demand for tenants are the parameters of the share contract and also  $e$ ,  $L$ ,  $\bar{U}$ , and the Lagrange multiplier on the sharecropper utility constraint perceived by the landlord. The shift in the demand curve for tenants  $L(\bar{U})$  induced by changes in the tax regime depends on income effects and output elasticities. This chapter does not consider the incidence of the land tax, but preliminary work suggests that solutions are quite messy and that in particular cases the land tax may be borne partly by the tenant.

13. The intuition is straightforward. With effort costlessly observable, it will be contractually specified. The contract between landlord and tenant then no longer serves as an incentive mechanism, but only as a means to attract the tenant. The cheapest way for a risk-neutral landlord to compensate a risk-averse tenant is through a riskless payment—a fixed wage.

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## *If Agricultural Land Taxation Is So Efficient, Why Is It So Rarely Used?*

*Jonathan Skinner*

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*The land tax enjoys a distinguished pedigree in the theoretical literature on tax efficiency, yet it is rarely used as a serious revenue source in rural areas of developing countries. This chapter considers three drawbacks of the land tax as opposed to taxes on exports or marketed output: (a) capitalization effects of the land tax impose a large burden on the current generation, (b) land taxation increases the riskiness of net farmer income, and (c) administration of the land tax entails costly informational requirements. This chapter demonstrates that only the second and third drawbacks are valid economic arguments against the land tax. Simulations based on an economic model of farm behavior suggest that if farmers have to choose a single tax rather than a mix of taxes, they may still prefer a land tax to an export tax despite the increased uncertainty of their after-tax income. Administrative costs are therefore the best explanation of the weak link between the theoretical and practical aspects of land taxation.*

LIBERALIZED AGRICULTURAL EXPORT POLICIES, realigned exchange rates, and a reduced role for marketing authorities have created a favorable environment for agricultural growth in many developing economies. But these policies are not without cost; countries lose an important source of revenue from the agricultural sector. Given the lack of foreign credit and the strained capability of other taxes, some countries are seeking alternative methods for taxing income from the agricultural sector.

One prospect for raising revenue is a tax based on land area or quality. The land tax has great potential for revenue collection because land is



readily observable and in fixed supply. The land tax causes no distortion of output prices; farmers are encouraged to produce at high levels because they receive the full price for their crops. Furthermore, the land tax has enjoyed a distinguished pedigree in the theoretical literature since Ricardo. For example, Newbery (1987, p. 381) acknowledges that the efficiency of the land tax is "not in doubt," while Lewis (1984, p. 167) writes that "it is the likely impact of the land tax in increasing farm marketing that explains its appeal to many economists."

It is therefore paradoxical that the use of land taxation has eroded so rapidly during the past several decades. In 1940 agricultural land taxation as a fraction of central government tax revenue was 23 percent in Egypt, 19 percent in India (including Bangladesh and Pakistan), and 5 percent in Chile (Bird 1974). By 1987 no country in this group collected more than 1 percent of central government revenue from agricultural land taxation, and few countries relied on land taxation for more than 3 percent of government revenue (Strasma and others 1987).<sup>1</sup> In 1959 Haskell P. Wald concluded that "when governments have had a choice, they have been inclined to favor a strengthening of income or export taxes, or an extension of indirect taxes, over an increase in land taxes" (p. 63).

This chapter examines three potential explanations for why the agricultural land tax is so rarely used for raising more than a trivial fraction of central government revenue. The first is that current landowners object to land taxation because they bear more than 100 percent of the tax burden. Any increase in land taxation leads to a large capital loss in land value because the prospect of future tax payments depresses current land prices. This chapter shows that while the capitalization effect of land taxation is substantial, the prospect of future export or commodity taxation similarly depresses current land prices. Replacing an export tax with a land tax could even *increase* land prices. Hence the capitalization effect is not a good explanation for why land taxation has declined in use.

The second drawback of the land tax is that farmers suffer from the undesirable risk characteristics of a land tax in the presence of imperfect insurance markets, as shown by Hoff in chapter 18. The land tax must be paid each year regardless of the success or price of the crop, while commodity taxes pool risk by taxing only the value of marketed output. This chapter makes some illustrative calculations of welfare under a land tax and under an output tax that show that a land tax generally dominates an output tax when the output tax rate is high, even in the presence of substantial consumption uncertainty. Furthermore, as Hoff has demonstrated, combining both taxes is Pareto-efficient relative to either tax alone. In Uruguay, for example, the government uses a land tax to raise revenue from cattle ranchers, but it still retains the export tax to stabilize the domestic price for producers and urban consumers (Jarvis and Medero 1988).

The final reason why land taxation may rarely be used to collect revenue lies in administrative factors. Unlike the commodity or export tax, which is based on readily observable measures of output, the land tax is based on site value, market value, or net income, measures that are often difficult to observe in rural areas with sparse land markets. Landowners have every incentive to understate the value of their taxable land. The administrative costs of ensuring compliance may thus offset the efficiency gains of the land tax.<sup>2</sup> Using a model developed by Stern (1982), I show that if a society has an aversion to inequality, a nondistortionary land tax imperfectly based on land value can make society worse off than an export tax administered without error. Problems of compliance and land valuation are the weakest link between the theoretical superiority of the land tax and its practical incarnation.<sup>3</sup>

While there is a wide gap between the positive analysis presented below and the normative process by which governments make choices, the implication of this chapter is that neither capitalization nor risk factors are good explanations for why governments choose export or commodity taxes over the land tax. Instead, the difficulty of administering the land tax may be the best explanation for its gradual erosion.

The next section presents a general model of an economy with an agricultural and urban sector. Each of the three sections that follows addresses the question of why land taxation is a declining source of revenue. The second section examines capitalization effects, followed by a section discussing the increased risk imposed on farmers by land taxation, and the fourth section addresses the problem of administration. The final section concludes with some reflections on the political dimension of land taxation and the distinction between central and local government revenue sources.

## A Theoretical Model of Landownership and Taxation

The organization of farm production and the type of land taxation vary widely among countries, so one must be careful about defining a single economic model.<sup>4</sup> In Asian countries such as Bangladesh, India, and Indonesia, the land tax falls on small-scale farmers who often consume a large fraction of their own production. In several Latin American countries, land taxation is used to tax the vast estates that may grow crops (or raise cattle) only for the export trade. Land taxation is far less prevalent in African countries without a tradition of individual property rights in land.

The type of land taxation also differs across countries. In some cases, land taxes are similar to imputed income taxes; the tax is based on the market value of the land or the annualized net profits from land. In other countries, an attempt is made to base the tax on land quality, such as soil quality and distance to the nearest paved road. A third method is to simply use land

area as the base, with no attempt to distinguish quality. In the model that follows, a proportional tax based on quality-adjusted land area is assumed, although costly assessment may be required to determine the land quality.

### The Agricultural Sector

The agricultural sector produces a tradable commodity  $x$  subject to an export tax  $\tau$  at the border. The domestic price  $p$  depends on the export tax and on the world price  $p^*$  that is assumed constant. Neglecting transportation costs, one can write

$$p_j = p_j^*[1 - \tau]$$

where  $j$  denotes the time period. Define the units of the traded good so that  $p^*$  is equal to 1 in terms of the numeraire nontraded good. The assumption of  $p^* = 1$  will be maintained throughout the analysis.

The production function of the tradable good for each farmer  $i$  in period  $j$  is given by

$$(19-1) \quad x_{ij} = F(L_{ij}, T_{ij}, \epsilon_{ij})$$

where  $F$  is assumed to have constant returns to scale,  $L_{ij}$  is the farmer's labor supply,  $T_{ij}$  is quantity of land, and  $\epsilon_{ij}$  is a multiplicative random variable reflecting weather conditions and other factors. Let  $F_{L_j}$  and  $F_{T_j}$  be the marginal product of labor and land in period  $j$ . Assume that workers are paid their marginal product  $w_j = p_j F_{L_j}$  and the (spot) annual rental value of land is  $p_j F_{T_j}$ .

In the derivations that follow, assume competitive markets and a representative farmer subject to uniform random shocks ( $\epsilon_{ij} = \epsilon_j$ ). Hence there is an equivalence between market outcomes and individual choices, so that aggregate measures of output or revenue are calculated by multiplying individual quantities by the number of farmers (this assumption is relaxed in the fourth section).

Assume that individuals in the agricultural sector consume only the tradable good  $x$ , the numeraire good  $z$ , and leisure  $\ell$ , and that each individual lives for two periods. Expected lifetime utility for an individual in the agricultural sector (indicated by a superscript  $a$ ) is written

$$(19-2) \quad EU^a = U(x_1^a, z_1^a, \ell_1) + [1 + \delta]^{-1} E U(x_2^a, z_2^a, \ell_2)$$

where the individual subscript  $i$  is suppressed,  $\delta$  is the time preference rate, and  $E$  is the expectations operator conditional on information in period 1.

At any given point in time, there are two generations alive. The younger generation provide a fraction  $L_j$  of time for work (equal to  $1 - \ell_j$ , or the fraction not spent in leisure) for which they receive a wage. At the end of the first period they choose consumption, and they use the remaining income to purchase assets for their elderly years in the second period. Hence only the older generation owns land or capital.

One can write the farmer's first-period full income as the wage rate,  $w$ , times the full endowment of time, 1.0. The farmer then "buys" leisure (at the wage  $w$ ), consumes the two commodities  $x$  and  $z$ , and saves the remainder as  $S$ . That is, letting  $m_1$  be expenditures in period 1,

$$(19-3) \quad w_1 = m_1 + S = p_1 x_1^a + z_1^a + \ell_1 w_1 + S.$$

The budget constraint in the second period is more complicated since the elderly generation split their life cycle saving between land and traditional capital. Furthermore, there may be unexpected capital gains or losses when land is sold at the end of period 2 to finance consumption. Saving  $S$  is distributed between purchases from previous generations of land at the end of period 1,  $Q_1 T$ , where  $Q_j$  is the price of one unit of land in period  $j$ , plus investments in traditional assets  $K$  that pay a fixed, untaxed rate of return  $r$ .<sup>5</sup> Total income in the second period consists of income flows net of the land tax  $\Gamma$ , plus the sale of land and capital stocks:

$$(19-4) \quad m_2 = w_2 + [Q_2 + p_2 F_{T2} - \Gamma]T + [1 + r]K.$$

Since total saving  $S = K + Q_1 T$ , one can also express equation 19-4 as

$$(19-4') \quad m_2 = w_2 + [Q_2 + p_2 F_{T2} - \Gamma]T + [1 + r][S - Q_1 T].$$

The arbitrage condition for the price of land holds that in a world of certainty and in steady-state equilibrium in which  $Q_j = Q_{j+1}$ , one dollar invested in land should yield the same net return as the same dollar in capital  $K$ :

$$(19-5) \quad p F_{Tj} - \Gamma = r Q_j.$$

Finally, it will be easier for derivations in later sections to express the utility function in its indirect form as a function of prices and income. Equation 19-2 can therefore be rewritten in terms of  $p_j$ , the price of leisure  $w_j$ , and full income  $m_j$ :

$$(19-6) \quad EU^a = V^a(p_1, w_1, m_1) + [1 + \delta]^{-1} E V^a(p_2, w_2, m_2).$$

To this point, only the agricultural sector has been discussed. Because export tax policy also affects the domestic price of the traded good, the welfare implications for consumers in the urban sector must also be considered.

### The Urban Sector

Individuals in the urban sector purchase the tradable good  $x$  from the rural sector. Holding other prices constant, the urban indirect utility function is written solely as a function of the domestic price of  $x$ :

$$(19-7) \quad U^b = U^b(x_1^b, z_1^b) + [1 + \delta]^{-1} U^b(x_2^b, z_2^b) = V^b(p_1) + [1 + \delta]^{-1} V^b(p_2)$$

where  $b$  denotes the urban sector and  $V^b$  is the indirect utility function. The implicit assumption in equation 19-7 is that policies in the agricultural sector do not affect income in the urban sector, but affect only the domestic price of  $x$ : the urban sector consumes imported goods purchased with foreign exchange earned from the agricultural exported goods. (A more general treatment of the urban sector would also account for changes in import demand as a consequence of tax policy shifts.)

**Taxation and Revenue**

Because the agricultural production function assumes constant returns to scale, there are no pure profits. Hence the export tax is equivalent to an equal-rate factor tax on labor and land at rate  $\tau$ . For a given tax regime ( $\tau, \Gamma$ ), the present value of aggregate tax revenue can be expressed as

$$(19-8) \quad R = \tau F_{L1} L_1 + \frac{\tau F_{L2} L_2 + [\tau F_{T2} + \Gamma] T}{1 + r} - \tau [\mathcal{X}^a + \mathcal{X}^b]$$

where  $\mathcal{X}^a$  and  $\mathcal{X}^b$  are the present value of aggregate expenditures on  $x$  goods by the rural and urban consumers (for example,  $\mathcal{X}^a = x_1^a + [1 + r]^{-1} x_2^a$ ). Revenue here is defined in terms of the present value for a given generation. This is to preserve comparability with shifts in social welfare or in utility, which are also measured on a lifetime basis.

**Making Urban-Rural Welfare Comparisons**

Replacing an export tax with a revenue-neutral land tax will affect not just the production incentives of farmers, but also the prices paid by urban consumers for the tradable good  $x$ . Furthermore, replacing an export or commodity tax with land taxation may affect individual farmers differently depending on their landholdings and productivity. To provide a means of quantifying these comparisons between urban and rural individuals (or among rural farmers), the social welfare function is written  $\Omega(U^{a1}, U^{a2}, \dots, U^b)$  where  $U^{ak}$  reflects the utility of farmers with different landholdings  $k$ .

Even in its most general form, the model is quite simple and ignores rural-urban migration (for example, see Heady and Mitra 1987), the impact of taxation on urban land and income, and variation in international exchange rates. Nevertheless, the general model can be used in the subsequent sections to analyze the impact of land taxation on intergenerational equity, risk patterns, and tax administration.

**Land Taxation and Capitalization Effects**

What is the relative benefit of switching from an export tax to a land tax in a model of perfect certainty and identical farmers? The answer to this question

must be considered in both a short-run and a long-run framework because the tax will affect current and future generations much differently.

To simplify the general model in the first section, assume the individual retires in the second period ( $\ell_2 = 1$ ) and the production function is linear;  $F = F_L L_1 + F_T T$  where  $F_L$  and  $F_T$  are constants.<sup>6</sup> The strategy used below for determining whether the land tax should be increased or reduced is based on the marginal shadow-price analysis in Ahmed and Stern (1984). First, one measures the (negative) impact on social welfare that results from raising the land tax by a sufficient amount to increase revenue by one rupee. Then one evaluates the same measure for the export tax. These two shadow-price measures are defined to be

$$(19-9) \quad \lambda_r \equiv \frac{-\partial\Omega/\partial\tau}{\partial R/\partial\tau} \quad \text{and} \quad \lambda_\Gamma \equiv \frac{-\partial\Omega/\partial\Gamma}{\partial R/\partial\Gamma}.$$

A welfare-improving reform occurs when an increase in the tax with the lower social cost is coupled with a revenue-neutral decline in the tax with the higher social cost. For example, when  $\lambda_\Gamma < \lambda_r$ , a shift in taxes from the export tax toward land taxation is efficient; when the two measures are equal, the tax system is at a local optimum. Note that this procedure provides only the direction, but not the magnitude, of welfare-improving change in the tax system.<sup>7</sup>

A shift in the land tax will have a different impact on current generations than on future generations. The short run is defined as the period during which all land is held by a given older generation. The market price of land,  $Q_2$ , must fall by enough to restore equality between the after-tax yield of land and that on capital assets. From the arbitrage condition 19-5,  $dQ_2/d\Gamma = -1/r$ . That is, a one-unit increase in the land tax  $\Gamma$  will impose a capital loss on the old of  $1/r$  per unit of  $T$  held.<sup>8</sup>

Expressing  $U^a$  and  $U^b$  in terms of their indirect utility functions and using Roy's identity holding  $Q_1$  constant implies that the short-run (SR) impact of the land tax on social welfare is

$$(19-10) \quad \lambda_\Gamma(SR) = \left[ \frac{\partial\Omega}{\partial U^a} \right] \frac{V_2^a (1 + \delta)^{-1} \left[ \frac{1 + r}{r} \right]}{(1 + r)^{-1}}.$$

With appropriate normalization, equation 19-10 can be rearranged to show that<sup>9</sup>

$$(19-10') \quad \lambda_\Gamma(SR) = \frac{1 + r}{r} > 1.$$

That is, holding the interest rate constant, the landowner is worse off by  $[1 + r]/r$  for every increase in tax revenue of \$1.<sup>10</sup> For example, suppose the interest rate were 6 percent; a \$1 revenue increase from the land tax would

make individuals currently alive worse off by \$17.67 (\$1 paid in tax plus \$1/.06 lost in property value). Even if one views  $r$  as reflecting the accumulated return over a twenty-year span of time (so that the  $r$  used in 19-10' is written as  $1.06^{20} - 1$ ), the cost to existing landowners is \$1.45 per \$1 in revenue collected. It is no surprise that in this simplified model, the landowners would object quite strenuously to a land tax.<sup>11</sup>

While the short-run impact of the land tax is very costly to the current generation of landowners, the long-run (*LR*) characteristics of the land tax when both  $Q_1$  and  $Q_2$  adjust to the new tax regime are highly favorable to future landowners. Future generations will buy and sell land at a price that is reduced by the amount  $1/\tau$  per increase in  $\Gamma$ . The marginal impact of the land tax on social welfare in the long run is given by

$$(19-11) \quad \lambda_{\Gamma}(LR) = \frac{V_2^a [1 + \delta]^{-1} [\partial Q_2 / \partial \Gamma - 1 - [1 + \tau] \partial Q_1 / \partial \Gamma]}{T [1 + \tau]^{-1}} = 0.$$

In the long run, the land tax is even better than a lump-sum tax; future generations *bear no burden at all*, but gain revenue at the expense of the landowners alive at the time of the tax.<sup>12</sup> In sum, a life-cycle model implies that land taxation is never “lump sum” in that the revenue collection is equal to the equivalent monetary loss of the individual. Current generations bear more than the burden of the tax (in the ratio  $[1 + \tau]/\tau$ ), and future generations bear no burden. Only when individuals live forever and never sell their land (or when they have strong Ricardian bequest functions) is the tax lump sum in the sense of reducing lifetime wealth by the present value of the tax revenue.

Can the capitalization of the land tax explain the preference in most developing countries for export taxes over land taxes? The answer is no. As is shown below, export taxes have similar capitalization effects, which can be larger in magnitude than those for land taxation.

Once again, the short-run impact of the export tax on current generations differs from the long-run impact. The older generation suffers a capital loss when the export tax is increased; from the arbitrage condition 19-5,  $dQ_2/d\tau = -F_T/\tau$ . The total change in income of this older, transition generation is given by<sup>13</sup>

$$(19-12) \quad \frac{dm_2(SR)}{d\tau} = -F_T \left[ \frac{1 + \tau}{\tau} \right] T.$$

Additional effects of the export tax are that (a) wage rates fall, so some of the burden is borne by the younger generation in the rural areas, and (b) the domestic price of the tradable  $x$  declines, making urban consumers of  $x$  better off (see Trapido 1988). The overall impact on social welfare is

$$(19-13) \quad \lambda_{\tau}(SR) = \frac{F_T T [1 + \tau] / \tau - [x_2^a + \psi_b x_2^b]}{F_T T - X_2 - \tau [\partial X_2 / \partial p_2]}$$

where  $X_2 = x_2^a + x_2^b$  and

$$\psi_b = \frac{\partial \Omega}{\partial U_b} \frac{\partial U_b}{\partial m_b}.$$

The parameter  $\psi_b$  summarizes the weight that the social welfare function places on marginal consumption of  $x$  by urban consumers relative to the benchmark of agricultural consumers. For example, if urban consumers were wealthier than rural consumers and society values equality, then  $\psi_b < 1$ .

The stylized economy jumps directly to a new steady state, so the welfare changes of those who are young during the transition can be described by the long-run analysis. Once again expressing the marginal social cost of the export tax as the ratio of the change in social welfare to the change in revenue,

$$(19-14) \quad \lambda_\tau(LR) = \frac{F_L L_1 - [X^a + \psi_b X^b]}{F_L L_1 + \frac{F_T T}{1 + \tau} - X - \tau \left[ F_L \partial L_1 / \partial \omega_1 + \frac{\partial X}{\partial p} \right]}$$

where  $X = X^a + X^b$ , or the total present value of combined urban and rural traded goods consumption. The numerator describes the (negative) shift in money income; the rural sector is worse off because of lower real wages  $F_L L_1$ , but that loss is cushioned by the fall in prices for domestic consumption of  $x$ . The denominator reflects the present value of the change in revenue as a consequence of increasing  $\tau$ .

Suppose that the urban consumers are weighted equally in the social welfare function with agricultural consumers (so that  $\psi_b = 1$ ) and that the present value of total domestic consumption of  $x$  exceeds gross first-period earnings  $F_L L_1$ . Then  $\lambda_\tau(LR) < 0$ ; the export tax makes future generations better off even if the revenue is simply tossed into the ocean. Future generations would therefore prefer an export tax even to a nondistortionary land tax. But this does not mean that the export tax is more efficient than the land tax. Long-run benefits of an export tax come at the expense of short-term capital losses suffered by the transition generation. Summed over all generations, land taxation is more efficient than export taxation.<sup>14</sup>

Finally, the relative impact of land and export taxation on land values can be derived. The effect of a one-rupee increase in land tax revenue on the price of land is

$$(19-15) \quad \frac{\partial Q_2 / \partial \Gamma}{\partial R / \partial \Gamma} (SR) = \frac{-1}{\tau}$$

while the impact on land prices per rupee paid in export taxes by the transition generation is

$$(19-16) \quad \frac{\partial Q_2 / \partial \tau}{\partial R / \partial \tau} (SR) = \frac{-F_T / \tau}{F_T - X - \tau [\partial X_2 / \partial p_2]}$$



which will generally be greater than  $1/r$  in absolute value. In part, this strong result is a consequence of assuming that members of the transition generation do not work, so the export tax affects only their income from land. In general, the outcome is ambiguous.

To summarize, the argument that taxpayers object to the land tax because they thereby suffer capitalization effects is probably not a good explanation for why the land tax is rarely used. Export taxes also depress land prices, and it is further shown that replacing an export tax with an equal-revenue land tax could increase land prices.

### The Land Tax Imposes More Risk on Farmers

To this point, the model has been cast in a world of perfect certainty. One of the major differences between land taxation and commodity taxation is that commodity taxation reduces risk borne by farmers. Chapter 18 has demonstrated a stronger result: any Pareto-efficient tax system will involve at least partial risk pooling using commodity or export taxation.

Treating uncertainty in an overlapping generations model can give a somewhat misleading picture of the effect of tax policy. In the long run, land prices adjust so that the rate of return on land—corrected for differences in risk—is the same as the return on other investments, so that future farmers do not bear the burden of past tax policy choices. I therefore focus on economic behavior in the second period for those individuals who have already purchased their land, thereby collapsing the model to a traditional one-period framework. Assume further that farmers consume only current income from wage earnings and land investments.

The question to be addressed in this section is: what is the magnitude of uncertainty necessary to find a single-source tax regime based on a land tax deficient in comparison with one based on an export tax? To answer this question, one must specify an exact form for the second-period utility function

$$(19-17) \quad EU = \frac{E \{x^{\phi_1} z^{\phi_2} \ell^{\phi_3}\}}{\phi_1 + \phi_2 + \phi_3}$$

subject to the budget constraint

$$(19-18) \quad px + z + w\ell = m \equiv w + [pF_T - \Gamma]T$$

where the agricultural and time subscripts can be suppressed to simplify the equations. The production function is

$$(19-19) \quad F = T^{1-\varepsilon}[1 - \ell]^{\varepsilon}[1 + \epsilon]$$

where  $\epsilon$  is the random variable, such as rain, reflecting unexpected differences in productivity.<sup>15</sup>

The model is straightforward to solve using iterative methods; the solution technique is described in the appendix to this chapter. Initially, optimal labor and commodity choices are determined given a particular level of export taxation  $\tau$  and degree of riskiness. Then the export tax is removed, and a land tax  $\Gamma$  is imposed at a rate such that expected utility is equal to the benchmark case with export taxation. That is,  $\Gamma^*$  satisfies the identity

$$(19-20) \quad E V(1 - \tau, m(\tau, 0; \epsilon)) = E V(1, m(0, \Gamma^*; \epsilon)).$$

The measure of the efficiency gain or loss is the difference between revenue raised under the land tax,  $\Gamma^*T$ , and the revenue raised under the export tax. The difference is the compensating variation with utility held at its original value.

I assume a binomial distribution with  $\epsilon = +\omega$  or  $-\omega$ , each with probability 0.5. The coefficient of variation, or the ratio of the standard deviation to average output, is approximately  $\omega$ . Other parameters are  $g = 0.5$  and  $T = 1$ . Recall that switching from export taxation to land taxation will harm the urban sector because the domestic price  $p$  will rise from  $(1 - \tau)$  to 1. Land tax revenue is therefore defined to be revenue net of the amount necessary to compensate urban residents for the higher price of  $x$  (equivalently, one can assume that all marketed production of  $x$  is exported). Finally, the utility function parameters are initially set at  $\phi_j = 0.1$ ,  $j = 1, 2, 3$ , yielding a measure of constant relative risk aversion of 0.7 (equal to  $1 - \sum \phi_j$ ), well within the range of 0.3 to 1.7 estimated for the majority of Indian rice farmers (Binswanger 1980).

Results are shown in table 19-1, rows 1-3. The numbers shown are a measure of compensating variation as a fraction of initial full income  $m$ . The value is positive if the land tax is more efficient, and negative if the land tax is less efficient. For example, when there is no uncertainty, the efficiency gain of replacing a 50 percent export tax with a land tax is 7.40 percent of total income, or 27.6 percent of revenue collected. As the uncertainty in production becomes more pronounced, the export tax can dominate land taxation.<sup>16</sup> A 10 percent export tax can benefit farmers who face uncertainty; even when the coefficient of variation is 0.2, the export tax is as efficient as the land tax. But for higher export tax rates, the land tax is more efficient even for large degrees of uncertainty.

Table 19-1 also reports results for alternative parameters of the utility function when  $\phi_j$  is scaled down to  $-0.5$  (leading to an Arrow-Pratt measure of 2.50), and up to  $\phi_j = 0.2$  (an Arrow-Pratt measure of 0.4). The benefits of an export tax are greater for those with greater aversion to risk, but the qualitative conclusions are similar.

It is likely that these calculations overstate the benefits of the reduced risk provided by the export tax. The absence of credit markets in rural areas does not mean that farmers are forced to consume their current net income, as is

Table 19-1. *Welfare Effects of Replacing an Export Tax with a Land Tax*

Percentage of income <sup>a</sup>	Coefficient of variation			
	0.0	0.1	0.2	0.4
Export tax	<i>Relative risk aversion = 0.7</i>			
10 percent	0.12	0.09	0.00	-0.64
30 percent	1.61	1.64	1.33	-0.96
50 percent	7.40	7.81	7.40	2.43
Export tax	<i>Relative risk aversion = 2.50</i>			
10 percent	0.12	0.05	-0.22	-1.57
30 percent	1.61	1.42	0.38	-4.91
50 percent	7.40	7.18	4.79	-7.84
Export tax	<i>Relative risk aversion = 0.4</i>			
10 percent	0.12	0.11	0.03	-0.44
30 percent	1.61	1.68	1.51	-0.08
50 percent	7.40	7.92	7.88	4.86

a. Expressed as a percentage of initial full income  $m$ . Positive value denotes welfare gain from shift to land tax, negative value denotes welfare loss.

assumed in the model above. While farmers may find it difficult to borrow, they are not prevented from saving. As Deaton (1989) has emphasized, farmers can insure against part of their income risk with precautionary saving, even in the absence of credit markets.

In chapter 18 Hoff demonstrated that a combination of a land tax to raise revenue and an export tax to stabilize income Pareto-dominates either tax in isolation. There is an optimal tradeoff between the insurance benefits of an export tax and the improved incentives of a land tax. If a nondistorting insurance program were possible that reduced  $\omega$  to zero, it would yield the efficiency gains shown in the first column of table 19-1.

In Uruguay cattle ranchers face substantial uncertainty from international fluctuations in beef prices. Jarvis and Medero (1988) have argued that the central government collects revenue from the land tax and uses variable export tax rates to dampen the international price oscillations, as well as to shield urban beef consumers from domestic price swings. Thus the government in Uruguay uses both export and land taxation to raise revenue and reduce risk.

### Administrative and Evasion Costs under a Land Tax

In theory, the problem of collecting land taxes is straightforward: conduct a cadastral survey that assesses the market or site value of each plot of land, and send a tax bill to each owner. In practice, cadastral surveys are expensive

and time-consuming, tax offices are short on assessors, assessments are eroded by inflation, and courts are often swamped by appeals from irate landowners.<sup>17</sup> As Richard Bird's classic book on land taxation argues:

[T]he administrative constraint on effective land tax administration is so severe in most developing countries today that virtually all the more refined fiscal devices beloved of theorists can and should be discarded for this reason alone. Not only will they not be well administered; they will in all likelihood be so poorly administered as to produce neither equity, efficiency, nor revenue. (Bird 1974, p. 223)

The careful survey by Strasma and others (1987) provides recent documentation of the difficulties inherent in the effective administration of the tax.

The purpose of this section is to provide a model of why countries have had a much harder time administering the land tax than other types of tax. The strong incentive to misrepresent the true value of one's land leaves the government with a difficult choice of either allowing widespread evasion or spending valuable resources to enforce compliance. For example, the administrative cost of the land development tax in Bangladesh during the mid-1980s was more than half the tax revenue. These administrative costs must be reckoned as real resource costs—just like traditional Harberger efficiency cost of distortionary taxation.<sup>18</sup> Few commodity or trade taxes entail efficiency costs in excess of 50 percent of tax revenue.

Once again the general model from the first section is specialized to address the issue at hand. As in the third section, I abstract from capitalization effects, and focus instead on second-period production decisions of landowners. It is assumed that all life-cycle capital is invested in land. Since the primary focus here is on equity and utility *among* farmers of different types, I assume that all marketed sales of  $x$  bypass the urban sector and are sold in export markets.

Assume there are two types of people with identical farm plot sizes. Normalize the population size of each group at unity. Person  $n$ , the benchmark (normal) individual, supplies  $L_n = 1 - \ell_n$  units of labor and owns  $T$  effective units of land. The high-quality farmer (person  $h$ ) is endowed with  $\xi > 1$  units of effective labor (that is, he is a more productive worker) and  $\beta T$  effective units of land, with  $\beta > 1$ . Utility for each person is given by  $V_i = EV(p, w_i, m_i)$  where the implicit wage  $w_i$  may differ across types. Expected full income is written

$$(19-21) \quad \begin{aligned} Em_n &= \omega_n + \{pF_{Tn} - [1 + \pi_2(\beta - 1)]\Gamma\}T \\ Em_h &= \omega_h + \{pF_{Th} - [\beta - \pi_1(\beta - 1)]\Gamma\}T \end{aligned}$$

With probability  $\pi_1$ , the administrative agency incorrectly assesses the high-quality land as normal land, and with probability  $\pi_2$  normal land is incorrectly assessed as high-quality land (see Stern 1982).

The probability  $\pi_1$  (or, in a group of many farmers, the fraction who are

misassessed) is endogenously determined as an optimal response by each individual to the tax premium on high-quality land  $\Gamma[\beta - 1]$  and administrative effort, measured as administrative costs per unit of land  $c$ . Thus,  $\pi_1 = \pi_1(c, \Gamma[\beta - 1])$ , with  $\pi_{11} < 0$  and  $\pi_{12} > 0$ , with the second subscript denoting the derivative with respect to the  $i$ th argument.<sup>19</sup> Similarly, the higher the administrative effort or cost  $c$ , the less likely that low-quality land is misassessed;  $\pi_{21} < 0$ . Noting that total physical land area is  $2T$ , revenue net of administrative costs is

$$(19-22) \quad R' = r[x_n^* + x_h^*] + [1 + \beta + (\pi_2 - \pi_1)[\beta - 1]\Gamma]T - 2cT$$

where  $x_i^*$  is net marketed sales of the tradable good.

Assume no administrative costs of the export tax. This is an obvious simplification; the point is that the export tax is administered at a central shipping area or airport and typically entails low costs of administration. Smuggling can be discouraged by imposing large penalties for avoiding export taxes, even if not every smuggler can be caught. By contrast, it is difficult to impose large penalties for underreporting land quality, since reasonable people may differ over the “true” value of land (Skinner 1990).

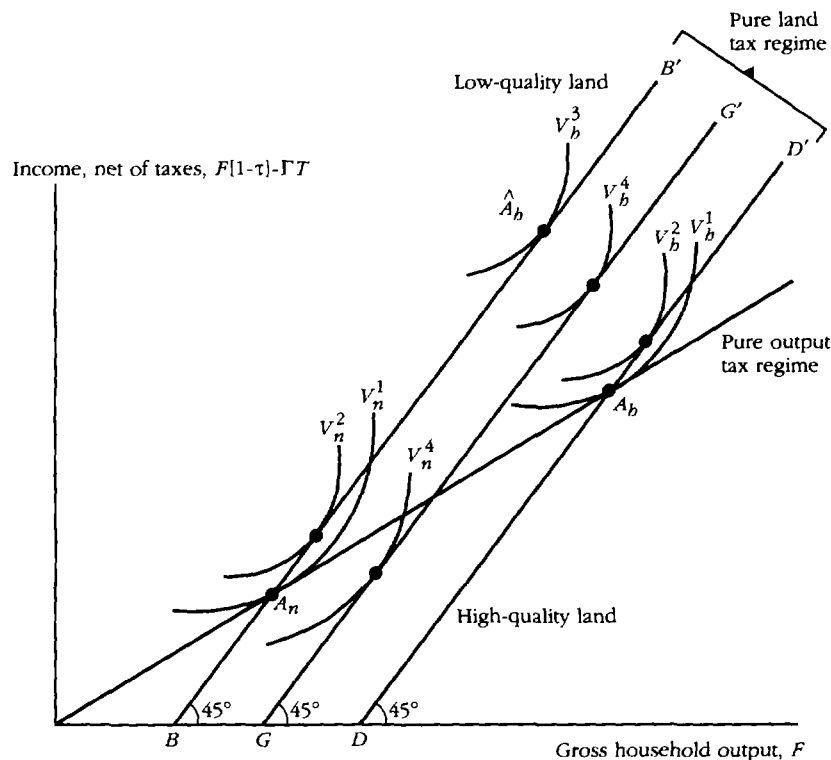
Figure 19-1 plots after-tax income against original income. Assume that all production of the  $x$  good is marketed and not consumed so the after-tax income line is straight.<sup>20</sup> Given a pure output tax regime, the two types will reveal their productive capacity through their marketed output and locate on a “separating equilibrium” (see, for example, Stiglitz 1987 or Stern 1982): person  $n$  at  $A_n$  and person  $h$  at  $A_h$ . Tax authorities need only collect the tax per unit of output, rather than determine who is a high- or low-ability farmer.

If tax authorities can identify which land is the high-quality land, a more efficient tax on land area can be assessed. Lines  $BB'$  and  $DD'$  reflect the after-tax budget lines of the low-quality and high-quality type, respectively, under a pure land tax regime yielding the same revenue as the output tax regime did. Each farmer will be better off at  $V_n^2$  and  $V_h^2$ . The problem, however, is the self-selection criterion—unlike the commodity tax regime, type  $h$  farmers will be better off to represent their land value as low-quality, and attain utility level  $V_h^3$ . The model presented above reflects this tendency toward a pooling equilibrium; unless real costs are expended to forcibly separate high-quality from low-quality landowners, everyone will represent himself as an owner of low-quality land.

Of course, one option would be to base the tax only on land acreage. In the model above, each farmer owns the same acreage, so each would pay the same tax and face budget line  $GG'$ . Note that while this tax is perfectly efficient, it is less equitable, since the utility of type  $n$  farmers drops to  $V_n^4$ , while the type  $h$  farmer’s utility rises to  $V_h^4$ . As the diagram is drawn, the normal farmer’s utility declines relative to utility under the export tax.

Is it therefore better for the government to spend more money on admin-

Figure 19-1. Incidence of a Pure Output Tax and a Pure Land Tax Paid by Two Types of Farmers



Note:  $h$  = highly productive farmer;  $n$  = normal farmer.

istration to ensure that type  $h$  owners declare their land truthfully? Not necessarily, since administration costs reduce net revenue (also see Kaplow 1989). In general, to raise more revenue from the land tax, the government is faced with two choices: either spend more on administration or raise the rates. In the derivations below, it is shown that neither option may be socially efficient at the margin, relative to an export tax.

Since we are concerned here only with different types of farmers, let  $\Omega = \Omega(V_n, V_h, \cdot)$ , with  $\psi_i \equiv (\partial\Omega/\partial V_i)(\partial V_i/\partial m_i)$ ,  $i = n, h$ , and  $\psi_n$  normalized to 1 (so that for a concave social welfare function,  $\psi_h < 1$ ). Then the marginal social cost of raising \$1 in revenue from an export tax can be derived using Roy's identity:

$$(19-23) \quad \lambda'_\tau \equiv -\frac{\partial\Omega}{\partial\tau} / \frac{\partial R}{\partial\tau} = \frac{x_n^* + \psi_h x_h^*}{x_n^* + x_h^* + \tau \left[ \frac{x_n^*}{\partial\tau} + \frac{x_h^*}{\partial\tau} \right]}$$

Once again, the numerator is weighted by the relative value of income in the social welfare function.

Another option available to the tax administrators is to increase spending on administration, with a shadow cost of

$$(19-24) \quad \lambda'_c \equiv -\frac{\partial \Omega}{\partial c} / \frac{\partial R}{\partial c} = \frac{[\pi_{12} - \psi_h \pi_{11}][\beta - 1]}{[\pi_{21} - \pi_{11}][\beta - 1] - 2/\Gamma}$$

This method of raising taxes is equitable since type *n* farmers are likely to pay less in taxes ( $\pi_{21} < 0$ ) and type *h* farmers more ( $-\pi_{11} > 0$ ). But spending money on tax administration makes little sense when statutory rates  $\Gamma$  are low. It may be socially inefficient (no matter how equitable) to increase *c* if the consequent tax revenue collected is minimal.

Finally, the simplest choice available to the government is to simply raise the statutory tax rate  $\Gamma$  holding *c* constant. The shadow cost of raising revenue by increasing the land tax rate is

$$(19-25) \quad \lambda'_\Gamma \equiv -\frac{\partial \Omega}{\partial \Gamma} / \frac{\partial R}{\partial \Gamma} = \frac{1 + \pi_2[\beta - 1] + \psi_h[\beta - \pi_1[\beta - 1]]}{1 + \beta + [\pi_2 - \pi_1][\beta - 1] - \Gamma\pi_{12}[\beta - 1]^2}$$

Raising the statutory tax rate  $\Gamma$  is not equitable if, for example, the degree of existing tax evasion by type *h* farmers is high. The denominator suggests further that the effective tax revenue collection from increasing the statutory rate  $\Gamma$  may be diminished if as a consequence evasion becomes more widespread. Hence, revenue is not simply a constant proportion  $\Gamma$  of total quality-adjusted land  $1 + \beta$ .

The following example illustrates how one might compare the three tax choices. Assume that high-productivity farmers enjoy only half the weight of normal farmers in the social welfare function ( $\psi_h = 0.5$ ), high-quality land is assessed at double the value of normal land ( $\beta = 2$ ), the land tax  $\Gamma$  is 2.5 percent of the market value for land (normalized to one), the existing evasion rate is 25 percent ( $\pi_1 = 0.25$ ), the export elasticity is 1.0,  $\pi_2$  is zero, and  $\pi_{11} = -100$  and  $\pi_{12} = 50$ . Assuming that  $\pi_{11} = -100$  means that an increase in administrative expenses of 0.1 percent of land value reduces evasion by 10 percent. Assuming that  $\pi_{12} = 50$  means that increasing statutory rates by 10 percent (from 0.025 of land value to 0.0275) increases evasion by 5 percent. Then the calculated values of the shadow prices  $\lambda'$  of raising \$1 of extra revenue through an increase in the export tax rate, land tax assessment effort, or land tax rate, are<sup>21</sup>

$$\begin{aligned} \lambda'_\Gamma &= 0.95 \\ \lambda'_c &= 2.50 \\ \lambda'_\tau &= 1.25. \end{aligned}$$

For these illustrative parameters, the export tax is the *least* costly way of raising revenues. In sum, accounting for the overall cost of the tax system (Slemrod 1990) inclusive of administrative and evasion costs, rather than

just the distortions under particular tax rates, alters the traditional comparison of the land tax versus the export or commodity tax.

## Conclusions and Discussion

Despite the theoretical pedigree of the agricultural land tax, its empirical importance in raising central government revenue continues to slide. This chapter has proposed three reasons why the land tax has been allowed to decline in importance. First, current generations of landowners may suffer large capital losses if land prices decline by the full present value of future tax assessments. But this is not a convincing explanation for why land taxes are now rarely used, since export taxes also depress land prices. In fact, replacing an export tax with a land tax could increase land prices.

The second reason is that relative to an export tax, the land tax thrusts more uncertainty upon the farmer. Regardless of the crop outcome, the land tax must be paid. However, numerical calculations suggested that the degree of uncertainty about farm income must be very large, and (in general) the level of taxation low, before an export tax is preferred to a land tax. Furthermore, the combination of both the land and export tax will Pareto-dominate either in isolation (chapter 18).

Finally, administering the land tax is difficult. Farmers with high-quality land have a strong incentive to represent it as low-quality land. Since there are few penalties for underassessment, real resources must be expended by the government to prevent the land tax from collapsing to a pooling equilibrium in which all farmers pay the same fee per acre. Once administration costs are included, the land tax may be less efficient than an export tax.

Is this last problem—which I view as the most important defect of the land tax—a fatal shortcoming? When markets for land are thin or incomplete, the difficulty of assigning market value or net income to each parcel is likely to ensure that such land taxes are rarely used. But there are alternative methods of collecting land tax that avoid the necessity of tax assessors' placing a market value on each parcel with periodic updating. For example, a crude index of land quality depending on the soil type, distance from major roads, and irrigation facilities can be determined for each plot of land. The tax assessment could then be calculated by multiplying the year-specific tax rate by the permanent index, thereby avoiding the necessity for yearly reassessment.

Such a procedure holds promise, especially as technological methods of mapping and soil quality assessment improve. However, it is unlikely that the tax rate could be set at a high level, since net income from land may vary widely even within these crude assessments of quality, leading to horizontal inequities. My suspicion is that the administrative difficulties of collecting



land taxes will ensure their continued decline in providing central government revenue in developing countries.

Local government land taxation apparently has not experienced the same decline in use.<sup>22</sup> One explanation may be that local governments have few other tax instruments available to them. Commodity taxes may be easily evaded, export taxes are unavailable, and income taxes in rural areas are impossible to administer. In this view, land taxes may be unappealing to local governments, but there are no better alternatives. Furthermore, modest local government revenue requirements imply a lower tax rate, reducing evasion and allowing for a simpler tax structure.

One shortcoming of the analysis to this point is that government tax choices are presumed to be guided by efficiency or equity considerations. An alternative view is that land taxation is more efficient and equitable than export taxation, but political barriers and vested interests have blocked its use. This is a theme often sounded in previous studies:

The weakness of land taxation is that while it arouses the opposition of the landed interests, it does not hold out an obvious appeal to any other important group. (Hirschman 1964, p. 433)

Examples of political opposition blocking land taxation abound. For instance, a 1986 World Bank-financed project in Argentina laid the administrative groundwork for a new land tax designed to reduce the nation's heavy reliance on export taxes. Agricultural political groups, viewing the proposed tax as yet another in a long history of revenue transfers from agriculture, effectively scuttled the proposal (Trapido 1988).

The historical evidence may appear perplexing in light of two results from the third section of this chapter that imply that large landowners *should* support a revenue-neutral shift from export to land taxation. First, switching to a land tax may increase the value of land through capitalization effects. And second, replacing the export tax increases the domestic price of the tradable good and consequently benefits landowners at the expense of urban consumers. Why, then, the strong opposition to land taxation from landowners? The answer is that historically, land tax increases were rarely paired with export tax cutbacks. In Argentina, for example, the government made no pledge to reduce its export tax once the proposed land tax was implemented. Political objections by landowners were not surprising under those circumstances. By contrast, landowners in Uruguay during the late 1960s actively supported a land tax paired with a cut in export taxes (Jarvis 1986, 1987).

The question still remains as to why landowners object more vehemently to increased land taxes than to increased export taxes or various forms of implicit taxation. Perhaps the land tax is unpopular because it is explicit rather than implicit. Standard economic models do not admit any such

difference between the two taxes. But there is some evidence that explicit tax payments generate more taxpayer resistance than implicit taxes collected at an intermediate stage of production, although such effects are difficult to measure.<sup>23</sup> Still, the secular decline of central government land tax revenue is a good example of how administrative difficulties can outweigh textbook efficiency.

## Appendix: A Model of Uncertainty

The utility function in equation 19-17 can be expressed in its indirect form:

$$(19-26) \quad V(\tau, \Gamma; \epsilon) = [\phi_1 + \phi_2 + \phi_3]^{-1} \frac{m(\tau, \Gamma; \epsilon)^\phi}{[1 - \tau]^\phi \phi_1 + \phi_3 F_L(\epsilon) \phi_3}$$

where  $\phi = \phi_1 + \phi_2 + \phi_3$ . Note that  $m$  must be derived implicitly, since  $F_L$  and  $F_T$  both depend on the marginal product of labor,  $1 - \ell$ , while the leisure demanded depends on total income  $m$ . The inner loop of the simulation therefore solves first for the optimal  $\ell$  conditional on the realization of  $\epsilon$  and the tax and uncertainty parameters. The expected value of the indirect utility function is  $0.5[V(\tau, \Gamma; 0.5) + V(\tau, \Gamma; -0.5)]$ .

Revenue is written

$$(19-27) \quad R' = \tau[w[1 - \ell] + F_T T - x] + \Gamma T.$$

In the counterfactual, the export tax is replaced with the land tax. This tax is adjusted using iterative methods in the outer loop until expected utility is equal to the baseline case of the export tax. If more revenue can be raised under the land tax holding expected utility constant, then the land tax is more efficient, and conversely. (The BASIC program is available from the author upon request.)

## Notes

The author is especially grateful to Karla Hoff for insightful suggestions, and to three anonymous referees for helpful comments.

1. The time-series pattern of other countries not mentioned in the text has also exhibited a strong downward secular trend in land taxation (Bird 1974, pp. 34-35; Skinner 1990). One problem with the statistics on land taxation is that the International Monetary Fund statistics used by Strasma and others do not report local government land tax revenue for many countries. Local governments appear to have been more successful in maintaining land taxes. The contrast between central and local government agricultural tax policy is discussed briefly at the end of this chapter.

2. Slemrod (1990) emphasizes the distinction between optimal taxation and opti-

mal tax systems. Land taxation is an optimal tax, but may not be an optimal tax system once administrative expenses are accounted for.

3. Bird (1974) reached a similar conclusion in his international comparisons of agricultural land tax administration.

4. See Bird (1974) and Strasma and others (1987) for more detailed discussions of different land tax systems.

5. Adding a capital income tax on  $rK$  would complicate the model without changing the basic results.

6. The young provide labor and the old own land. When the production function is nonlinear, shifts in, say, labor supply by the young affect the return to land for the old. This "pecuniary externality" is ruled out by assumption to simplify the analysis.

7. One cannot determine the optimal tax rates using this procedure because local, not global, parameters are used in the marginal assessment.

8. The capitalization effect derived above depends crucially on the assumption that the marginal product of land is unaffected by the supply of capital and that the interest rate is held constant. If the land tax encourages capital accumulation, and the marginal product of land is thereby enhanced, the capitalization effects will be less than  $1/\tau$  (Chamley and Wright 1987).

9. Equation 19-10' is derived by using  $dQ_2/d\Gamma = -1/\tau$  from the arbitrage condition,  $\partial V_2^a/\partial m_2 = [(1 + \delta)/(1 + r)](\partial V_1^a/\partial m_1)$  from the Euler equation, and normalizing  $(\partial \Omega/\partial L_b)(\partial V_1^a/\partial m_1) \equiv 1$ .

10. As discussed in note 8, in an overlapping generations model with endogenous capital, a land tax will generally increase the stock of reproducible capital, reduce the interest rate, and hence cushion the capitalization effects (Chamley and Wright 1987).

11. The assumption of perfect capital markets is a strong one, especially for developing countries. But capitalization effects hold even with imperfect capital markets. However, this model neglects the important role of land equity as collateral in rural credit markets (see chapter 12).

12. See Feldstein (1977) and Chamley and Wright (1987) for detailed analyses of the impact of land taxation on capital accumulation.

13. Note that time subscripts can be dropped from  $F_T$  and  $F_L$  because the production function is linear.

14. This can be shown by taking the present value of  $\lambda_r$  and  $\lambda_T$  across generations. The ratio of the loss in social welfare to revenue collected across all generations is 1.0 for the land tax, and assuming that  $\psi_b = 1$  (to abstract from redistributive issues), this same ratio always exceeds one for the export tax.

15. I assume labor supply is chosen after  $\epsilon$  is revealed to the farmer. Allowing  $\ell$  to be chosen before  $\epsilon$  is revealed will increase the impact of uncertainty on production decisions.

16. These calculations do not account for the increased risk assumed by the government under an export tax. Also, it may appear that for some parameters, the efficiency gain of a land tax increases when the coefficient of variation rises from 0.0 to 0.1. The puzzle is resolved by noting that the absolute gain from land taxation is less when the coefficient of variation is 0.1, but  $m$  declines by even more, causing the ratio to rise.

17. Strasma and others (1987) suggested that the administrative capability of the government is overwhelmed if 5 percent of landowners appeal their tax assessments.

18. Of course, administrative costs of land taxation in Bangladesh also yield social benefits by maintaining records of landownership.

19. The function  $\pi_1$  could be derived using the standard model of expected evasion in which the individual's decision to evade depends on the probability of an "audit" or assessment (implicitly a function of  $c$ ), the gains from evading  $\Gamma[\beta - 1]$ , and the penalty of being caught (see Allingham and Sandmo 1972). One problem with this type of model is that it would predict that everyone should evade, since the penalties are rarely large enough to justify reporting land quality truthfully (Skinner and Slemrod 1985).

20. This assumption need not be maintained for the analytical derivations below.

21. Additional parameter assumptions are that effective labor units on high-quality land,  $\xi$ , are 2 (implying, with  $\beta = 2$ , that  $x_n^* = 2x_n^*$ ), and the existing export tax rate  $\tau$  is 30 percent. Letting  $\eta_c$  be the export elasticity, the calculations are:

$$\lambda'_r = \frac{x_n^*[1 + .5 \times 2]}{3x_n^*[1 - \tau\eta_c]} = 0.95 \quad \text{from equation 19-23,}$$

$$\lambda'_c = \frac{.5 \times 100}{100 - 2/.025} = 2.50 \quad \text{from equation 19-24, and}$$

$$\lambda'_r = \frac{1 + .5[2 - .25]}{3 - .25 - .025 \times 50} = 1.25 \quad \text{from equation 19-25.}$$

22. There are no comprehensive statistics on local government use of agricultural land taxation.

23. As Nicholas Stern has pointed out, Mrs. Thatcher lost political ground over a very explicit poll tax. Her support for the poll tax was precisely to make explicit—and presumably less popular—the financing of local councils dominated by the Labour Party.

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*Targeting Taxes and Transfers:  
Administrative Costs and Policy Design  
in Developing Economies*

*Timothy Besley*

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*It is often argued that administrative and compliance costs are responsible for the shape of tax and transfer systems in developing countries in significant ways. This chapter discusses what these costs are and how policies may be adapted to these constraints. It derives (a) a cost-benefit rule for the reform of commodity taxes in the presence of administrative costs, (b) the value of using indirect indicators of income as a basis for both tax and transfer programs, (c) precise conditions under which it is better to pay officials responsible for the collection of taxes an efficiency wage rather than their reservation wage, and (d) the value of rural works projects and public provision of private goods as self-targeted income redistribution measures.*

WHILE THE TAX AND TRANSFER SYSTEM in force in any particular developing country is in large part a product of that country's special social and economic structure, there are still some interesting things that many seem to have in common (Tanzi 1987). Of particular note is the heavy reliance on trade and commodity taxes. Compared to more developed countries, developing countries make little use of income taxes. On the transfer side, things are not as well documented and, in the wake of recent structural adjustment programs, there has been much change. Even a casual inspection of the evidence suggests that food subsidy schemes and public provision programs, especially for health and education, are important. In line with the relative unimportance of income taxes, income transfers are little used.

Such stylized facts are hardly surprising. For many sectors of developing countries, income-based tax or transfer programs are an unrealistic option. Not the least of the difficulties would be the task of measuring the incomes of millions of individuals who do not currently fall under the ambit of income-based tax or transfer programs. Some of the difficulties are conceptual: for example, how should the livestock depreciation of a small farmer be treated? But similar problems arise in developed countries in implementing anything closely approximating a tax on Haig-Simons or Hicksian income.<sup>1</sup> It is unlikely, therefore, that conceptual problems are a serious barrier to the operation of income-based tax or transfer programs in developing countries. Instead, the problems are intensely practical. The administrative costs of establishing an infrastructure to implement policies that require a detailed appraisal of all individuals' incomes would be immense.

Imperfect information plays a central role in the analysis of tax design. Indeed one of the main components involved in running a tax system is collecting and processing information. There are two aspects of imperfect information that are worth keeping distinct. First, there are problems of imperfect information that are *strategic*. These arise in situations where one agent has private information that the government would like to use for tax or transfer purposes. Such problems motivated the analysis of optimal income taxation pioneered by Mirrlees (1971). When such problems exist, taxes need to be made *incentive-compatible*: taxpayers need to have an incentive to reveal truthfully information that is relevant to the policymaker.

Not all problems of imperfect information are *strategic*. A second kind of uncertainty is about the environment in which policymaking takes place. Governments may be uncertain about key behavioral parameters, such as demand elasticities, or may not know the average per capita income in a region of the country. Imperfect information of this kind is also pervasive, especially in developing countries. The development of administrative capacity for tax purposes is in large measure the process of accumulating information about the environment and about individuals, the end being to enhance the sophistication of the policies that are possible. Particularly important is increasing the ambit of income-based taxes and transfers.

When the administrative infrastructure is weak and information poor, it may be worthwhile to implement policies that economize on information and play to the strengths of the existing administration. History may matter in important ways. For example, the long experience that India has had with rural public works projects may make such policies attractive even if implementing them in another country without that history is not.

One must be wary of ignoring administrative considerations in policy design. A policy that is unsophisticated yet well administered may be better than a more sophisticated policy administered incompetently. This possibility is considered in Stern (1982), who shows that an income tax may dominate a lump-sum tax if the latter is subject to errors in administration.

Administrative considerations might also help to explain the widespread use of trade taxes in developing countries. Ports provide a convenient location at which goods can be taxed. Chapter 19 showed that an export tax can dominate a land tax if the assessment of land quality is subject to error. Even trade taxes, however, may exceed a country's administrative capacity. In Ghana, for example, taxation of cocoa exported through official channels has led to smuggling to neighboring Togo and Côte d'Ivoire.<sup>2</sup>

The remainder of this chapter is organized as follows. In the next section, we consider the problem of building institutions to administer taxes. Most models of optimal taxation forsake consideration of such concerns.<sup>3</sup> The third section introduces administrative costs into a model of tax reform and examines some implications of this. In the fourth section, we consider using imperfect indicators of income for tax purposes. We illustrate the analogy between this and the use of random taxation. The fifth section considers transfer policies when incomes cannot be measured, while the sixth section considers corruption in tax collection and applies the efficiency wage model, developed in Calvo and Wellicz (1979) and Shapiro and Stiglitz (1984), to this issue.

### **Building Institutions to Administer Taxes and Transfers**

Most countries have had, and some retain, traditional methods for collection of agricultural taxes that are assessed locally. For example, India has a long history of agricultural taxation based upon fairly detailed evaluation of landholdings and output (Angrish 1972). The assessment of such taxes is vested primarily in localities and they are often levied in kind. Throughout rural Africa, agricultural taxes assessed and collected at the local level have also been important. Personal taxes that are variously described as poll, hut, or village taxes have been levied depending on a person's circumstances, very often as perceived by local chiefs (Bird 1974, chapter 2). Those assessing the taxes typically have good information about the local residents, their endowments and circumstances, so that the strategic information problems that we referred to above seem to have not been serious. The problem of tax compliance under such systems is also diminished because the benefits from tax revenues raised can often be directly perceived by the taxpayer. Personal taxes of the kind described here have provided significant tax revenues in some countries. In Nigeria, for example, they constituted 48 percent of tax revenues raised in 1960–61 (Bird 1974).

Such systems are effective, however, only when the social and economic structure permits. The process of economic development to some extent erodes the institutions by which taxes are locally levied. For example, populations become more mobile and kinship less important. The benefits of



taxes may also seem remote, perhaps concentrated in urban areas. This in turn increases the compliance problem. Consider, for example, the case of Zaire's *impôt indigène* (a long-standing system of taxation), which while responsible for 46 percent of government revenues in 1900, constituted only 3 percent by 1958 (Bird 1974). There also seems to be a widespread view that the level of corruption increases in the early stages of economic development (Huntington 1968). If correct, this makes the task of developing an adequate administrative capacity for taxation all the more difficult. Many developing countries therefore find themselves in a hiatus created by the breakdown of many traditional forms of tax collection, yet lacking the institutions to adopt the tax structures currently used in the developed world.

The policy problem is thus to build a tax administration that can tax the rural sector efficiently and fairly. To do this, the government must find out who the taxpayers are and how much they earn, and then enforce compliance with the tax code. One possibility is to exploit existing institutions for purposes of taxation: for example, levying taxes administered by village councils. The rich social and economic structure of village life is thus harnessed as a revenue-extracting tool. This is a familiar story in the colonial history of some countries. There are, however, limits to revenue extraction by such means. To the extent that it becomes a tool for funneling funds out of the village, it may tend to undermine the motivation underpinning the original institution, and it may induce populations to choose a more atomistic existence. The alternative is to build bureaucracies to administer taxes and to decentralize them in rural areas in order to build up local expertise among tax agencies. This pattern has been widely followed (Radian 1980). It has not, however, been without its problems.

Following Bird (1983), we will divide the tasks involved in levying taxes into three parts: to identify taxpayers, to assess the tax that they should pay, and to collect the tax. These may be thought of as the "three E's" of tax administration: enumerate, estimate, and enforce. There are many criticisms of the way in which developing countries have attempted to organize these activities. The main ones are:

- An excessive number of different taxes with different rate structures that dilutes the expertise of tax administrators, since a small staff typically has to administer all of the taxes.
- The confusing way that tax law is written and the absence of manuals to consult.
- The dearth of information available to the tax administration to check and cross-check taxpayers. Since populations are mobile, it may not be possible to trace many individual taxpayers. Since much trading is informal, there is often very little documentary evidence to provide a basis of investigations. In any case, tax inspectors have few weapons with which to investigate noncompliance.

- Poor training and pay of tax inspectors, resulting in low quality and corrupt administration. The legal sanctions to enforce punishments on either taxpayers or inspectors who do not comply with the law are typically rather weak.

Each of these factors increases the costs of raising a given tax and limits the array of taxes that can be profitably levied.

Behind all this lies a problem that a culture of tax compliance has not yet emerged. Traditional tax systems in rural areas have been sustained by a combination of commitment to other individuals in the community and the tangibility of benefits from taxation, although, as we noted above, this may diminish as more funds are funneled out of the community. Hence, neither of these motives may be so strong when taxes are levied by a central administration, which makes the task of extracting resources from rural areas to finance urban development more difficult. Thus, taxing agricultural commodities has been the *sine qua non* for the latter. Noncompliance with taxes may also have contagion effects, because some taxpayers regard it as unfair that they should have to pay taxes when others do not. Similarly, the dishonesty of tax inspectors may not be punished by cultural sanctions. Economic incentives may be used to induce honest behavior even though, as noted in Arrow (1970), one would rather that society developed an honor code to police the system.

Many of the problems that we have mentioned here apply equally to transfer programs. Ideally one would like to assess transfers based on a detailed evaluation of individuals' characteristics. Target populations are typically hard to identify and governments lack the administrative infrastructure necessary to make accurate assessments of who is needy.

## The Theory of Tax Reform with Administrative Costs

### *The Model*

This section develops the theory of tax reform in a model with administrative costs. While we shall not presume prior familiarity with the theory of tax reform, there is no attempt to be comprehensive. For a more detailed account, the reader is referred to Stern (1987b).

Consider a government that is implementing a set of tax reforms. In doing so, it is assumed to care about the well-being of its citizens as measured by their utility levels. In the initial equilibrium, it is taxing and subsidizing certain goods and has an administrative machinery that possesses certain types of information. Over time, there is scope for investing in tax infrastructure by collecting information pertinent to tax collection

and tax incidence. Indeed, such activities constitute an important part of tax reform procedures.

We begin by using the standard analytical framework. There are  $H$  households, each with an indirect utility function denoted by

$$(20-1) \quad v_h(q, m^h, \theta^h)$$

where  $q$  is the price vector of all goods produced and consumed by the household,  $m^h$  is lump-sum income, and  $\theta^h$  represents household characteristics. This indirect utility function summarizes both production and consumption decisions by the household. Hence, Roy's identity with respect to equation 20-1 would give the net demand or supply for each good. Any household-specific prices (such as wage rates) are part of the vector  $\theta^h$ . We shall allow the government to levy taxes only in the form of changes in the price vector  $q$ . Note that this already implies some restriction on the ability to tax; that is, the tax rate is independent of  $h$ . In principle, the government would like to implement a lump-sum tax that depended upon  $m^h$  and  $\theta^h$ . The conventional income tax system that is operated in developed countries is like a tax on an element of  $\theta^h$ , for example, the wage received, and it is enacted anonymously.

Assume that the government evaluates tax reforms according to social weights derived from the social welfare function:

$$(20-2) \quad W(V^1, \dots, V^H).$$

Letting  $t_i$  denote the per unit tax rate on good  $i$ , the government has revenues net of marginal subsidies of

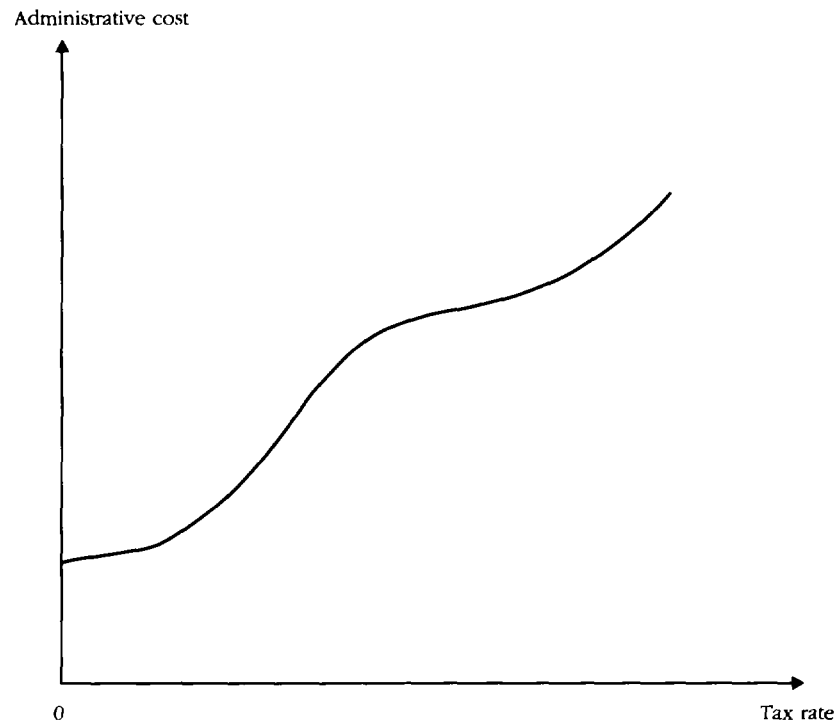
$$(20-3) \quad \sum_h \sum_i t_i x_i(q, m^h, \theta^h)$$

where  $x_i(\cdot)$  is the demand function for good  $i$ .

Taxation entails administrative costs, which we take to be a function of the tax rates levied and what we shall refer to as *tax capital*, denoted  $K$ . The latter can be thought of as the investments that the country has made in infrastructure to raise taxes. It includes both physical capital and the state of knowledge. For example, the costs of levying a tax on rice, when the government has no information about rice transactions, could be regarded as effectively infinite. The administrative costs of the tax vector  $t$  are thus:

$$(20-4) \quad F(t, K) + \tau K$$

where  $\tau$  is the user cost of tax capital. We assume that the function  $F(\cdot, \cdot)$  is increasing in  $|t|$ .<sup>4</sup> In practice, the shape of the function may be quite complicated. Figure 20-1 illustrates a typical case. There is an initial fixed cost associated with a tax and an increasing marginal cost, over some range. The function would become convex for high tax rates because of difficulties

Figure 20-1. *An Administrative Cost Curve*

involved in enforcing payment of such rates. There seems, however, to be very little evidence about the actual shape of administrative cost functions.

Putting together costs and revenues, we have the government's budget constraint:

$$(20-5) \quad \sum_h \sum_t t_t x_t^h(q, m^h, \theta^h) - R - F(K, t) - rK = 0$$

where  $R$  is the revenue required for expenditure programs.<sup>5</sup> Note that we are pursuing the issues in a static model and that we have not allowed the vector  $K$  to affect household utility directly. These are quite strong assumptions. For example, households presumably care about how taxes are collected—how intrusive and time-consuming the process of complying with the tax rules is. We shall return to this below. We turn now to considering tax reform in this framework.

Tax reforms are of two kinds: reform of tax rates given an administrative infrastructure, and reform of the infrastructure (which corresponds in this model to the accumulation of tax capital). Most of the literature to date has concentrated on the former.<sup>6</sup> It is also important to note that our adminis-

trative costs are costs of implementing a tax system and *not* those of changing taxes.<sup>7</sup> Costs of changing a system may themselves be important and affect which parts of the tax system might be chosen for attention. These are likely, in practice, to depend on political considerations as much as anything else.

### Reform of Tax Rates

Consider first the reform of taxes in the absence of administrative costs. Total welfare,  $\Omega$ , can be written in the form of individuals' welfare plus government revenue valued at its shadow price, denoted here by  $\lambda$ , so that  $\Omega \equiv W + \lambda R$ . Differentiating  $\Omega$  with respect to the tax rate on good  $i$  yields

$$(20-6) \quad \Delta_i \equiv - \sum_h \beta_h x_i^h = \text{social cost of raising the tax on good } i$$

where  $\beta_i^h$  is the social marginal utility of income of individual  $i$ , and

$$(20-7) \quad \Lambda_i \equiv \sum_h x_i^h + \sum_h \sum_j \frac{\partial}{\partial q_i} t_j x_j^h = \text{revenue from raising the tax on good } i.$$

A change in the tax rate on good  $i$  will increase welfare if  $\Omega_i = \Delta_i + \lambda \Lambda_i > 0$ , where  $\Omega_i$  is the partial derivative of the welfare function with respect to the  $i$ th tax rate;  $\Omega_i > 0$  means that the reduction in the welfare of consumers of the good is offset by the increase in tax revenues valued at their shadow price. In this framework it is easily seen that if taxes are set optimally, then cost-benefit ratios should be equalized for all commodities at an optimum; that is,  $-\Delta_i/\Lambda_i = \lambda$  for all  $i$ . Hence, for a reform to be worthwhile, tax rates should be increased on goods for which the cost-benefit ratio is below  $\lambda$  and reduced in goods for which it is more.

The modification of this argument in the presence of administrative costs is fairly straightforward. All we require is that the benefit from raising a tax be measured *net of collection and enforcement costs*. This is seen most clearly if one defines  $\mu_i \equiv [\Lambda_i - F_i]/\Lambda_i$ , where  $F_i$  is the partial derivative of the administrative cost function with respect to the  $i$ th tax rate. Obviously,  $\mu_i < 1$  when there are administrative costs associated with a tax increase. It represents the proportion of any tax increase that actually augments revenues. The condition for a marginal tax reform on good  $i$  to be worthwhile is now that  $\Omega_i = \Delta_i + \lambda \mu_i \Lambda_i > 0$ . Even this simple extension of tax reform rules can have a significant impact. Tax increases that are worthwhile on the cost-benefit test ignoring administrative costs may not be so if the leakage to administrative costs is considered. The optimal tax rule would now be to set cost-benefit ratios equal to  $\lambda \mu_i$ . This term is the shadow price times the proportion of the tax that actually finds its way into government revenues. Other things being equal, one would be less likely to advocate a tax increase for goods where  $\mu_i$  is low.

So far, we have only considered local tax reforms. If costs are as in figure 20-1, then administrative costs may introduce nonconvexities into the analysis. In particular, there may be some goods for which  $t = 0$  is an optimum given  $K$ . One obvious case, for example, is where transactions in the commodity are unobservable. Such nonconvexities would also imply that the optimal tax rule to equalize cost-benefit ratios is invalid since taxes that satisfy the first-order conditions may not raise welfare enough to outweigh the fixed cost of administering the tax.

### **Reforming Tax Capital**

There are two reasons for being interested in the reform of tax capital. First, one might wish to reduce the cost of raising tax revenue for a given tax structure. A number of countries have recently computerized tax records to lower administrative costs without wishing to implement large-scale tax reforms. The second reason for accumulating tax capital is as an instrument for the reform of tax rates. The government may wish to expand its tax inspectorate in order to combat the increased evasion that might result from an increase in taxes. A tax capital reform has direct and indirect benefits. Direct benefits accrue when the costs of levying a given set of taxes are lowered. The indirect benefits arise from being able to implement taxes that were not previously possible.

To make these ideas precise, write welfare as  $W(t) + \lambda[R(t) - F(K, t) - rK]$ . Welfare is increasing in  $K$  if

$$(20-8) \quad \sum_j \Omega_j \frac{dt_j}{dK} - \lambda[F_K + r] > 0.$$

The first term represents the indirect welfare effect of the reform on optimal tax rates, while the second is the direct welfare effect on administrative costs.

This rule is even simpler in the case where taxes are set optimally in the initial state, given the country's administrative capacity, since this implies that  $\Omega_j = 0$  for all  $j$ . Hence a marginal reform of tax capital is desirable in this case *if and only if it lowers administrative costs*. The indirect effect of the change in tax capital on optimal tax rates can be ignored. This demonstrates the importance of understanding the initial tax equilibrium when putting forward rules for tax reform. One needs to consider the indirect effects due to changes in tax rates only if it is believed that there are reasons, other than a lack of tax capital, why taxes are not being set optimally in the first place.

Note that if tax capital were allowed to enter the taxpayers' utility functions, then the simplicity of this rule would be undermined somewhat. In this case, one would need to take the direct effect on taxpayer welfare into consideration, as well as the change in administrative costs, when formulat-

ing the cost-benefit rule. For example, the cost of introducing tax collection procedures that made the lives of taxpayers more difficult would have to be weighed against the reduction in administrative costs.

### Measuring Indicators for Tax Purposes

The above analysis is best thought of as a model for the reform of commodity taxation taking account of administrative costs. There has also been much discussion of extending the tax base by taxing goods or activities that serve as signals of high income. This role is partly served by commodity taxes. For example, air conditioners are consumed disproportionately by the rich, and so are a signal of having high income. Thinking about consumption patterns in this way serves as a useful focus for thinking of other ways of broadening the tax base to include those who are normally thought of as being hard to tax.

Consider, for example, the suggestion of Bird (1983, p. 11) to establish "a set of *standard assessment guidelines* for each major economic activity, on the basis of which the income of any individual taxpayer can be estimated in a relatively objective fashion." This is likely to be compatible with the administrative constraints that many developing countries face. It also suggests the following problem. Suppose that the government cannot observe agents' incomes, although it can observe, at some cost, other things that are correlated with it, such as the size of someone's house, what durables he owns, and so on. How should such information be used for tax purposes?

Let  $y$  denote income and let  $x$  denote another variable that can be observed at cost  $c(\rho)$ , where  $\rho$  is a measure of the *informativeness* of  $x$  about  $y$ , an idea that we will make precise below. Assume that  $c(\cdot)$  is increasing and convex for  $\rho \in [0,1]$ ; that is, more informative signals cost more. To fix ideas, we consider an example in which  $x$  and  $y$  are jointly normally distributed and the utility function of an agent is of the form  $-\exp(-Ay)$ ; that is, absolute risk aversion is constant. Consider introducing a tax of  $\tau$  on good  $x$ , which is redistributed back to consumers in the form of a lump-sum subsidy denoted by  $\beta$ .<sup>8</sup> Given our assumptions about the utility function and the distribution of  $x$  and  $y$ , social welfare (measured here by the sum of utilities) is monotone in:

$$(20-9) \quad \mu_y - \mu_x \tau + \beta - \frac{1}{2} A[\sigma_x^2 \tau^2 + \sigma_y^2 - 2\rho \sigma_x \sigma_y \tau]$$

where  $\mu_i$  and  $\sigma_i$  are the mean and standard deviation of variable  $i$ .<sup>9</sup> The symbol  $\rho$  is the correlation coefficient between  $x$  and  $y$  and is a means of quantifying the informativeness of  $x$  about  $y$ . If  $\rho = 1$ , then observing  $x$  would be just as good as observing  $y$  for tax purposes, while with  $\rho = 0$ ,  $x$

provides no information. The government is assumed to be risk-neutral and to face the budget constraint:

$$(20-10) \quad \tau\mu_x - c(\rho) - \beta = R$$

where, as above,  $R$  is the revenue requirement, which we shall take to be zero hereafter. Solving 20-10 for  $\beta$ , substituting in 20-9, and setting the derivative of the resulting expression with respect to  $\tau$  equal to zero, yields:

$$(20-11) \quad \tau^* = \rho\sigma_y/\sigma_x.$$

Hence, in this simple setup that assumes that the tax imposes no deadweight loss, the optimal tax is just equal to the regression coefficient of  $y$  on  $x$ . It is clear from equation 20-11 that the optimal tax is increasing in  $\rho$ ; that is, more informative signals are taxed more highly. Since  $1/\sigma_x$  measures the precision of  $x$ , the tax is higher the more precise is the signal. It is, however, increasing in the variability of income. The value of redistributive taxation is greater, the greater is initial income inequality. Substituting equation 20-11 into equation 20-9 yields

$$(20-12) \quad V^* \equiv \mu_y - c(\rho) - \frac{1}{2} A\sigma_y^2 [1 - \rho^2]$$

as an expression for maximized social welfare.

We wish to compare welfare under optimal taxation with welfare under no intervention. It is straightforward to check that the latter is just  $V \equiv \mu_y - 1/2 A\sigma_y^2$ . Hence, the difference between welfare in the two cases is given by

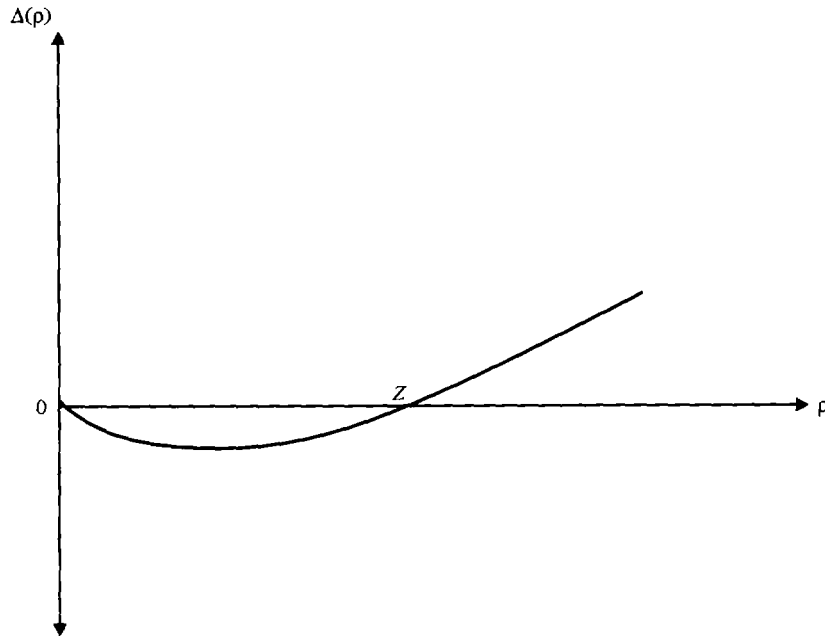
$$(20-13) \quad \Delta(\rho) \equiv V^* - V = \frac{1}{2} A\rho^2\sigma_y^2 - c(\rho).$$

The right-hand side of equation 20-13 has a convenient interpretation. The first term,  $[1/2]A\rho^2\sigma_y^2$ , can be thought of as the amount by which the tax reduces society's inequality premium, defined as the aggregate amount that society would be prepared to give up in order to equalize incomes.<sup>10</sup> Although equation 20-13 has been derived for special utility and density functions, it is valid as a second-order approximation to any case. The second term in equation 20-13 is just the cost of purchasing a signal of value  $\rho$ . Hence, in the absence of deadweight loss from the tax, whether taxing a signal of informativeness  $\rho$  is worthwhile depends on trading-off administrative costs against the reduction in inequality. The gain from levying the tax is greater the larger is  $A$ , a measure of the concavity of individual utility functions, and the larger is  $\sigma_y^2$ , the inequality in income. In more general models, incentive effects would have to be considered too.

Consider some properties of  $\Delta(\rho)$ . First we ask if, beginning with a situa-



Figure 20-2. *The Minimum Level of Informativeness at Which a Tax is Worthwhile (Point Z)*

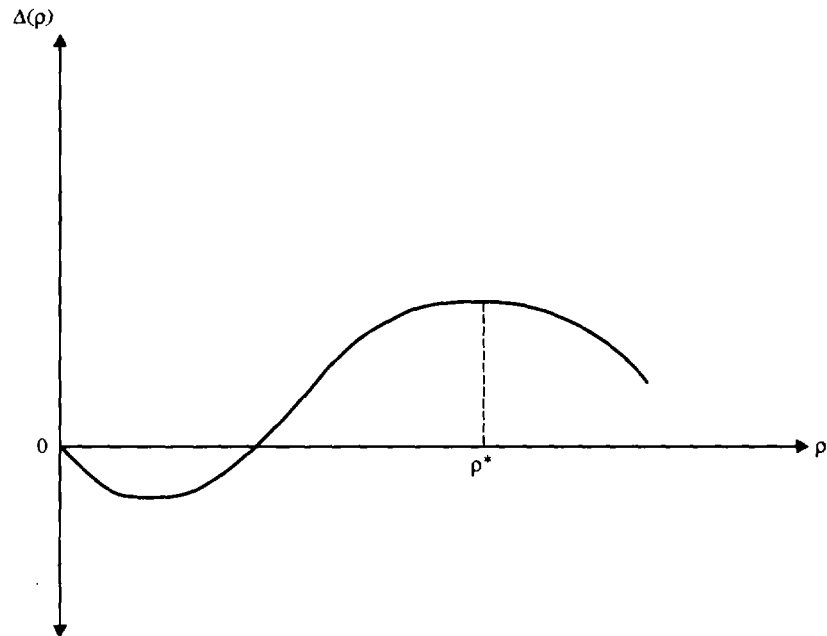


tion in which there is no tax, it would be worthwhile introducing one with  $\rho > 0$ . It is straightforward to check that

$$(20-14) \quad \Delta'(0) = -c'(0) < 0$$

Hence, introducing a tax on a barely informative signal is never worthwhile. This is just a manifestation of the nonconcavity in the value of information, first noted by Radner and Stiglitz (1981). It introduces some interesting complications into the present analysis.

Suppose, for example, that the cost function is of the form  $c(\rho) = a\rho + 1/2b\rho^2$ . Then we must have a corner solution, with either  $\rho = 0$  or  $\rho = 1$ . To see this, it is easiest to refer to figure 20-2 where we graph  $\Delta(\rho)$ . We require  $A\sigma_y^2 > b$  in order to have a turning point, which is in this case a global minimum. Whether we are at a corner with  $\rho = 0$  or  $\rho = 1$ , depends on whether point Z lies above or below  $\rho$ . A sufficient condition for  $\rho = 0$  to be optimal is that  $1/2[A\sigma_y^2 - b] - a < 0$ . In this example, taxation of an imperfect indicator of income is never a good idea. It is either worthwhile to measure the thing that we are directly interested in, that is, income (this is the corner solution with  $\rho = 1$ ) or do nothing at all (the corner solution with  $\rho = 0$ ).

Figure 20-3. *An Interior Solution*

In figure 20-3, we illustrate a case with an interior solution despite the nonconcavity that we have noted. Even with quite regular cost functions, we may have many points of inflection. This suggests the need to perform cost-benefit calculations rather carefully. This nonconcavity bounds the choice of  $\rho$  that would be made away from zero; that is, we will either choose zero or a  $\rho > 0$  that does not lie within a neighborhood of zero. This makes precise the idea that a signal is useful for tax purposes only if it is sufficiently informative; that is, if it satisfies  $[1/2]A\sigma_x^2 > c(\rho)/\rho^2$  (using equation 20-13).

This simple model can usefully be extended to the case of many indicators, that is,  $x$  can be a vector. The problem of choosing the best set of indicators from the point of informativeness about income is more difficult in this case since each signal has a  $\rho$  (a correlation coefficient with income) associated with it. It is more difficult to extend the model to allow for incentive effects and the excess burden that they give rise to. There are a number of possible cases. First,  $x$  could be manipulated in a way that does not affect income. Hence, if  $x$  is the number of square feet in one's house, then one could live in a smaller house and spend one's income on other things. Second,  $x$  could be manipulated with consequences for one's income. For example, if  $x$  is land, an individual would tend to reduce his land holdings and do more off-farm work since the latter is effectively untaxed.

It is also important to distinguish between cases where the tax rules are known versus those where they are not. In the first case, individuals reorganize their affairs anticipating correctly what taxes they will pay if they behave in particular ways. In the second, they have beliefs about the tax rules but there is some uncertainty. This is related to the question, discussed in Weiss (1976) and Stiglitz (1982), of whether random taxes are better than deterministic taxes. Not knowing the rules that are used for taxing indicators is like being uncertain about what tax rates one will face. This may actually mitigate the disincentive to work associated with a given tax.

## Transfers When Income Is Unobservable

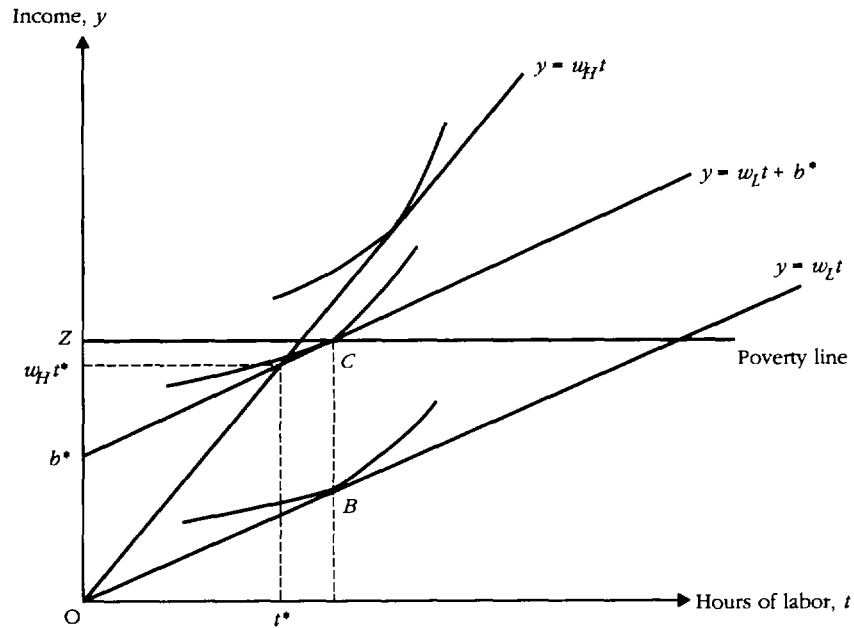
As well as presenting a limitation on the type of tax system that can be implemented, income unobservability limits the ability of governments to implement transfer programs to reduce poverty. The purpose of this section, therefore, is to discuss three alternatives to income-based transfer programs: public works programs, public provision of private goods, and statistical targeting.<sup>11</sup>

### *Self-Targeting Programs*

*Public works projects.* Even if income cannot be measured, it may be possible to design programs that, by targeting underlying differences between individuals, are able to direct transfers of cash to those whose needs are greatest. Among the most widely used tools in this respect are public works programs (PWP). They offer employment in exchange for an income that is large enough for individuals to sustain themselves. Suppose that the PWP offers a wage of  $\hat{w}$  for a working day of length  $t$ , so that all those with wages below  $\hat{w}$  and optimal labor supplies at  $\hat{w}$  that are more than or equal to  $t$  will choose to work on the government project. They may choose, in addition, to undertake some further work at whatever wage is available in the private labor market (which itself will be a function of  $t$  and  $\hat{w}$ ). By suitable choice of  $\hat{w}$ , the government may be able to design a scheme that attracts only those who cannot sustain themselves.

Such a case, taken from Besley and Coate (1992), is illustrated in figure 20-4. We have assumed that there are only two types of individuals who face exogenously given wage rates of  $w_H$  and  $w_L$ , and that the government wishes to get the poorer individuals up to the income level  $z$  (which can be thought of as a poverty line). The diagram neglects income effects on labor supply for simplicity. Initially individuals would be in equilibrium at points A and B, entailing consumption for the lower income individuals below  $z$ . If the government cannot observe the wage rates available to each individual, then

Figure 20-4. *The Optimal Public Works Program*



it cannot single out the low-wage individuals for selective treatment. Hence, if the amount  $b^*$ , which is required to get the low-wage individuals to income level  $z$ , were offered in a transfer program, there would be nothing to stop this transfer from being taken by the high-wage individuals as well. Consider, as an alternative, a PWP with  $\hat{w} = w_H$  and  $t = t^*$  in the diagram. Two things about this solution are clear. First, only low-income individuals would find it strictly worthwhile to join the program (attaining point  $C$  in the diagram). Second, this work program would get individuals to the target consumption level.

It is not clear, however, that this scheme would be better than a universal transfer program. One simple test is whether the government saves money by offering the package  $\{w_H, t^*\}$  rather than a blanket handout of  $b^*$ . Figure 20-4 helps to evaluate this. Suppose that the proportion of the population with low incomes is  $\gamma$ . The cost of the public works project is then  $\gamma[w_H - a]t^*$ , where  $a$  is the marginal product of labor in the public works project, which is assumed to be constant. Hence,  $w_H - a$  is the subsidy-tax granted to each individual per unit time in the public works project. By contrast, since all individuals claim the transfer when there is no work required in exchange, a pure transfer program costs  $b^*$ . Making use of figure 20-4, it is clear that  $b^* = [w_H - w_L]t^*$ . Putting these things together, we have deter-

mined that it is less costly to have a PWP to bring individuals up to the target income level  $z$  rather than a universal cash transfer if  $[1 - \gamma]w_H > w_L - \gamma a$ . This inequality behaves much as one might have expected. A PWP is preferred when  $a$  is high,  $w_L$  is low,  $w_H$  is high, and  $\gamma$  is low.

Projects where individual participation depends on self-selection and not on any administered test may play an especially crucial role in countries when income cannot be reliably measured, since the tests imposed are *self-acting*. Such programs may be valuable even when income is observable, since there may be incentive effects from pure income transfers on the decision to enter the labor force that PWPs may serve a role in mitigating.

It is debatable, however, whether PWPs are an administrative convenience. While, if properly designed, they do not require means tests, they still require some fairly detailed information about the distribution of individuals' types in the population, the fraction  $\gamma$  in our model. Just what administrative burdens would result from a scheme of the kind described here is an important issue for further investigation.

The example above was based on some restrictive assumptions. It is interesting to consider the consequences of relaxing some of them, as discussed below.

- The target income level may be affected by the terms of the PWP. If work done in PWPs is hard, then individuals may need to consume more calories. Individuals might also need to be compensated for the fact that PWPs are unpleasant in other ways. Either of these effects makes it less likely that a PWP would be preferred on the criterion given above.
- There may be general equilibrium effects on wages. If government demands laborers, then the wage earned by all may rise. Whether this improves or worsens the case for a PWP depends largely on what happens to the *relative* wages of the low- and high-wage individuals. A higher wage for the high-wage individuals would enable the government to pay a higher wage in the PWP without inducing the high-wage individuals to join the program. At a higher wage, the target income level can be met with fewer hours of work ( $t^*$  falls), and hence the foregone output under the PWP (equal to  $t^*[w_L - a]$ ) also falls. Higher wages for low-wage individuals means that the opportunity cost of their labor time in the PWP has risen. Since both sides of the inequality given above have increased, one cannot say a priori if it is more likely that a PWP will be preferred now than before. For empirical analysis relevant to this issue, see Ravallion (1989).
- So far we have assumed that human capital levels, which determine wage rates, are fixed; that is, we have not considered the consequences of allowing individuals to make investments that alter their wage rates. Besley and Coate (1992) investigate this issue in some detail. They find

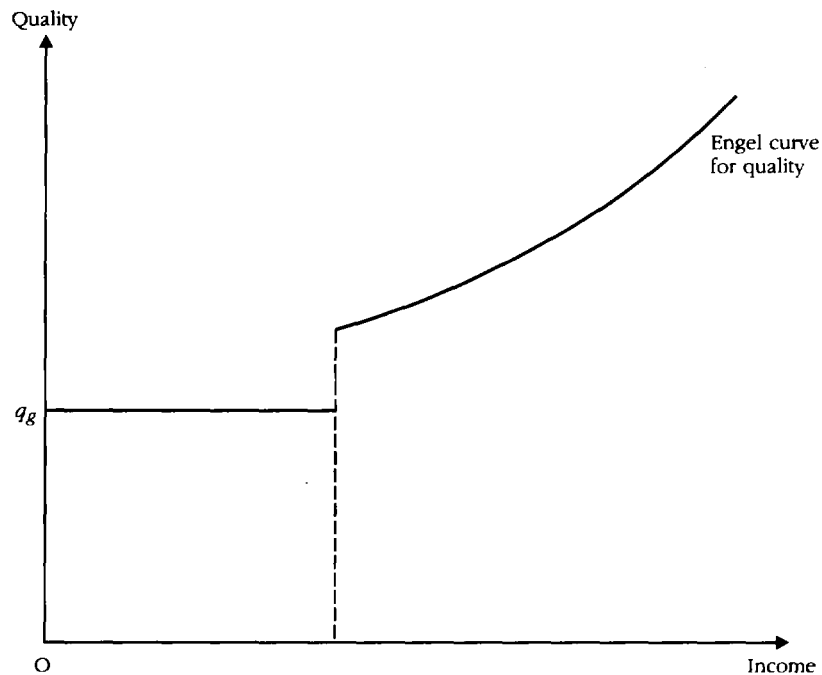
that instituting a work requirement in exchange for a transfer may increase human capital investment, although the objective adopted by the government is crucial to this conclusion. It relies on the government trying to give individuals a target income level as opposed to a target level of well-being.

*Public provision of private goods.* An alternative model for self-targeting redistribution schemes is public provision of goods rather than cash.<sup>12</sup> One model of this can be developed as follows. Many publicly provided goods are best thought of as being indivisible and hence being demanded discretely; that is, a consumer buys one or zero units. This is not to say, however, that all units are identical. While demanded discretely, such goods are typically available at different quality levels. For example, the same educational qualification is available at many different standards. Discreteness often implies that individuals are unable to consume these goods from two different sources simultaneously. For example, one cannot easily obtain medical care both from the public and private sectors for the same episode of an illness.

Moreover, a consumer who relies on public provision of the private good is stuck with consuming at the preset public-sector quality level. If the good concerned is normal and there is a private sector, then if the state provides a fixed quality level free of charge, one would find the population dividing into two classes—better-off consumers would use the private sector, leaving the public sector to the poor. This is illustrated in figure 20-5, where  $y^c$  denotes the critical income level below which individuals opt to consume in the public sector. We have assumed for simplicity that the private sector provides a continuum of possible quality levels. Note that there is a jump in the quality level demanded at  $y^c$ . Since public provision is free, an individual would turn to the private sector only if he had a demand for quality that exceeded that available in the private sector by a sufficient margin.

This argument for public provision rests squarely on an inability to make income transfers between individuals. The first-best solution, which we argued above may be administratively impossible, would always be direct income redistribution. This is because public provision of the kind that we have described entails a deadweight loss. Most individuals consuming in the public sector are not choosing to consume the quality level of the service that they would optimally choose to consume were they given the cash equivalent of the government transfer. Nonetheless, Besley and Coate (1991) show that there are conditions under which the deadweight loss is outweighed by the redistributive gain.

The idea that the government can redistribute by providing a basic quality level in the public sector bears a striking resemblance to some of the policies advocated in the literature on *basic needs policies* (Streeten 1981).

Figure 20-5. *The Effect of Providing Quality ( $q_g$ ) Universally*

However, the motivation described here differs quite markedly from that of most advocates of such programs. It comes from noting that policies that rely on income-contingent transfers are unlikely to be effective because of the costs of income measurement. We are interested in in-kind provision precisely because it may be a reasonably good substitute for transfers of cash. The advocates of basic needs policies, in contrast, seem to advocate policies based on the intrinsic value of the goods being transferred.

In recent years, there has been much discussion of the inadequacy of public provision programs in developing countries (Jimenez 1987). The fault with the model above is that quality was taken as something that could be straightforwardly fixed by the government. In practice, this has not been the case. Because of budgetary constraints, very often linked to import compression in the wake of indebtedness and other difficulties, quality has become an endogenous variable. For example, drugs in health facilities are unavailable for long periods. This often leads to richer individuals lobbying and bribing for the drugs and skews the benefits of public provision in favor of the rich. In the wake of this, user charges have come into vogue. A complete discussion of such charges lies beyond the scope of this chapter. Suffice it to

note that the view, often expressed, that the adverse effects of user charges on the poor can be undone by using other redistributive instruments, is blind to many of the constraints on such instruments. To say, for example, that income transfers could be used to undo the effects of user charges misunderstands one of the main arguments for wanting public provision in the first place.

### ***Statistical Targeting***

Transfers under limited information about individual responses and incomes could also be made using *statistical targeting*. The object of such schemes is to target transfers based on easily observable characteristics, such as region of residence or age. Many of the issues considered above are also relevant here. Note that, in addition to the problem of the targeted characteristic being manipulable, there may be severe social constraints on the characteristics that can be used for such transfer schemes. For example, transfers based on ethnic origin may be socially unacceptable.

In practice, versions of such schemes are used primarily for regional targeting. Ration shops for food are one such example (Besley and Kanbur 1988, 1990). A certain amount of food is made available to everyone in a given region, at a particular store, at below-market price. If purchase and resale cannot be prevented, then this is equivalent to all patrons of a particular shop receiving the same addition to their incomes. Hence, if the consumers who use a particular store are on average socially deserving, such a scheme serves as a targeted income-transfer program. Locating ration shops in areas where the incidence of poverty is greatest will maximize the amount of needful assistance. Two things about this example are worthy of note. First, while food is normally the commodity used in such schemes, it seems inessential. At the same time, food is relatively fungible because unwanted ration shop allocations can easily be turned into cash. Second, food-based redistribution schemes tend to command greater political support than cash-based ones; they are a socially acceptable way of making transfers. Finally, it should be noted that such transfer schemes, while being able to target the poor in some measure, may not require an elaborate administrative machinery in order to be implemented. As discussed in chapter 23, it may be possible to reduce the extent of poverty in Indonesia through a set of region-specific income grants at a total cost equal to the current level of anti-poverty grants there.

### **Efficiency Wages and Tax Inspector Honesty**

A central difference between the policymaking environments in industrial and developing countries is the extent of administrative corruption.<sup>13</sup> This



may present problems for the development of effective administration for both tax and transfer programs. For example, administrators of transfer programs may misappropriate funds intended to assist the poor, or tax inspectors may accept bribes in lieu of tax payments. In this section, we shall give a concrete analysis of the second phenomenon. We shall focus on the problem of keeping administrators honest when collecting taxes. The prototype model developed here breaks with the “traditional” tax compliance model, which has focused exclusively on the decision of an individual taxpayer to pay taxes, without regard to corruption of inspectors.<sup>14</sup> In contrast, here we consider the consequences of having a number of tax inspectors who are prepared to accept bribes from taxpayers who wish to evade taxes.

We shall examine the argument that increasing payments to tax inspectors is a means of improving tax compliance. There are two reasons why this might be so.<sup>15</sup> First, there is a screening effect. Low wages mean that only those with low reservation wages will apply to become inspectors. For this argument to work it has to be true, however, that honesty and reservation wages are positively correlated. There are good reasons why this might be so. Dishonest individuals take account of the bribes that they will accept in the decision to become tax inspectors and hence are prepared to take the job at a lower wage than an honest individual. Hence, dishonest individuals may be the only people prepared to become tax inspectors at very low wages. This constitutes the *adverse selection effect* of low wages.

There is a second argument for paying higher wages that is based on considerations of *moral hazard*. A higher wage raises the present discounted value of remaining as a tax inspector relative to any outside possibilities and hence reduces the incentive to undertake activities, such as taking bribes, that increase the chance of being dismissed. This is essentially the efficiency wage argument of Calvo and Wellicz (1979) and Shapiro and Stiglitz (1984).

The aim of this section is to build a simple model to understand the tradeoffs involved in choosing between two wage strategies. The model is developed in greater detail in Besley and McLaren (1993). The first possibility is to pay the minimum wage at which honest individuals are prepared to become tax inspectors. This we call a *reservation wage strategy*. An alternative possibility is to pay the wage at which dishonest tax inspectors behave honestly, which we refer to as an *efficiency wage*. We compare these wage strategies in terms of the discounted stream of revenues, net of administrative costs, to which they give rise. Thus, we focus exclusively on the revenue-raising argument for levying taxes. Finally, we will discuss strategies involving tax farming—that is, privatizing tax collection.

### **The Model**

The model has  $M$  taxpayers and  $N$  tax inspectors. A fraction  $\gamma$  of the tax inspectors are dishonest, by which we mean that they are prepared to accept

bribes or pocket tax revenues if paid the reservation wage of the honest tax inspector  $\omega$ .<sup>16</sup> This reservation wage is also available to dishonest tax inspectors who are dismissed from public service. In each period, tax inspectors and taxpayers encounter each other. We assume that all taxpayers have identical incomes, each denoted by  $y$ . An honest tax inspector collects a tax of  $\tau y$ , while a dishonest one will offer to take a bribe denoted by  $b$ , which is assumed to be less than or equal to  $\tau y$ ; that is, no extortion is possible. The government audits tax inspectors randomly, and we denote the probability of taking a bribe without being caught by  $q$  per unit of time.<sup>17</sup> We take this to be exogenous in order to home in directly on the role of wage incentives.

Consider the case of an infinitely lived, risk-neutral, dishonest tax inspector.<sup>18</sup> In any encounter with a taxpayer, he faces the choice of whether or not to take a bribe. In doing so he will weigh the probability of being caught and dismissed. The outcome of this deliberation depends crucially on his wage. A dishonest tax inspector will behave honestly if and only if he is paid a wage such that

$$(20-15) \quad \omega \geq \frac{\delta q}{1 - q} b + \omega \equiv \hat{\omega}$$

where  $\delta$  is his discount rate.<sup>19</sup> Equality in 20-15 defines the efficiency wage. As long as there is some probability of not being caught, the efficiency wage exceeds the tax inspector's reservation wage. Note that, as one would expect, the efficiency wage increases with the size of the bribe, the discount rate, and the probability of not being caught.

We model the determination of the bribe as the solution to a bargaining problem between taxpayers and tax inspectors. We will adopt the generalized Nash bargaining approach (Roth 1979). Letting  $\alpha$  and  $\beta$  denote the bargaining strength parameters of the taxpayer and tax inspector, respectively, the bribe that solves the generalized Nash bargain satisfies

$$(20-16) \quad \underset{b}{\text{Max}} \{ \tau y - b \}^\alpha b^\beta$$

assuming that the threat point for the two parties is one in which all taxes are paid honestly. It is straightforward to check that the optimal  $b$  satisfies

$$(20-17) \quad b^* = \frac{\alpha \tau y}{\alpha + \beta}$$

Thus, the tax inspector captures a share of the surplus  $\mu \equiv \alpha / (\alpha + \beta)$ . This fraction is increasing in  $\alpha$ ; that is, if the bargaining strength of the tax inspector increases, then he captures a greater share of the unpaid tax revenues. The limiting case of  $\mu = 1$  is that where the tax inspector can pocket the tax revenues that he has collected without colluding with a taxpayer.

### Tax Revenues and Tax Inspector Incentives

We consider determinants of the choice between paying reservation and efficiency wages on the criterion of revenues raised. We shall formulate the tradeoff between these two options by considering what tax revenues would be raised in either case, as a function of  $\gamma$ , the fraction of tax inspectors who are dishonest, and  $q$ .

The first step is to characterize the  $(\gamma, q)$  pairs that yield zero revenues, net of collection costs, for each case. In the case of reservation wages, the number of dishonest tax inspectors falls through time, since each period (defined here as the duration of one taxpayer encounter) a number of the dishonest tax inspectors are audited and dismissed. Since all inspectors behave honestly in an efficiency-wage regime, there is no such effect. This advantage of reservation wages has the important implication that it may be misleading to appraise the two wage strategies that we have identified with reference to tax revenues at a single point in time. The case for reservation wages improves through time because the composition of tax inspectors—that is, the balance between honest and dishonest ones—improves. It is straightforward to verify (see the appendix to this chapter for details) that the number of dishonest taxpayers at time  $t$ ,  $D_t$ , is given by

$$(20-18) \quad D_t = \gamma N \{1 - [1 - \gamma][1 - q]\}^t.$$

Notice that over an infinite time horizon, the number of dishonest inspectors falls to zero.<sup>20</sup>

At any point in time the government is able to secure tax revenues from the honest tax inspectors and from those dishonest tax inspectors who are audited. Using this fact, the total tax receipts at time  $t$  are

$$(20-19) \quad \tau \gamma N [1 - q \gamma \{1 - (1 - \gamma)(1 - q)\}^t]$$

where we have also used the fact that only  $N/M$  of taxpayers are visited in each time period. The total administrative costs are independent of time and equal to  $N\omega$ .

Assuming, for simplicity, that the government and tax inspectors use the same discount rate, the condition for the discounted present value of tax revenues to be zero is<sup>21</sup>

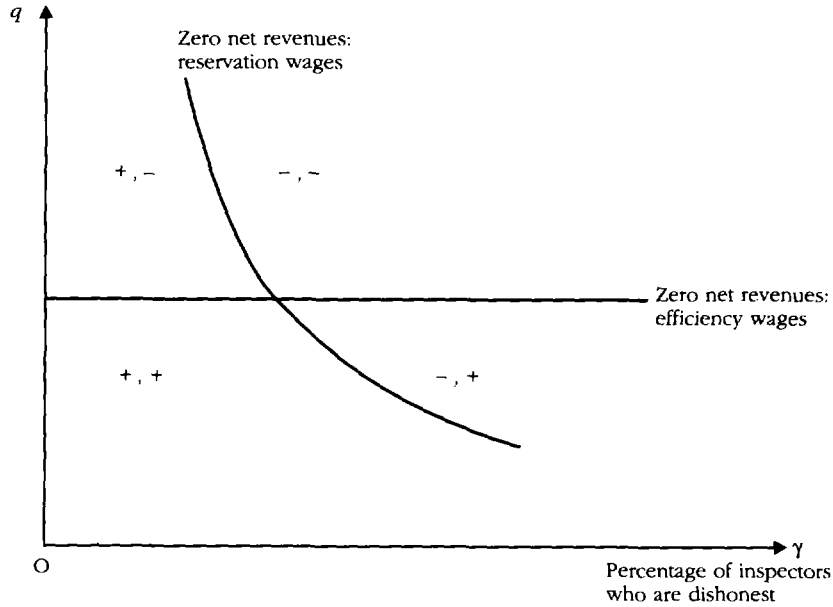
$$\frac{1 + \delta}{\delta} \left[ 1 - q \tau \cdot \frac{\delta}{\delta + [1 - \gamma][1 - q]} \right] \tau \gamma N - \frac{1 + \delta}{\delta} N \omega = 0$$

or

$$(20-20) \quad \frac{1 + \delta}{\delta} [C - 1] - C \left[ \frac{q \gamma [1 + \delta]}{\delta + [1 - \gamma][1 - q]} \right] = 0$$

where  $C \equiv \tau \gamma / \omega$  is the ratio of tax revenue to costs of collection when all tax

Figure 20-6. Tax Revenues as a Function of the Auditing and the Honesty of Tax Inspectors



Note: Whether a tax yields revenue in excess of the wage bill for tax inspectors depends on  $\gamma$ ,  $q$ , and the wage rate. (+, +) indicates the region of  $(\gamma, q)$  points for which net revenues are positive under either a reservation or efficiency wage; (+, -) indicates the locus of  $(\gamma, q)$  for which only the reservation wage yields positive net revenues.

inspectors behave honestly. We will assume that  $C > 1$ , otherwise levying the tax in question could never be worthwhile for revenue-raising purposes. Equation 20-20 has two main components. The first term represents the revenues that would be raised with a completely honest tax inspectorate. Hence, the second term can be thought of as the cost of administrative corruption. Figure 20-6 illustrates the relationship between  $q$  and  $\gamma$  given in equation 20-20. It is a rectangular hyperbola truncated at either end.<sup>22</sup> Any  $(\gamma, q)$  pair below this curve will yield positive revenues. It clarifies the idea that it is possible to raise tax revenue, if tax inspectors are paid their reservation wage, only if either tax inspectors are sufficiently honest ( $\gamma$  is low) or there is sufficient auditing of their behavior ( $q$  is low).

Consider next the case where tax inspectors receive an efficiency wage. Since the government is assumed to be unable to identify which tax inspectors are dishonest, the same wage is paid to all inspectors. Using equation 20-15, the zero net revenue locus for efficiency wages is defined by

$$(20-21) \quad \frac{1 + \delta}{\delta} [C - 1] - \frac{q\mu}{1 - q} C = 0$$

where  $\mu$  is the parameter reflecting bargaining strength that we introduced above. Since, from equation 20-17, the size of the bribe depends on the tax rate, the administrative costs of taxation depend positively on the tax rate. The second term in equation 20-21 is best thought of as the cost of corruption in an efficiency wage regime.

The zero net revenue locus is independent of  $\gamma$  (since if tax inspectors are paid their efficiency wage, none acts dishonestly). It is characterized by

$$(20-22) \quad q = \left[ \frac{1 + \delta}{\delta} [C - 1] \right] / \left[ \mu C + \frac{1 + \delta}{\delta} [C - 1] \right] < 1$$

using equation 20-21. It clear from equation 20-22 that it is only possible to raise positive net revenues when paying efficiency wages if  $q$  is sufficiently small, since for low values of  $q$ , the efficiency wage rate becomes very large. If the probability of getting audited were too small, then the efficiency wage would have to be raised to a point where implementing the tax would not be profitable. Equation 20-22 is represented by the horizontal line in figure 20-6.

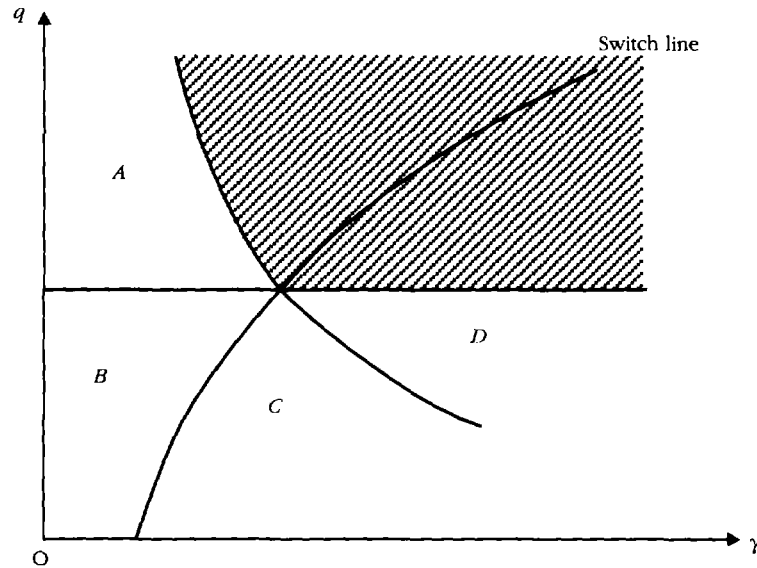
We consider next whether net revenues are highest when tax inspectors are paid efficiency or reservation wages. Comparing equations 20-21 and 20-22 yields the following condition determining whether efficiency wages raise more (or less) net revenues than reservation wages:

$$(20-23) \quad \frac{q\mu}{1 - q} < (>) \frac{q\gamma [1 + \delta]}{\delta + [1 - \tau][1 - q]}$$

Equality in 20-23 defines  $q$  as an increasing, concave function of  $\gamma$ , which is illustrated in figure 20-7 as the switch line. Below the switch line, the payment of efficiency wages yields greater net revenues than payments of reservation wages. A higher  $\delta$  or  $\mu$ , other things being equal, means that reservation wages are more likely to be preferred since the efficiency wage is increased. Payment of efficiency wages yields greater net revenues when  $\gamma$  is large—that is, when more tax inspectors are corrupt. This also makes intuitive sense.

Figure 20-7 illustrates the different regimes in which reservation or efficiency wages are preferred. There are five regimes. The shaded area represents values of  $q$  and  $\gamma$  for which no positive tax revenue solution exists. Note that the possibility of efficiency wages for tax inspectors reduces the size of this region by the area  $D$ , but does not eliminate it.

There are two cases in which the government prefers to pay reservation wages. First, the area labeled  $A$  constitutes a regime in which reservation wages raise more revenue and, furthermore, efficiency wages could not be used at all to raise revenue, since  $q$  is too high and dishonest tax inspectors could not be deterred from accepting bribes at low enough cost. The second case in which reservation wages are preferable is given by area  $B$ . Here, both payment schemes yield positive revenues, although a low  $\gamma$  implies that

Figure 20-7. *The Choice between Different Wage Regimes*

reservation wages are preferred to paying reservation wages. That is, there are too few dishonest tax inspectors to make an efficiency wage regime that eliminates one payoff to being corrupt.

Efficiency wages are preferred in areas C and D in figure 20-7. Region C is again a case when both strategies yield positive net revenues but the level of dishonesty is high enough to make efficiency wages worthwhile. The final case is for parameter values in the region labeled D. This is a case where only efficiency wages can be used to raise revenues. The number of dishonest tax inspectors is so high relative to the probability of being audited that collection of positive net revenue is possible only by inducing dishonest tax inspectors to behave honestly.

### **Extensions**

So far, we have taken the monitoring level to be exogenous. The optimal monitoring level would, of course, be different in the two wage regimes. The model can also be extended to allow for more hierarchical bureaucracies in the spirit of Calvo and Wellicz (1979). We would find that the efficiency wage at any level would be a decreasing function of the amount of monitoring at higher levels.

We have also neglected the use of fines as an enforcement mechanism. If unlimited fines were possible, then even a small probability of being caught could be used to enforce honesty. More generally, the efficiency wage will be

a decreasing function of the fine level. The problem with this solution is that it presupposes the existence of an adequately functioning legal system, a luxury that many countries with widespread bureaucratic corruption do not possess. In the absence of effective legal sanctions, the second-best instrument of efficiency wages may still serve an important purpose.

The literature on bureaucratic corruption has emphasized the short duration of tenure in public offices as an impediment to establishing effective administration. Just why this is can be made precise in terms of our model. Suppose that we introduce some probability that an individual will have to leave public employment other than because he is dismissed. This acts just like an increase in his discount rate in our model so that it increases his efficiency wage. Hence, it becomes more expensive to enforce honesty.

There is a third wage strategy that we have not considered here, that of paying subreservation wages.<sup>23</sup> In this case the tax inspectorate is 100 percent dishonest, because of the adverse selection effect that was noted above. Surprisingly, this regime may sometimes be preferred to either of those studied so far (Besley and McLaren 1993). Capitulation wages may be a good idea when the fraction of dishonest individuals in the economy is high ( $\gamma$  is high) and monitoring is very lax ( $q$  is low), so that paying efficiency wages is very expensive.

A fourth solution to the problems of corrupt tax administration involves explicit privatization of tax collection, that is, *tax farming*. This differs from the subreservation wage regime just described, since in this case  $\mu = 1$ ; that is, the government allows an inspector to legally pocket all tax revenues that he has raised, in exchange for a fee that is paid up front. In fact, if this can be done, it dominates all of the other alternatives that we have considered on the criterion of net revenues raised. The government can raise  $M\tau\gamma$  at a cost of just  $N\omega$ . It is interesting to note that this strategy was employed in the Roman Empire. There are, however, two problems with it. First, there is the difficulty of preventing tax collection from turning into extortion, as happened, for example, in Roman Sicily—admittedly under the eye of the voracious Governor Verres. Second, to work effectively the inspector must pledge money in advance—an insurmountable problem in economies with liquidity constraints. Moral hazard on the part of the government—for example, selling the rights to collecting taxes from a particular individual twice over—may also be a problem with this solution.

Clearly, there is much else that could be done to enrich the simple model of this section. The model is only a first step that serves to introduce the potential significance of wage incentives in tax compliance.

## Conclusions

This chapter has considered some aspects of administrative costs and policy design in developing countries. We have emphasized the importance of

viewing policies as rational responses to limited information and administrative capability. In the last section, we also looked at some possible determinants of administrative costs. The approach taken in this chapter has, however, been piecemeal, and there are many issues that we have not dealt with. What we have done, however, does serve to reinforce the point that the design of policy must take account of the full array of constraints that are faced by developing countries and that these may include administrative capacities.

## Appendix<sup>24</sup>

### *Derivation of the Efficiency Wage*

Since one earns  $\omega$  in every period, the value of being employed for life in the private sector is simply  $V^P \equiv \omega[1 + \delta]/\delta$ . The value of a dishonest life is given by

$$V^D = \omega + qb + qV^D/[1 + \delta] + [1 - q]V^P/[1 + \delta]$$

where we have assumed that the tax inspector is paid at the beginning of each period. This consists of four terms—the wage, the expected value of bribes, future lifetime utility (if not caught), and future lifetime utility (if caught and turned out into the private sector). This equation can be solved to yield

$$V^D = \frac{1 + \delta}{1 + \delta - q} \{ \omega + qb + [1 - q] \omega / \delta \}.$$

The value of an honest life is  $V^H = \omega[1 + \delta]/\delta$ , since one is guaranteed to earn  $\omega$  each period. The tax inspector will behave dishonestly if and only if  $V^D > V^H$ , and the efficiency wage equates them. It is now straightforward to verify that the efficiency wage is that given in equation 20-17.

### *Number of Dishonest Tax Inspectors in the Reservation Wage Regime*

Consider next what happens to labor turnover under reservation wages. In every period, a fraction  $1 - q$  of the dishonest are located and dismissed. But since a fraction  $\gamma$  of all new hires is corrupt, the stock of dishonest tax inspectors must change according to

$$D_{t+1} - D_t = -[1 - \gamma][1 - q]D_t.$$

This is a simple first-order difference equation that can be solved to yield:

$$D_t = D_0 [1 - [1 - \gamma][1 - q]]^t = \gamma N [1 - [1 - \gamma][1 - q]]^t$$



noting that  $N_o = \gamma N$ . Revenues are thus equal to

$$\frac{N}{M} \left[ (1-q)D_t + N - D_t \right] \tau_y M = N \left[ 1 - q\gamma[1 - [1 - \gamma][1 - q]]^t \right] \tau_y$$

The left-hand side says that taxes are collected both from the dishonest who are caught taking bribes and from the honest. To calculate the present value of revenues, note that

$$\sum_{t=0}^{\infty} \left[ \frac{1 - [1 - \gamma][1 - q]}{1 + \delta} \right]^t = \frac{1 + \delta}{[1 - \gamma][1 - q] + \delta}$$

It is now straightforward for the reader to verify equation 20-20.

## Notes

The author is grateful to Steve Coate, Ravi Kanbur, Jim Poterba, Nick Stern, Joe Stiglitz, and especially Karla Hoff for helpful comments on an earlier draft. The usual caveat applies.

1. See Goode (1977) for a discussion of some of the difficulties.
2. As well as being a means of evading taxes, smuggling has served as a means to acquire consumer goods that are in short supply (Azam and Besley 1989).
3. Heller and Shell (1974) and Yitzhaki (1979) are exceptions. However, their concerns are somewhat different from those of this chapter.
4. We use  $\text{mod } t$  since subsidies are also costly to administer.
5. We are taking government revenues to be fixed exogenously. We shall consider transfer and expenditure policies in more detail below.
6. Stern (1987b) and Ahmed and Stern (1989) are exceptions. They consider the possibility that leakage via administrative costs affects tax reform rules. However, they take administrative costs to be fixed.
7. This could be modeled by making administrative costs depend on  $dt$  and  $dK$ .
8. This assumption is made for analytical convenience. The government may also wish to use targeted subsidy programs of the type discussed later in this chapter.
9. Let  $I$  denote the after-tax return. Then equation 20-9 can be derived from

$$W = \int U(I)df(I) = - \int \exp(-AI) dF(I) = - \exp(-A\mu_I + \frac{1}{2}A^2\sigma_I^2)$$

which follows from a standard property of the moment generating function of the normal distribution, where  $\mu_I$  and  $\sigma_I^2$  are, respectively, the mean and variance of  $I$ .

10. An alternative way of defining the inequality premium is as the difference between society's mean income and its equally distributed equivalent income as defined by Atkinson (1970). Note also that this inequality premium exactly parallels the risk premium, which is familiar from the theory of choice under uncertainty.

11. For a general discussion of targeting in relation to poverty alleviation programs, see Besley and Kanbur (1988).

12. The model developed here is based on Besley and Coate (1991). In related

work, Nichols and Zeckhauser (1982) have suggested that in-kind provision can be used to reduce the burden of the income tax. They develop their argument based on income being observable.

13. For a wide-ranging discussion of corruption in developing countries, see Gould and Amaro-Reyes (1983).

14. See the papers by Allingham and Sandmo (1972), Srinivasan (1973), and, more recently, Reinganum and Wilde (1985). Gang, Goswami, and Sanyal (1988) consider some implications of a corrupt inspectorate in a model of taxpayer compliance. Their model, unlike the one presented here, focuses on monitoring and fines as means of enforcing honest behavior.

15. See Becker and Stigler (1974) for some general discussion of these issues.

16. Honesty is not an absolute notion. It only makes sense to talk at a particular wage level. It is convenient, however, to refer to those who are dishonest at the reservation wage as the dishonest individuals, and to label those who behave honestly at the reservation wage as honest.

17. A more general analysis would take account of the effect on  $q$  of social norms and the fact that the government can vary its effort to seek out those who are dishonest.

18. Finite lives can be dealt with, as in the manner of Akerlof and Katz (1989).

19. This is proved in the appendix to this chapter.

20. Besley and McLaren (1993) consider a model with random dislocation of tax inspectors from their jobs, which implies a steady state in which there is a positive number of dishonest tax inspectors.

21. This is also proved in the appendix to this chapter.

22. To see this, note that equation 20-20 can be written in the form  $[q - k][1 - \gamma - k]$  where  $k$  is a positive constant. This makes sense, since to collect taxes that cover the wage bill when inspectors are paid only their reservation wage, it must be that

$$\lim_{q \rightarrow 1} \gamma(q) > 0 \quad \text{and} \quad \lim_{\gamma \rightarrow 1} q(\gamma) > 0.$$

The limiting values of  $q$  and  $\gamma$  are the same since they enter in tax revenues symmetrically—see equation 20-20.

23. Besley and McLaren (1993) describe this strategy as one of *capitulation wages*. Under capitulation wages, the government gets tax payments from two sources. First, there may be a minimal tax payment that every inspector declares for every taxpayer. It seems reasonable to suppose that the bribery problem is for extra tax payments over and above minimal levels. Second, the government gets tax payments from auditing.

24. This appendix is based on Besley and McLaren (1993).

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*Implications of Imperfect Risk Markets  
for Agricultural Taxation*

*David M. Newbery*

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*Partially stabilizing the domestic price of serially uncorrelated traded agricultural goods can be cost-effective if the stabilization program is well designed. Unfortunately, the prices of most traded agricultural crops are highly serially correlated, which makes price stabilization difficult and less effective. Stabilizing the prices of internationally nontraded goods requires costly storage and only incomplete price stabilization is justified. The major focus of this chapter is the interaction between price stabilization and taxation. If agricultural exports supply a significant fraction of total government revenue, as in the case of Ghanaian cocoa, then the optimal tax on export crops will depend on the world price and may either stabilize or destabilize the domestic price. Calculations for Ghana suggest that to a first approximation, the export tax should be set as a constant fraction of the export price.*

THE MAIN AGRICULTURAL RISKS relevant to the design of public policy are price risks, general supply risks, and idiosyncratic supply risks. These risks will affect farmers, consumers of the agricultural products, the government (via variations in tax receipts), and the population in general, to the extent that the agricultural risks have macroeconomic or general equilibrium impacts on the rest of the economy (via changes in exchange rates, variations in purchasing power that affect demands for other nontraded goods, and so on). Farmers (and other consumers) are concerned with the anticipated and realized variability of real consumption. The distinction between

anticipations or perceptions and realizations may be important, but will largely be avoided in what follows by assuming rational expectations.<sup>1</sup>

### The Nature of Agricultural Risks

Consider the risks facing farmers. If we examine the components of real consumption variability, we can see that it will depend on the extent to which consumer prices co-vary with the farmer's income, and the extent to which the farmer can lend and borrow to even out the uncorrelated component of his income. It is conventional in developing countries to assume that farmers are severely constrained in the extent to which they can engage in consumption smoothing, though there is good evidence to the contrary from careful studies of semiarid Indian villages undertaken by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) (Walker and Jodha 1982). They report the responses of drought-hit farms in different areas of India compared with normal behavior. In some areas the drought was so severe that crop and livestock income contributed only 5–16 percent of total sustenance, with public relief contributing 22–56 percent. Total consumption expenditure per household fell 8–12 percent compared to normal, but expenditures on socioreligious ceremonies fell by up to 64 percent, 42 percent of households withdrew children from school, assets were depleted by up to 60 percent, and debts were increased by up to 192 percent. The picture that emerges is one in which a great deal of consumption smoothing takes place, and a wide variety of responses to risk were evident. Although the fall in current consumption looks low when compared to the fall in current income, consumption is likely to remain low for several years because assets have been depleted and debts need repaying. Cattle, jewelry, and interfamily assistance provide options for increasing consumption temporarily above income in lean years, even more so for idiosyncratic than for general risks that affect an entire area.

It is, however, important to remember that consumption smoothing is feasible only if the trend path of real income can be confidently predicted. It is important to look at the source of the income variation. Idiosyncratic variations in output (such as local flooding, infestations, and weather damage) will by definition be uncorrelated with output variations elsewhere and, hence, with prices. They will have a full impact on income, but should not affect expectations about future production, price, and hence income. Such risks are most readily dealt with by local institutional responses such as credit markets, crop diversification where the impact is crop-specific, or land diversification (strip farming) where the impact is location-specific. Farming practices in risk-prone areas that are normally semiarid exhibit a wide range of adaptation to such risks, and central government intervention to alleviate

these risks is probably inappropriate. Indeed, it is unlikely that these risks will be perceived at any distance, as they do not show up in aggregate statistics. Tax policies may amplify or reduce their impact. A fixed annual land tax will amplify idiosyncratic income risk, while an output tax system that bears most heavily on the risky crop will attenuate overall risk by reducing the contribution of that crop to overall income, and perhaps by encouraging substitution into less risky crops—this will of course have some efficiency costs.

Real price variability—prices deflated by a suitable index of consumer goods—may be serially uncorrelated, in which case predicting trend income is simple. But many export crops, notably tree crops, exhibit considerable serial correlation on world markets, and yet more exhibit such correlation in domestic prices as a result of sticky adjustments in exchange rates, rates of inflation, and other interventions. If the prices of nontraded agricultural goods fluctuate because of serially uncorrelated supply disturbances, then there is no reason to anticipate serial correlation in prices (except through normal stock carry-forward linkages that are rather weak and short-lived), though even in this case government interventions such as rationing, price supports, compulsory purchase, and so on may have a persistence that outlives their original purpose. If the prices of these nontraded goods fluctuate because of demand fluctuations, then again these trade cycles are likely to be persistent and to induce serial correlation. Serial correlation in prices implies that sudden price changes will signal a continuing deviation from past experience, to which it is prudent to adjust consumption. Serial correlation in prices thus reduces the opportunities for consumption smoothing. Price fluctuations are preeminently thought by governments to merit stabilizing interventions, and will be discussed further below.

Supply variations that induce correlated price variations become important for nontraded goods and for traded goods where the country has market power or where it is climatically associated with countries with market power and suffers correlated supply disruptions (for example, West African cocoa producers or countries whose crops are affected by El Niño weather patterns). In such cases, prices are likely to vary inversely with output, and incomes will normally be less variable than output, unless demand elasticities are very low. If the government attempts to stabilize prices that are negatively correlated with output movements, then it may destabilize incomes.

Agricultural markets may cause serious consumer risk if the price of the main food staple fluctuates, and governments are normally very sensitive to such price instabilities. The special problems raised by interventions in the market for basic foodstuffs merit a separate discussion that is deferred to a later section. If the government succeeds in stabilizing the income of producers, then the risk must either be shifted to consumers or, more likely, be



borne by the government. Similarly, if consumption risk is reduced, it is likely to result in a transfer of risk to the government. Both risk transfers make sense, in that the government will normally have better access to risk-sharing or risk-reducing actions than the individual farmer or consumer, and thus can bear the risk at a lower total cost. But the costs are not zero, and if imprudently managed, the stabilization program may be more costly than the individual benefits.

### Stabilizing the Producer Price of Traded Goods

Consider first the problems raised by stabilizing the prices of traded goods in order to provide insurance to the producers. The government can choose between two options or use them in combination. The least costly option is to shift the risk costs abroad by international lending and borrowing so that the government can maintain domestic macroeconomic balance. If export revenue falls and domestic producer incomes are stabilized, then the government can hold public and total expenditure constant and match the resulting trade deficit with a budget deficit—effectively borrowing from abroad, and conversely if export revenues increase. This approach has much to commend it as a method of avoiding the “Dutch disease” or “booming sector” problems caused by commodity price booms, and these can be costly if not sterilized, as the East African coffee boom studies by Bevan, Collier, and Gunning (1989) show. The alternative is to finance the losses of the stabilization fund by increased current taxation and to transfer the profits of the fund to either increased public expenditure or reduced taxation. This shifts the risks from producers to the rest of the economy. The fluctuations in export revenue will be matched by fluctuations in private income, and if not evened out by foreign borrowing and lending, will lead to fluctuations in current consumption. As remarked above, this strategy runs the danger of Dutch disease problems if the export crop comprises a major share of export revenue or GDP.

Now consider the problems raised by stabilizing producer incomes. There are few cases of successful publicly funded crop insurance programs except for highly specific contingencies, such as flood or hail damage, that lie beyond the influence of the individual farmer. Schemes that make insurance payouts dependent on an individual’s yield create obvious problems of moral hazard: the farmer has little incentive to do anything more than meet the minimum conditions of eligibility—perhaps just planting the crop. Most interventions that are designed to stabilize producer incomes do so by attempting to stabilize prices. The larger the correlation is between output and price (that is, the more positive or less negative it is), the more effective such schemes will be. For nontraded goods for which there is both a short-

run supply response and for which the major source of instability lies on the demand side, the correlation may be positive, and price stabilization will unambiguously reduce income instability. As remarked above, if the source of variability is on the supply side and the good is nontraded, then the correlation will be negative, and price stabilization may reduce income stability. The typical case for traded goods is of nonsignificant correlation between production and price, and here price stabilization will reduce income instability.

Following the earlier argument, it is useful to make two distinctions: first, between crops whose prices are serially correlated and those whose prices are not, and second, between crops that are either systematically imported or exported and those that are either nontraded or for which the direction of trade fluctuates.

### Serially Uncorrelated Price Stabilization

If farmers and the government alike believe that prices are serially uncorrelated, then their best estimate of next year's price is just the long-run average price. The annual cost for the producer of the price instability, compared to a stable price, is measured by the formula  $B_R = [1/2] R\Delta\sigma_c^2$  as a fraction of income, where  $\Delta x$  is the change in  $x$  caused by the scheme,  $\sigma_c^2$  is the square of the coefficient of variation (cv) of consumption, and  $R$  is the coefficient of relative risk aversion. If price and output are uncorrelated, and if output is unresponsive in the short run (that is, after the date at which a revised estimate of the market price is available), and if the normal ratio of profit (or income) to revenue is  $\mu$ , and if  $\sigma_y$  is the cv of income, then complete price stabilization results in  $\Delta\sigma_y = \Delta\sigma_p/\mu$ . The appendix to this chapter shows that this is a good approximation even where there is a significant supply response. In the appendix, costs are quadratic, so that in the absence of risk, profits would be one-half revenue,  $\Delta\sigma_c^2 = 4\Delta\sigma_y^2$ , and  $B_R = 2R\Delta\sigma_y^2$  according to this formula. In fact, as the appendix shows, this slightly overstates the proportional gain relative to the previous equilibrium, but is still a reasonable approximation. Finally, if income can be averaged over a time horizon of  $T$  years,  $\Delta\sigma_c^2 = \Delta\sigma_y^2/T$ . The producer benefit to a specialized farmer of complete price stabilization is then roughly  $B_R = [1/2] R\Delta\sigma_p^2/[\mu^2 T]$ . Thus if  $R = 1$ ,  $\sigma_p = 0.3$ ,  $\mu = 0.5$ ,  $T = 4$ , and  $B_R = 0.045$ , or 4.5 percent of average income.

This estimate is likely to overstate the benefit for at least two reasons. First, if the commodity can be stored, and is exported, then a small risk-neutral stockholder would buy when the price was below average (and raise the f.o.b. price) until the expected price change over the forthcoming year was reduced to the annual carrying cost—that is, unlikely to exceed 10

percent (real). Of course, if all exporters do this, the effect will be to depress next year's price, but even so it seems unlikely that prices would fall to less than 20 percent below average, with the expected price next year of 10 percent below average.<sup>2</sup> Selling from storage will not be able to reduce above-average prices unless there are positive stocks (after a year of exceptionally low prices). Nevertheless, it would need to be quite an unstable price in the absence of storage for storage not to be able to reduce the cv to below 30 percent. In turn, storage demands favor the emergence of futures (or at least forward) markets, which then allow private merchants to offer forward contracts at fixed prices to growers. Unless discouraged, the private sector may be able to offer stable forward prices without government intervention in cases where the transaction costs are lower than the risk benefits.

Second, the gains have been estimated for a specialized producer. But most farmers are quite diversified and the risk benefits are then considerably overstated. If returns to different crops are uncorrelated, and the farmer derives a fraction  $\gamma$  of his income from the crop in question, price stabilization will only be worth roughly  $\gamma^2$  times the value to a fully specialized farmer. If as much as half his income derives from this crop, the gains are only one-quarter those previously estimated (as a fraction of *total* income).

If the crop is a pure traded good, that is, always exported or always imported, then the government could in principle offer forward contracts and stabilize the price in much the same way as a merchant offering a forward contract, with no costs of storage—the expected returns to the government of the forward contract will be zero. The alternative would be to fix the market price for the entire crop. The farmer faces different incentives under the two systems, for with a forward contract he is obligated to deliver only the contracted amount. If he produces more than this amount, he sells the contracted amount at the agreed price and the surplus at the market price. If he is in deficit, then he would need to buy the shortfall at the market price to meet the contract terms or, equivalently, buy back the contract at the current market price and sell his entire crop at that price. If the government or marketing board fixes the price, then the farmer must sell his entire crop at that price.

This alternative of fixing the harvest price may induce smuggling if the domestic price diverges from the world price or the price in neighboring countries. It also will suppress any short-run price responses to changing market information, which might be quite costly. We can calculate the advantage of complete coverage (that is, compulsory stabilization) if there is nothing the farmer can do after planting and before harvest to affect output. In that case, fixing the price is superior to an unbiased forward contract if the correlation between output and price is less than  $r^*$ , where  $r^{*2} = \sigma_p^2 / [1 - \sigma_p^2]$ , but in this case the extra benefit of complete coverage is small. The appendix to this chapter shows that the advantage of the marketing board

over the futures market when the correlation coefficient is zero amounts to about  $[1/2] R\sigma_q^2\sigma_p^2$  where, again,  $R$  is the coefficient of relative risk aversion, and  $\sigma_q$  is the coefficient of variation of output. For plausible values of  $\sigma_p$  (0.1–0.3),  $\sigma_q$  (0.1–0.4), and  $R$  (1–2), this will amount to less than 1 percent of the value of output.

The benefit of the marketing board has, however, been calculated on the assumption that during the course of the crop year, as the uncertainty about output is gradually resolved, there is nothing that the farmer can do to vary output. In general this is an unreasonable assumption, and one would expect the farmer to vary his effort in weeding, fertilizing, spraying, and so on in response to the latest information about predicted future prices available from the price of futures contracts. If the farmer has sold a fixed amount forward on a futures market he still has every incentive to produce efficiently, since he receives the full value of his production at the going price (the futures contract just providing offsetting insurance payments or receipts). If the world price is high, then he will attempt to increase output; if the price is low, he will economize on inputs or, in extreme cases, avoid the cost of harvesting. If, however, he is committed to sell to the marketing board, then he has no incentive to adjust inputs efficiently. It is hard to believe that the cost of the inflexibility introduced by the marketing board will be less than the rather small benefit of risk reduction.

The intuitive explanation for the ranking of futures markets and complete price stabilization goes as follows. Futures markets offer a guaranteed price, just like price stabilization, but leave the farmer free to choose the amount of price insurance he would like to purchase. If there is any correlation between price and the farmer's output, he will not wish to purchase full price insurance, because he is interested in income insurance rather than price insurance and can take advantage of the correlation between price and output, and therefore between price and income to choose a more satisfactory combination of price and output risk. If he could purchase price insurance for his entire crop, then a revealed preference argument would demonstrate that futures markets were unambiguously better than being forced to buy full price insurance from a marketing board (assuming both offer the same guaranteed price). The problem is that with supply uncertainty, the farmer cannot sell his actual output forward, only his expected output or some other fraction. This reduces the advantage of the futures market, and if the correlation between price and output is low enough, the drawbacks of not being able to hedge actual output offset the advantage of being able to exploit the correlation between price and output in choosing the optimal futures hedge (see Newbery 1983).

Given the potential advantages of complete stabilization in the uncorrelated case and the costs of inducing an incorrect supply response, one can pose the obvious question of what is the optimal degree of price stabilization? This question has been addressed by Mirrlees (1988) for a model in which

the farmer makes his supply choice before the market price is known. At that date the best estimate of the future market price will typically diverge from the long-run average price, and the question is how to relate the guaranteed price to the expected price and the long-run average price, subject to the government making zero expected loss on the price guarantee scheme. For the problem to be interesting, there must be a difference between the forecast price and the long-run average price, and if the successive postharvest spot prices are serially uncorrelated, there must be some specific information relating to the current year's supply and demand that becomes available in time to influence current output decisions. (The techniques Mirrlees employs can be applied to cases in which the harvest prices are serially correlated, though there are no numerical estimates of their importance, and interesting problems of dynamic consistency arise.)

The answer, quantified under plausible assumptions, is that a substantial degree of price stabilization is warranted, with the guaranteed price placing typically less than 20 percent weight on the current forecast price, and more than 80 percent on the long-run average, with the average level adjusted so that the scheme breaks even. Since the price does move in response to forecasts, the average price paid is higher than the expected price, for the following reason. In high-price states the government makes a profit and in low-price states it makes a loss, but the size of output is higher in the first case than the second, so it would tend to make a positive net profit unless it raised the average return to the farmers. An appropriate premium on a five- or six-year moving average, with the futures price counting as a one-year weight, would probably approximate the optimal scheme quite well.

When there is no correlation between price and output, then a carefully designed price stabilization scheme, such as a moving average scheme, is superior to complete stabilization, which in turn is superior to the use of a futures market will be less than the estimate of  $B_R = [1/2] R\Delta\sigma_p^2/[\mu^2T]$  given above, which was for complete stabilization (not 80 percent stabilization, which would achieve  $1 - 0.2^2$  or 96 percent of the gains of total stabilization) and which ignored the costs of not adjusting supply to the revised price information. Again, the relative advantage of stabilization over forward contracts is small, though the advantage relative to neither stabilization nor forward contracts can be large, as estimated above.

### **Stabilizing the Price of Nontraded Goods**

If the crop is not traded on world markets or if it is sometimes exported and sometimes imported, then, in the absence of storage, domestic price volatility may be high, because the bounds between c.i.f. and f.o.b. may be large (often as much as the f.o.b. price itself). Storage may then be highly cost-effective, and efficient price stabilization would just replicate private

competitive storage (Newbery and Stiglitz 1981, chapter 30). The benefits of allowing this storage to be conducted by the private sector include the following. If private agents derive a convenience yield, storage costs may be lower. If transport costs are high, the choice of the best spatial location of storage requires careful calculation, which is arguably best guided by the profit, rather than bureaucratic motive. Governments are too fond of stabilizing prices across the country, destroying the incentives for careful location of storage facilities. If the private sector is too credit-constrained or risk averse, the government might be better advised to offer credit for storage hypothecated on the stocks and to encourage a forward market to shift storage risks to speculators who might initially be government agents.

If transport costs are high, then it is cheaper to store the crop before transporting it, so that the transport costs do not bear interest costs. The exception is when the convenience yield to the consumer in terms of timeliness or reliability of access is high, in which case the consumer may have a comparative advantage in storage. Pan-country pricing, that is, setting a uniform price across the country, will discourage this activity and will also force the government to organize transport. Intraseasonal price stabilization will also discourage private storage, and again is likely to be costly.

The moral is that the prices of nontraded or partly traded crops should not be completely stabilized, as this would both require excessively costly public storage and would eliminate private storage. Private storage would stimulate the demand for forward markets, which are likely to be desirable in any case, because these offer farmers higher benefits than complete price stabilization when prices and supplies are negatively correlated. This is likely to be the case when the domestic market is insulated from the world market.

### Price Stabilization with Serial Correlation

Many of the major traded primary commodities exhibit significant annual serial correlation that dramatically affects the costs, benefits, and feasibility of price stabilization. Cuddington and Urzua (1987) have attempted to identify the extent to which price changes of primary commodities persist, using annual data on twenty-four commodity prices for the period 1900-87, deflated by an index of manufacturing unit values. They regress the change in the log of the real commodity price on a constant plus error,  $e(t)$ , which is in turn expressed as  $A(L)u(t)$ , where  $u(t)$  is white noise. Their measure of persistence is then  $\Sigma a_i$ , where  $a_i$  is the coefficient of the lag polynomial  $A(L)$  and is a measure of the extent to which the price change will persist. The first column of table 21-1, reproduced from Cuddington and Urzua (1987), gives the persistence measures of three groups of commodities, each group ranked in increasing order of persistence.<sup>3</sup> The last column gives the highest-

Table 21-1. *Persistence of Price Shocks, 1900-87*

Commodity	Persistence		Longest lag (years)
	Autocorrelation measure	Deaton PER20	
Rice	0.11	0.18	9
Palm oil	0.13	0.13	5
Coffee	0.38	0.17	11
Bananas	0.45	0.59	10
Wheat	0.46	0.24	10
Sugar	0.52	0.11	6
Cocoa	0.65	0.29	2
Tea	0.72	0.37	2
Beef	1.0		0
Maize	1.1	0.19	10
Lamb	1.30		4
Average	0.61		6.28
Timber	0.1		8
Wool	0.35		2
Jute	0.4	0.19	5
Hides	0.43		2
Cotton	0.67	0.39	3
Tobacco	0.73		4
Rubber	1.0		0
Average	0.51		3.43
Oil	0.51		11
Silver	0.65		8
Tin	0.65	0.43	5
Lead	0.73		3
Aluminum	0.93		5
Zinc	1.0		0
Copper	1.0	0.31	0
Coal	1.0		0
Average	0.81		4.0

Note: Annual data. The first measure is the sum of the statistically significant autocorrelation coefficients, as calculated by Cuddington and Urzua and explained in the text. The second measure of persistence is PER20, from table 21-2 and explained therein. The longest lag is the highest-order statistically significant lag, as estimated by Cuddington and Urzua.

Sources: Cuddington and Urzua (1987); Deaton and Laroque (1992).

order significant lag for the more parsimonious lag specification. Thus if one looks at cocoa, 65 percent of a price change is expected to persist, and the remaining 35 percent can be accounted for by short-term fluctuations, with a maximum statistically significant lag of two years. In each group the average persistence is over 50 percent, and for many commodities prices seem to

follow a random walk with persistence of 100 percent. It was impossible to reject the null hypothesis that all commodity price series followed a random walk using the rather weak statistical tests available. One must interpret this rather carefully, for even if it is hard to reject the hypothesis that commodity prices follow random walks, there are no plausible theories that suggest that these prices should follow random walks, and rather good arguments why eventually they should return to an equilibrium determined by demand and supply.

Deaton and Laroque (1992) have also studied this problem using more sophisticated methods, but the same commodity price data. Their measures of persistence are the sum of all autocorrelation coefficients whether significant or not, with the sums being linearly declining weighted averages over the window widths of twenty or forty years.<sup>4</sup> Their results are reported in table 21-2. Where the same commodity appears in both studies, the measures of persistence from Deaton and Laroque are given in column 2 of table 21-1. For some commodities, such as rice, palm oil, and bananas, the measures are close. For other commodities, the differences are considerable, with Deaton and Laroque's more reliable measures tending to be lower than those of Cuddington and Urzua (1987), which Deaton and Laroque argue are likely on statistical grounds to be biased upward. If one takes the Cuddington and Urzua evidence, then perhaps one-half of price shocks are persistent for many of the important export crops of developed countries. If one takes Deaton and Laroque's estimates, then about one-quarter of price shocks are permanent. Even in this case, though, table 21-2 shows high, first-order autocorrelations. Three-quarters or more of the price shock will persist for at least a year, and even after two years typically 60 percent of the price shock will persist.

The appendix to this chapter shows how to modify the analysis of behavior under risk, the impact of price stabilization, and the introduction of futures markets when prices are serially correlated. The interesting point here is that futures markets now offer rather different options than feasible price stabilization. Even if futures markets only extend one year ahead, it is possible to roll over hedges to provide additional income-smoothing to that achievable within the crop year. The model in the appendix is one in which there is no output uncertainty, no transaction costs, and an unbiased futures market, and to that extent the model is heavily weighted in favor of futures markets. The way the rollover works is to sell more futures initially than needed for one-period hedging, and then use the surplus futures sales to finance the next year's futures transactions. The insurance is not perfect, for the amount of hedging required next year will depend on production, and that will depend on the futures price prevailing next year, which is not yet known. Consequently, despite the absence of production risk, future output cannot be perfectly hedged, and there remains some residual risk, as there



Table 21-2. *Variability and Persistence of Annual Commodity Prices, 1900-87*

Commodity	CV	AR1	AR2	PER20	PER40
Bananas	0.17	0.91	0.82	0.59	0.52
Cocoa	0.54	0.83	0.66	0.29	0.24
Coffee	0.45	0.80	0.62	0.17	0.11
Copper	0.38	0.84	0.64	0.31	0.22
Cotton	0.35	0.88	0.68	0.39	0.13
Jute	0.33	0.71	0.45	0.19	0.09
Maize	0.38	0.76	0.53	0.19	0.10
Palm oil	0.48	0.73	0.48	0.13	0.05
Rice	0.36	0.83	0.61	0.18	0.08
Sugar	0.60	0.62	0.39	0.11	0.06
Tea	0.26	0.78	0.59	0.37	0.28
Tin	0.42	0.90	0.76	0.43	0.18
Wheat	0.38	0.86	0.68	0.24	0.11

Note: CV is the coefficient of variation. AR1 and AR2 are the first- and second-order autocorrelation coefficients of the deflated series of prices. PER20 and PER40 are the Campbell-Mankiw-Cochrane measures of persistence with window widths of twenty and forty years.

Source: Deaton and Laroque (1992).

would be if there were output risk. Nevertheless, because the costs of risk increase with the square of the deviation, reducing the risk by a given fraction reduces the cost of risk by more than that fraction and can be worthwhile.

The study of price stabilization when prices are serially correlated can undoubtedly be taken further using models such as those discussed in the appendix. This is an urgent task given the prevalence of serially correlated prices.

If crops exhibit serial correlation, then it becomes important to distinguish deviations from the predicted path and changes in the level of predicted future prices. The practical importance of this will be illustrated for Ghanaian cocoa, but the idea is simple. Provided it is not too costly, it is desirable to stabilize fluctuations along the trend path, but in general it is also desirable to adjust to the revised estimate of the trend as quickly as possible, to minimize efficiency losses. Whether this adjustment should be complete will depend sensitively on whether the crop is subject to a revenue-raising export tax, for then the question amounts to the extent to which the optimal tax is a constant or variable fraction of the f.o.b. price. For Ghanaian cocoa, there are two offsetting tendencies working in opposition, and which on balance argue for a reasonably stable ratio of tax to f.o.b. price, but it is easy to imagine cases in which the ratio is not stable, implying long-run stabilization or destabilization.

## The Interaction between Price Stabilization and Taxation

Many primary producing countries that are heavily dependent on a single export crop also impose heavy export taxes on that crop. Ghanaian cocoa is a leading but not exceptional example. Such exports are attractive candidates for taxation in countries at low levels of development for several related reasons. The fact that the export is dominant in the economy suggests that the opportunity cost of its production is low relative to the opportunity cost in other countries, so the producers may be enjoying significant rents that might be taxed. Countries lacking such international cost advantages might be expected to be more diversified in their export patterns. Countries at low levels of development have few "tax handles" and lack the ability to tax either incomes outside the formal sector or informal domestic production. Trade taxes remain as an obvious tax base. The issue is to choose the right balance between export taxes on the export crop and taxes on consumer goods, ideally imposed at the final stage, if need be by allowing credits to domestic producers against their sales tax liabilities. Producer price stabilization, in such cases affects tax revenue and introduces a new element into the equation. How should that modify the earlier results on the desirable way to stabilize prices?

Efficient price stabilization of crops with low serial price correlation, typically annual crops, is reasonably straightforward for the following reason. Current changes in tax revenue caused by a divergence between the expected and actual price, which will affect the budget this year, should be temporary and on average will cancel out, provided the tax rules are based on the average prices expected to prevail. The problems arise with serial correlation because current shortfalls in tax revenue require a change in the producer price if the shortfall is not to persist. With that in mind, consider the difference between taxing nontraded and traded goods.

Nontraded goods are most likely to be taxed by lowering the producer price below the urban consumer price, often by compulsory procurement or by giving marketing boards legal monopsony buying rights (often enforced by road blocks to prevent arbitrage, as for Kenyan maize at various periods in the past). For these goods, price and output are likely to be correlated as variable supplies confront relatively unchanged domestic demand. In these cases, there are normally advantages to the use of privately supplied forward markets, with forward contracts entered into at the time of planting. Such schemes will not work in the presence of tax wedges between producers and the wholesale market, and will need to be replaced by a preannounced harvest price, procurement price, or price offered by the marketing board. Once the appropriate level has been set to generate the required tax revenue on average, the price can be stabilized at this level using the Mirrlees formula. Traded, nonserially correlated crops can be similarly treated, and for

these crops, price stabilization has some advantages over forward contracts, as noted above, so the minor sacrifice of using the wrong instrument or technique does not arise.

The more interesting and difficult questions relate to the stabilization of serially correlated crops, especially tree crops, that have a dominant role in foreign trade but are subject to heavy export taxes or import protection. Ghanaian cocoa is a good example, accounting for two-thirds of export revenue and a third of total tax revenue. The important characteristics of such cases are that price stabilization will have a nonzero expected impact on the future government budget. Thus if the world price falls, signaling a period of lower future prices, and the government does not lower the producer price by a greater absolute amount to make up for the reduced output that will be forthcoming at the lower producer price, then export tax revenue will be lower for the foreseeable future. The alternative of holding cocoa tax revenue constant will destabilize producer prices. What should happen in such cases?

The case of Ghanaian cocoa has been analyzed in some detail in Newbery (1990) and throws light on these questions. The formula for the optimal cocoa tax relates the tax on cocoa to four factors: the tax on other consumer goods, the cocoa supply elasticity, the price elasticity of demand for taxed consumer goods, and a distributional parameter. A characteristic feature of the long-run cocoa supply function is that it is very elastic at a critical level, below which cocoa production is unprofitable, and less elastic above this level. Thus the elasticity falls as the price rises. This is modeled by a supply function of the form  $Y = A(p - k)^\mu$ , where  $Y$  is cocoa supply at a producer price  $p$ .

Now consider the effect on the optimal cocoa tax of an unexpected fall in the world price that is expected to persist for the foreseeable future. If the cocoa and consumer tax rates are kept constant, the producer price of cocoa will fall and induce a reduction in supply. Cocoa tax revenue will fall for two reasons: the same tax rate on a lower world price produces less revenue per ton, and fewer tons are produced. The second effect is that the elasticity of cocoa supply rises, and this would argue for a lower tax on cocoa, given the formula for the optimum tax. The reason is simple—the deadweight cost of the cocoa tax has risen with the supply elasticity, making the tax less attractive than alternative sources of revenue.

All these effects reduce cocoa tax revenue, and the shortfall must be made up either by raising consumer taxes or cutting expenditure. Either way, the marginal cost of raising tax revenue will increase, and this will argue for a higher tax rate on cocoa. The net effect of all these forces is illustrated in table 21-3. This table shows the optimal producer price as a ratio of the f.o.b. price, as well as the elasticity at that price ( $\eta$ ), and the optimal shadow tax on cocoa, which is the ratio of the farmgate producer price to the marginal

Table 21-3. *Optimal Taxes and Cocoa Prices for Ghana*

	Values for inequality aversion $\nu$			
	$\nu = 0$	$\nu = 0.5$	$\nu = 1$	$\nu = 2$
<i>Case 1</i> World price = 320 cedis/kg; Rev = 100; $\eta = (130, 0.15)$				
DOM/FOB price	50	53	54	58
Elasticity	0.8	0.7	0.6	0.5
Shadow tax rate	32	29	26	21
Indirect tax	41	43	46	52
<i>Case 2</i> World price = 320 cedis/kg; Rev = 100; $\eta = (120, 0.15)$				
DOM/FOB price	48	50	53	57
Elasticity	0.7	0.6	0.5	0.45
Shadow tax rate	35	32	29	23
Indirect tax	42	44	46	52
<i>Case 3</i> World price = 280 cedis/kg; Rev = 100; $\eta = (130, 0.15)$				
DOM/FOB price	50	51	52	54
Elasticity	1.1	0.95	0.9	0.75
Shadow tax rate	31	29	28	25
Indirect tax	62	63	63	66
<i>Case 4</i> World price = 320 cedis/kg; Rev = 80; $\eta = (130, 0.15)$				
DOM/FOB price	52	55	57	63
Elasticity	0.85	0.7	0.6	0.5
Shadow tax rate	28	24	21	13
Indirect tax	35	36	39	46
<i>Case 5</i> World price = 320 cedis/kg; Rev = 100; $\eta = (95, 0.3)$				
DOM/FOB price	49	50	52	55
Elasticity	1.0	0.9	0.9	0.8
Shadow tax rate	32	30	28	24
Indirect tax	61	63	64	67

Note: All data by percent except for elasticity data. Italicized data identify parameters that have changed.

export revenue (its shadow price) less the handling costs from farm to port. The value of the supply elasticity is computed using values for  $(k, \mu)$  shown in brackets after the expression for  $\eta$ . The government's revenue requirement,  $Rev$ , is specified, and if the cocoa tax falls, then indirect taxes must rise. Table 21-3 shows how the indirect tax rate on consumer goods, defined as the ratio of the tax to the pretax price, varies with the producer price of cocoa as the coefficient of inequality aversion,  $\nu$ , varies.<sup>5</sup>

Table 21-3 reveals that the producer price is sensitive to inequality aversion and to the government's revenue requirements. Compare cases 2 and 3—if the world price of cocoa falls 12.5 percent from 320 Ghanaian cedis per kilogram (\$1,800 per ton in U.S. dollars) to 280 cedis per kilogram (\$1,575 per ton), then the ratio of the producer price to f.o.b. price rises from 48

percent to 50 percent if the government is unconcerned with the distribution of income ( $\nu = 0$ ); it falls from 53 percent to 52 percent if  $\nu$  is 1.0, and from 57 percent to 54 percent if  $\nu$  is 2.0.

The degree of price stabilization varies with attitudes to inequality aversion, for the following reason. If the government is very concerned with inequality ( $\nu = 2$ ), then the cocoa producer price is raised to 57 percent of the f.o.b. price, or 79 percent of the farmgate shadow value,<sup>6</sup> and the loss in taxes is met by increasing the consumer tax rate to 52 percent of the pretax price. If the government is not interested in redistribution ( $\nu = 0$ ), cocoa will be more heavily taxed, the cocoa price is reduced to 48 percent of the f.o.b. price (that is, 65 percent of the shadow price), and the consumer tax rate is lowered to 42 percent. The reason is that raising the cocoa price is a good way of raising rural wages and land rents and therefore raising the prices of nontraded agricultural goods that are produced by poor farmers but consumed by average consumers. Raising cocoa prices thus transfers income from representative consumers to poorer rural families. It is also useful to point out that a 12.5 percent fall in the f.o.b. price already reduces the farmgate shadow value by 15 percent, because handling costs do not change. Thus the cocoa export tax structure is *stabilizing* for inequality aversion  $\nu \leq 1$ , and somewhat *destabilizing* for  $\nu > 2$  (that is, the producer price then changes more than the shadow price).

If the cocoa producer price is high (that is, where  $\nu = 2$ ), the supply elasticity is low, and hence the tax rate may need to be raised when revenue shortfalls must be made up. When the cocoa price is lower (that is,  $\nu = 0$ ), the supply elasticity rises rapidly, and it is desirable to lower the tax rate as the world price falls, even though this means raising the consumer goods tax rate. At  $\nu = 0$  the consumer tax rate rises from 42 to 62 percent, at  $\nu = 2$  it rises from 52 to 66 percent, given the fall in the world cocoa price of 12.5 percent. The other lesson to draw from this example is that even when the tax policy appears to be destabilizing and the producer price changes more than the shadow price, the cocoa farmer is being protected from maintaining his contribution to total tax revenue because part of that cost is transferred to other consumers. The macroeconomic consequences of a fall in the export price of cocoa—which causes a fall in export revenue and cocoa supply, and potentially a trade and budget deficit—are diffused through the whole economy and the costs of adjustment do not fall only on cocoa farmers. The fall in the world (long-run equilibrium) price of cocoa causes falls in the price of nontraded agricultural goods and a rise in the price of taxed consumer goods. It will cause a fall in the real exchange rate and a fall in the price of nontradables relative to imports. Changes in the price of cocoa will cause changes in the real disposable income of both producers and consumers, and the effect of the policy toward cocoa farmers will be possibly to destabilize the incomes of consumers, though this is better described as one of spreading the risk of cocoa price fluctuations over consumers as well as producers.

Table 21-3 also shows that the producer price is moderately sensitive to the location and shape of the cocoa supply curve, and it is less sensitive to inequality aversion when the revenue constraint binds tightly. Compare cases 2 and 3, or 3 and 4.

### ***Speeds of Price and Tax Adjustment***

The previous story of cocoa tax policy concentrated on the required adjustments to permanent changes in the perceived equilibrium world cocoa price. If cocoa prices followed a pure random walk, each price change would signal the need for a corresponding tax change. The only issue to settle is whether frequent smaller adjustments are preferable to infrequent larger adjustments and what the control variables are. If the cocoa export tax *rate* is chosen as the control, the producer prices will change automatically unless the tax rate is changed. Near the elastic part of the supply schedule it may be desirable to make rapid adjustments of the cocoa tax rate—equivalently, the tax schedule can be made nonlinear. Then it remains to decide how often to adjust the consumer tax rate—and since annual adjustments of the fiscal deficit are likely to be required, there is no reason not to synchronize adjustments of the consumer tax rates with the cocoa tax changes.

Maintaining a constant real price of cocoa over an extended period is dangerous, in that quite large adjustments might be needed if they are made infrequently. Since the short-run supply elasticities are lower than long-run elasticities, there is a case for at least preserving the tax *rate* when the world price falls, and there is less urgency to raise the producer *price* when the world price rises. But if the intention is to induce additional supplies—that is, if the world price rises—then short-run price adjustments may still be needed to induce long-run supply responses. Thus, both when prices are rising and when they are falling, there is a stronger case for maintaining the tax *rate* than the producer price.

### ***Does Taxation Strengthen the Case for Price Stabilization?***

The main practical finding of Newbery and Stiglitz (1981) was that the gains from price stabilization were likely to be small, in large part because it was assumed that agents had already optimally adjusted to the prevailing risks, and that markets, although incomplete, were nevertheless competitive and flexible. That book was careful to point out the qualifications behind this claim, and it devoted a whole section to examining the macroeconomic case for price stabilization without finding very convincing arguments for overturning the microbased estimates. But supposing markets are not competitive, or are subject to distortions, either monopoly markups or taxation,

might these competitive estimates seriously underestimate the gains from price stabilization?

This question is briefly addressed in the appendix where it is shown in a simple quadratic cost model that the certainty equivalent gains from price stabilization can be written as  $\Delta U = [1/2] \Delta \bar{p} \Delta x$ , where  $x$  is the expected output level and  $\bar{p}$  is the expected price. If output is subject to a tax at rate  $\tau = t/p$ , then the total change in welfare (the certainty equivalent value of farmer's income and tax receipts) is  $\Delta U + t\Delta x = [1/2] \bar{p}[1 + 2\tau]\Delta x$ . The total benefit as a fraction of the farmer's certainty equivalent income is thus increased by a factor  $[1 + 2\tau]$ , which might be appreciable. If tax revenue is more valuable than farmer's income because of the cost of raising additional tax revenue, then this factor will be further increased to  $[1 + 2\lambda\tau]$ , where  $\lambda$  is the marginal cost of raising taxes, taking farmer's income as numeraire.

Whether or not distortions substantially strengthen the case for price stabilization depends on the size of the supply response to price stabilization, and that in turn will depend on how much *additional* insurance this provides, as well as the nature of the insurance. For example, at low levels of subsistence, stabilizing the price of the main food grain may encourage farmers to allocate a significantly greater area to cash crops, rather than making sure that they have an adequate area under staples to avoid famine in worst-case scenarios. If the cash crops are taxed, then the output response to price stabilization may generate substantial additional revenues that accrue to the government. There might be a further small-order effect: as revenue rises, taxes can be lowered, and this will reduce the deadweight losses of the tax system. These reduced losses should be counted as an additional benefit of price stabilization.

### Interactions among Price Stabilizations in Different Markets

If the government decides to stabilize the producer price of cocoa and maize in Ghana, or other sets of commodities in other countries, how important is it to take possible repercussions into account? This is a question that Braverman and others (1990 and chapter 22 of this book) have addressed in the case of Brazil. Specifically, they ask whether the benefits of band-width price stabilization can be reasonably well approximated by looking at each commodity in isolation, or whether it is necessary to study multimarket interactions—that is, whether it is important to look at the effect on producer and consumer welfare of simultaneously stabilizing prices in all markets, allowing for the effects of price changes in one market to influence production and consumption in other markets. It is known from earlier work that these interactions are important for assessing the desirability of

agricultural price reforms, but it has not been clear whether the same was true of the benefits of price stabilization. From an intellectual point of view, it is certainly interesting to see if multimarket interactions alter the case for intervention. Chapter 22 claims that in Brazil the results allowing for interactions are remarkably close to those that ignore the interactions—a surprising result, which, if generally true, would simplify the analysis of the case for price stabilization. I shall argue that the result is unlikely to be generally true.

How would one expect multimarket interactions to arise for price instability? What are likely to be the main channels through which changes in price instability in one market impact on prices in other markets? How can one explain the apparent lack of such effects observed in the Brazilian examples? Divide the effects into changes in quantities—and possibly prices—and changes in real income instability or the insurance impact. First consider the induced impact on quantities in one market of changes in price instability in another. If we consider the argument above that production responses to prices stabilized at some level rather than at their market-clearing level are small, then we should look to the demand side. Here the main channel is likely to be substitution effects for very close substitutes, such as wheat and rice, and beef and mutton, and income effects on the poor when the price of the main foodgrain rises sharply. For grains the cross-price effects across different grains may well be small, and in a country like Brazil the income effects appear to be small at the aggregate level. However, in India this might not be true. The next section, on food price stabilization, provides an example where market interactions are likely to be strong.

But what about the insurance effects? Here one must be rather careful as to what is being measured. If one looks at one market and assumes that producers are specialized, then there are no portfolio effects of risk pooling from different commodities. Looking at many commodities for a representative producer who is assumed to produce all crops means that the producer may already be quite well diversified with no intervention, with the implication that reducing the price instabilities of each commodity separately may not be worth so much more. This would not matter if the benefits of risk reduction had already taken account of the share of income coming from the stabilized crop. As pointed out above, the gains to a farmer with fraction  $\mu$  in the stabilized crop would be  $\mu^2$  times that of a specialized farmer. Provided this is done, then the only reason for worrying about multimarket interactions when measuring the gains to price stabilization in more than one market is that there are correlations among prices and outputs for different products. If the correlations among products are zero, then the variance of total income is the sum of the variances of the individual crops, and because the benefits depend on the change in variance of income, an additive approach ignoring interactions would be correct.



Consider this example: a farmer grows two crops that each experience a common output shock due to weather but whose output is not perfectly correlated. If one of the crops is nontraded, then its price is likely to be correlated with output and hence the output of both crops. We can model the effect on the farmer as follows. He receives an average fraction  $x$  from the nontraded crop whose output is  $\bar{\theta}$  and price is  $\bar{p}$ , and a fraction  $1-x$  from the traded good whose output is  $\bar{\theta}\bar{\phi}$ , where  $E\bar{\theta}\bar{\phi} = 0$ . The unaccounted-for extra gains from perfectly stabilizing both crop prices and just adding the gains to each crop (appropriately weighted by  $x^2$  and  $[1-x]^2$ ) would be  $2x[1-x]\{cov(\bar{p}\bar{\theta}, \bar{\theta}\bar{\phi})/\bar{p} - cov(\bar{\theta}, \bar{\theta}\bar{\phi})\} = 2x[1-x]\rho\sigma_{\theta}\sigma_p$ , where  $\rho$  is the correlation coefficient between price and output for the nontraded crop that is presumably negative. (The formulas for this calculation can be found in Newbery and Stiglitz 1981, p. 193.) Thus if  $x = 0.5$ ,  $\rho = -0.7$ ,  $\sigma_{\theta} = 0.3$ , and  $\sigma_p = 0.3$ , then the gains to price stabilization will overstate the change in the squared cv of income by 0.0315, arguably appreciable relative to the total reduction.

Thus, whether interactions are important depends on the correlations between crops, and on their respective shares. But it should not be necessary to do any general equilibrium analysis to calculate the interactive risk benefits, though it may be necessary to do so to find the impact on average income.

## General Policy toward Basic Foodstuffs

Most studies of commodity price instability have concentrated on the effects on producers and exporting countries of stabilizing the prices of primary, typically nonfood, commodities. In contrast, agricultural price policy within countries emphasizes the price and availability of the major foodgrain, for obvious reasons. Not only are cereal prices volatile, but they constitute a significant fraction of the expenditure of the poor. In the Philippines the expenditure share of rice is 36 percent for the poorest quartile, and 34 percent for the next quartile (Garcia and Pinstrip-Anderson 1987), while in India in 1964-65 the expenditure share of foodgrains was 54 percent for the poorest quintile (Mellor 1978). An increase in food prices relative to income of the poor may literally be a matter of life or death. Whereas fluctuations in the world price of an export crop typically affect all farmers proportionally or progressively, if richer farmers specialize more in export crops, food price fluctuations are likely to have an adverse distributional impact, because food expenditures are a relatively larger share of consumption for the poor. If the main concern with export price instability is with efficiency, or remedying the market failures associated with missing insurance markets, a large part of the concern with food price instability is necessarily with equity or food security.

Food price stabilization differs from the standard theory of export commodity price instability in a number of important ways. First, it is likely to be very misleading to work in terms of a representative consumer, whereas it might be quite reasonable to consider a representative producer of an export crop. Second, and related, there may be a reasonably well-defined poverty line in terms of the ability to purchase food; beyond this the social costs of an increase in food prices may rise very rapidly. Third, some of the instruments available to deal with food price instability differ from those available to primary producers. Futures and forward markets are not of practical importance to consumers, because the minimum transactions are too large for consumption hedging. Consumers may borrow and lend and can also even out their consumption of cereals by storing grain. The main problem with these intertemporal smoothing strategies is that credit may not be available or may be too costly to make the options feasible or attractive.

There are other institutions that may substitute for these expensive alternatives. Price stabilization may reduce the instabilities for both producer and consumer, whereas ration shops and food entitlements may be relatively more effective than price stabilization to consumers. Newbery (1989) has investigated the relative merits of some of these alternative institutional responses to consumer risk. First, consider the critical question of market failure—does the competitive market with rational expectations undertake adequate storage from the consumers' point of view? The answer, in general, is no. The competitive market will arbitrage the present value of future food supplies provided it is above the current cost of food—that is, provided food is relatively cheap now compared to next period. The consumer wishes rather to arbitrage the marginal utility of consumption, not the price. If the price of food is expected to increase, the marginal utility of food consumption will increase even more, for it will be equal to the price times the marginal utility of income. The latter will rise as real income falls, which is what will happen for a food buyer when the price rises. Another way of making the same point is that the value of food to a starving person is not adequately measured by its market price.

Now for most agricultural goods, such as coffee, sugar, and so on, the expenditure share is so small (less than 2 percent) that changes in their prices have negligible income effects. But, as remarked above, for consumers near the subsistence margin, the income effects of changes in prices of staple foods are the dominant force behind demand adjustments. So the value of additional storage for consumers may be very high. Indeed, in isolated subsistence communities, each family typically undertakes grain storage despite its high carrying cost. If consumers could store as cheaply as specialist stockholders, then they could do the socially optimal storage and there would be no market failure. If consumers face a cost disadvantage, then it would be desirable to increase storage above the competitive level, possibly by subsidizing private storage.

A more fundamental question is whether it is more cost-effective to devote public funds to increasing the supply of storage and to price stabilization, or whether it would be better to use the money to purchase grain to provide at a fixed and below-market clearing price in ration shops. A fixed ration available to all at a predetermined price is like a forward or futures contract and has the same risk-reducing properties except that the size of hedge is predetermined. Rations provide income insurance that pays off when the price of grain is high, and this reduces the demand elasticity and increases the volatility of market prices. It also increases the demand for storage, by transferring purchasing power to those with relatively higher demands for food, hence raising the price. It can be shown that if private storage responds to the increased need for storage or if the public sector provides the extra storage, perhaps by purchasing the rations in advance and storing, then rations are initially superior to extra price stabilization. The main problem with rations is that they increase price volatility, which, if not offset, will impact adversely those not covered by the ration scheme. At high program levels—that is, when the degree of intervention is large—rations may be inferior to price stabilization if the coverage is incomplete, even allowing for the extra administrative costs of operating public storage schemes, rather than leaving storage to the market.

The intuition behind this result is that rations transfer purchasing power or insurance uniformly to consumers who are covered by the ration program, whereas price stabilization benefits consumers in proportion to their food consumption, which will be lower for the more deserving poor. For small interventions the lack of full coverage is unimportant, because the effect of rations on price instability is initially negligible, but as the scale of the intervention increases, so does the social cost to those not covered.

### **The Political Economy of Government Price Interventions**

One measure of the importance governments may attach to price stabilization, or at least price control, is that the typical form of intervention for agricultural goods is to fix the price, whereas for other goods the tax, tariff, or quota is the decision variable, with the price adjusting to the intervention. This is not a completely rigid distinction—some countries also attempt to control the price of energy, and some impose quotas on agricultural goods, but the exception proves the rule. It follows that, in a competitive market like agriculture, if the price is set at a nonmarket-clearing level, then either the government must handle at least one side of the market (through a marketing board, export agency, or import agency) or a complex system of endogenous taxes and subsidies must be set up, as with the European Com-

munity's Common Agricultural Policy. With nonstandardized commodities, like most producer goods, setting prices with limited information is a recipe for disaster, and government attempts at market control are usually delegated to cartels such as the International Air Transport Association or the European Iron and Steel Federation. With energy, where goods are homogeneous and production is often under state ownership, direct price control is feasible.

Optimal tax theory in a riskless world concentrates attention on the relationship among different tax rates, not different prices, so tax interventions are a more natural way of implementing optimal policies. Add to this the evident superiority of market solutions to administrative outcomes for potentially competitive markets like agriculture, and it is hard to see any good economic case for directly controlling prices, apart from risk reduction. A simple interpretation of price interventions is that they are a logical response to the need for reducing risk. That case has been set out above. If the world price fluctuates and is nonnegatively correlated with production, then stabilizing the price to some degree will be justified (Mirrlees 1988), though a stabilized forward market may be even better. The problem with this explanation is that if price stabilization were the goal, then one would expect an explicit relationship between the announced price and the world price (for a traded good) or between the extent of the intervention and the size of the stockpile (for a stored, nontraded good). Rarely is this the case, though budgeting pressures may induce an adaptive relationship after the fact as the divergence between the domestic and world price grows, so that efficiency and possibly budgetary costs become too large to ignore. Similarly, in the case of nontraded goods the finance of buffer stocks can rapidly amount to a sizable fraction of the public budget.

Again, if interventions were really designed to balance risk benefits against efficiency costs, then one would expect to observe the preservation of seasonal and spatial price variations, which, while consistent with annual, regionally specific price stabilization, preserve incentives for efficient storage and transport and maintain the benefits of the decentralized competitive market. But all too often these features are absent. So what is the real reason for agricultural price interventions?

I submit that they have little to do with risk reduction, and more to do with redistributing income. (This is also true of most international commodity agreements.) The rationale of price stabilization is a convenient cloak for the activity of price manipulation, which in turn is designed to transfer rents to appropriate clients and to confer power on those who are enabled to control the prices and the allocation of rents. The enormous advantage of price interventions over the levying of taxes and subsidies is that, like the allocation of quotas, they are opaque rather than transparent. Few economists, let alone consumers, are aware of the implicit taxes and subsidies implied by a system of domestic price-fixing, relative to an unobserved world

market price (f.o.b. or c.i.f. *now in this country*) and an unknown set of margins between crops delivered at different places into the up-country buying post, or f.o.b. at the main port, or at wholesale or retail. Few consumers can relate the price they pay in the supermarket for coffee beans of \$4.20 per pound to the world market price of \$1.25 per pound.

A simple political-economic theory of these price interventions might go as follows. Once the price becomes a decision variable, it becomes worthwhile to organize pressure groups to influence the choice. Different prices are salient to different groups or their representatives. Farmers are directly affected by output prices, somewhat less so by input prices. Consumers can be sensitized to prices for some foods, such as bread, grain, possibly milk, and so on, but not others, such as meat and vegetables, where quality variation makes price variation inevitable. Even here, salient items may become sensitive. Whether the pressures are mediated directly, via landowning politicians, or indirectly, via political support, trade unions, or the urban proletariat, matters perhaps less than the perceived benefit of the intervention—the degree of price raising or lowering achieved, as well as its durability. It is worth noting the difference between producers, who want real price stability (that is, maintaining the purchasing power of their product) and consumers, who seem more concerned with nominal price stability (that is, a real reduction in prices).

Some support for this view comes from Gardner's (1987) explanation of the structure of U.S. farm commodity programs. His argument is that interventions can be best understood as a mechanism for redistributing income to farmers constrained by the deadweight costs involved. He finds that higher deadweight costs per dollar transferred reduces intervention, that import penetration increases protection, and that there is an optimal "interest" group size—presumably because larger groups gain less per member for a fixed budget transfer, and larger transfers have higher deadweight losses.

Certainly the history of marketing board interventions is not a happy one for those advocating government intervention for price stabilization. Perhaps the locus classicus is Helleiner (1964), but the recent history of the Ghana Cocoa Board repeats the old story. Even if price stabilization was an original motive, the creation of an organization that can tax farmers rapidly gathers a momentum of its own, perhaps explained as both a desire to generate revenue for the government (that is a straight export tax) and a desire to maximize the size, staff, and salaries of the members of the marketing board. Control over the trade of an export crop in a country with an overvalued currency undoubtedly offers additional advantages. Thus the Ghana Cocoa Board trebled its employment over a period in which cocoa output fell to less than half its earlier level, and the fraction of the world price received by farmers fell from over 50 percent of the f.o.b. price when that price was high to, at one point, less than 10 percent of its effective value. Similar stories of administrative inefficiency could be replicated for many

countries, and when storage is involved, the potential for incurring unjustified and excessive costs has a whole new dimension, as the Common Agricultural Policy shows.

## Conclusions

The economic theory of risk offers several important insights. First, the cost of the risk increases as the *square* of the amplitude of the fluctuation. Small fluctuations are not very costly, and it is entirely plausible that the costs of creating institutions to reduce these risks will not be justified. Large fluctuations are, however, potentially far more costly, and these are the risks most likely to create a demand for risk sharing or risk pooling. The policy issue to resolve is how far the existing institutions—such as borrowing, storage, forward contracts, sharecropping, crop diversification, extended family networks, and so on—adequately meet these demands, and how cost-effective additional publicly supplied stabilization schemes would be. Second, all agents face some risk, and the relevant question to ask is what determines the cost of an additional risk. The answer is that it depends on its *covariance* with existing risks—the cost will be higher the stronger the degree of positive covariance, whereas negatively correlated risks will actually reduce the total cost of risk bearing. Stabilization schemes need to take into account the covariances and correlations and hence to distinguish between traded and nontraded goods. Third, different issues arise whether one is concerned primarily with producer or consumer risk, and different instruments may be appropriate. Fourth, it is important to distinguish between serially uncorrelated and serially correlated prices. Most internationally traded commodities exhibit a high degree of autocorrelation in their prices, and this fact should be reflected in the choice of policy.

Finally, and central to this chapter, when price shocks are persistent and the commodity in question is both important at the macro level and a major source of taxation, then the whole structure of taxes should be adjusted when international prices change. If the export tax is optimally set, then its marginal cost will be equated to that of other sources of revenue. Changes in the external price level will change the marginal cost of export taxation and require compensating adjustments in the other taxes. We examined what this might mean in the case of Ghanaian cocoa export taxes and showed that, as a rough approximation, the export tax rate rather than the tax level should be maintained. Finer adjustments might be justified, but whether the export tax stabilized or destabilized domestic producer prices turned out to depend on attitudes to inequality. For a range of plausible values, the optimal Ghanaian cocoa tax was roughly neutral as regards stabilization.

## Appendix: Derivation of Risk Formulas

### Production under Risk

Farmers choose the level of input,  $x$ , at the start of the crop year, to produce output  $q = x\bar{\theta}$ , where  $\bar{\theta}$  is a random variable reflecting the influence of weather, and so on. Its expected value at the time of planting is  $E\bar{\theta} = 1$ , and the value of  $\theta$  is revealed at the harvest. The price at harvest is  $\bar{p} = f + \bar{u}$ , where  $\bar{u}$  is a mean-zero random variable, uncorrelated with  $\bar{\theta}$ , and  $f$  is the expected value of  $p$  (and also the futures price if there is an unbiased futures market). The farmer's income, in the absence of a futures market, is

$$(21-1) \quad \bar{y} = \bar{p}\bar{q} - \frac{1}{2}cx^2$$

and the farmer has a constant absolute risk aversion utility function. Assuming  $\bar{p}\bar{\theta}$  is normally distributed (or under weaker assumptions, given in Newbery (1988), to a high degree of approximation), the farmer chooses  $x$  to maximize

$$(21-2) \quad U = E\bar{y} - \frac{1}{2}A\text{var}(\bar{y}).$$

If  $\bar{p}$  and  $\bar{\theta}$  are uncorrelated, this can be written

$$(21-3) \quad U = \bar{p}x - \frac{1}{2} \left[ cx^2 - A\bar{p}^2x^2[\sigma_q^2 + \sigma_p^2 + \sigma_q^2\sigma_p^2] \right]$$

where  $A$  is the coefficient of absolute risk aversion,  $\sigma_q$  is the coefficient of variation (cv) of  $\theta$  (and  $q$ ), and  $\sigma_p$  is the cv of price,  $SD(\bar{u})/\bar{p}$ . The optimal choice of  $x$  is given by

$$(21-4) \quad x = \frac{\bar{p}x}{c\phi}$$

where

$$\phi \equiv 1 + 2R[\sigma_q^2 + \sigma_p^2 + \sigma_q^2\sigma_p^2] \quad \text{and} \quad R = \frac{A\bar{p}^2}{2c}.$$

Here  $R$  is the (dimensionless) coefficient of relative risk aversion, evaluated at the risk-free level of income,  $\bar{y} = [1/2] \bar{p}^2/c$ . The certainty equivalent level of income is then  $U = [1/2] \bar{p}^2/[c\phi]$ .

### Perfect Price Stabilization

The effect of perfectly stabilizing price is to set  $\sigma_p = 0$ , and to change the value of  $\phi$  to  $\phi^* = 1 + 2R\sigma_q^2$ . The cash value of stabilization to the farmer is measured by the change in certainty equivalent income,  $\Delta U$ :

$$(21-5) \quad \frac{\Delta U}{U} = \frac{\phi - \phi^*}{\phi^*} = \frac{2R\sigma_p^2[1 + \sigma_q^2]}{1 + 2R\sigma_p^2}.$$

If the farmer has access to an unbiased futures market with price  $f$ , then income must be augmented by the term  $z[f - p]$ , where  $z$  is the volume of futures sold. Substituting this term in equation 21-2 and choosing  $z$  optimally (Newbery and Stiglitz 1981, p. 184) shows that  $z = x$ , and the effect on equation 21-3 is to eliminate the term  $\sigma_p^2$ . The benefit of introducing the futures market will differ from equation 21-5 in that the numerator will be just  $2R\sigma_p^2$ , slightly less than the benefit of perfect price stabilization.

### Output Responses to Stabilization and the Effect of Tax Distortions

The welfare impact of a futures market or price stabilization can usefully be expressed in terms of the supply response, as follows. The certainty equivalent income is  $U = [1/2] \bar{p}x$ , where equations 21-4 and 21-5 show that  $\Delta U = [1/2] \Delta \bar{p} \Delta x$ , and  $\Delta U/U = \Delta x/x$ . If output is subject to a tax at rate  $\tau = t/p$ , then the total change in welfare (the certainty equivalent value of farmer's income and tax receipts) is  $\Delta U + t\Delta x = [1/2] \bar{p}(1 + 2\tau)\Delta x$ . The total benefit as a fraction of the farmer's certainty equivalent income is thus increased by a factor  $[1 + 2\tau]$ , which might be appreciable.

### Price Stabilization When Prices Are Autocorrelated

Suppose prices follow the following simple autoregressive scheme:

$$(21-6) \quad \bar{p}_t = \alpha p_{t-1} + [1 - \alpha] \bar{p} + \bar{u}_t$$

where  $\bar{u}_t$  is i.i.d. with zero mean. This can also be written as

$$\bar{p}_t = f_t + \bar{u}_t$$

where

$$f_t = E_{t-1} \bar{p}_t = \alpha p_{t-1} + [1 - \alpha] \bar{p}.$$

Again,  $f_t$  is the expected price, equal to the futures price at the start of period  $t$  in an unbiased market. To simplify the analysis, suppose there is no output



risk, so that  $\sigma_q = 0$ . The same arguments as before imply that in the absence of a futures market:

$$(21-7) \quad q = \frac{f}{c\phi}, \quad U = \frac{f^2}{2c\phi}, \quad \phi \equiv [1 + 2R\sigma_p^2]$$

where the time subscript has been suppressed. Now consider the problem facing a farmer with a two-year horizon, with the initial expected price  $f_t = \bar{p}$ , its long-run average level. This in turn implies that  $p_t = \bar{p}[1 + \bar{\epsilon}_t]$ , where  $\bar{\epsilon}_t = \bar{u}_t/\bar{p}$ , and  $f_{t+1} = \bar{p}[1 + \alpha\bar{\epsilon}_t]$ . Consider the present value of the sum of the two certainty equivalent incomes at the end of period  $t$ :

$$(21-8) \quad W = \frac{f_t^2}{2c\phi} + \frac{\beta f_{t+1}^2}{2c\phi} = \frac{\bar{p}^2}{2c\phi} \left[ 1 + \beta[1 + \alpha\bar{\epsilon}_t^2] \right]$$

where  $\beta$  is the discount factor. Each term in equation 21-8 is the certainty equivalent income for that period, but at the start of period  $t$ , the certainty equivalent income in period  $t + 1$  is uncertain. The certainty equivalent present value can be found by replacing  $y$  by  $W$  in equation 21-2 and is

$$(21-9) \quad V = \frac{\bar{p}^2}{2c\phi} \left\{ 1 + \beta[1 + \alpha^2\sigma_p^2] - R\beta^2\alpha^2\sigma_p^2[2 + \alpha^2\sigma_p^2]/\phi \right\}.$$

The effect of opening an unbiased futures market and allowing one period ahead hedging is to set  $\phi = \phi^* = 1$  in equations 21-8 and 21-9. If  $\alpha = 1$ , the formula reduces to the one-period case already considered. If  $\alpha$  is strictly positive but not equal to 1, there is no simple analytical expression for the proportion gain in certainty equivalent income in introducing a futures market. But suppose  $\beta = 0.9$ ,  $\sigma_p^2 = 0.1$ , and  $R = 1$ . Then the proportional benefits of having a futures market rather than none fall as  $\alpha$  increases, and are only 90 percent as large at  $\alpha = 1$  as at  $\alpha = 0$ .

Even if the futures market only extends one period ahead, it is possible to increase the degree of hedging by rolling over contracts as they mature. Consider the strategy of selling  $[\bar{p}/c][1 + \beta z y]$  futures at the start of period  $t$ , and find the optimal value of  $z y$ . The present value at the end of period  $t$  is:

$$(21-10) \quad W = \frac{\bar{p}^2}{2c} \left\{ 1 + \beta[1 + \alpha^2\bar{\epsilon}_t^2] + \beta z \left[ \frac{f_t - \bar{p}_t}{\bar{p}} \right] \right\}.$$

The choice of  $z$  is that which minimizes the certainty equivalent value of  $W$ , which in this case amounts to minimizing the variance of  $W$ . The solution is  $z = 2\alpha$ , and this gives

$$(21-11) \quad V = \frac{\bar{p}^2}{2c} \left\{ 1 + \beta[1 + \alpha^2\sigma_p^2] - R\beta^2\alpha^4\sigma_p^4 \right\}.$$

It follows immediately that this strategy of sequential futures trading reduces risk further than futures trading confined to each year.

## Notes

The author is indebted to Angus Deaton for his perceptive comments but does not hold him accountable for the final outcome.

1. It may be the case that farmers are discouraged from engaging in some activities because they are perceived to be risky, when in fact they are relatively secure. Given the scarcity, and in some cases the absence, of risk-shifting institutions comparable to the stock exchange, such perceptions may lead to underinvestment and inefficiency. To the extent that government policy can correct or offset such misperceptions there will be social gains.

2. The (realistic) assumption here is that stocks are unlikely to be held for more than two years. See Newbery and Stiglitz (1981, chapter 30). Storage introduces positive serial correlation and raises some of the problems discussed in the next section.

3. The models on which these figures were estimated were later reestimated, with some revisions to the figures, in Cuddington (1992, table 3).

4. The theoretical and econometric basis for these estimates is given in Cochrane (1988) and Campbell and Mankiw (1987). The wider the window, the more data are allowed to influence the estimate, but at lower reliability. The wider window may thus give a downward-biased estimate.

5. The assumption is that the government's attitude toward the distribution of income can be represented by a "coefficient of inequality aversion" (Atkinson 1970) that may take the value 0.5, 1.0, or 2.0. To take the central value of 1.0, this implies that the social cost of a tax of \$1 on a person whose annual income is \$5,000, is considered to be twice that of a person with twice his income (\$10,000). At an inequality aversion of  $\nu$ , the social cost is  $2^\nu$  times as costly as taxing \$1 on the \$10,000 income. An inequality aversion coefficient of 0 would imply that the government attached zero weight to redistributing income. A central value might be 1.0, which implies that the government attaches equal weight to a given percentage increase in income, no matter what the income level.

6. Allowing for handling, and the optimal export tax of 12 percent of the f.o.b. price.

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*The word "processed" describes informally reproduced works that may not be commonly available through libraries.*

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## How to Analyze the Brazilian Price Band Proposals

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*One of the major concerns in developing countries is the instability of prices of key agricultural commodities. This chapter modifies a methodology developed by Newbery and Stiglitz to study the costs and benefits of the Brazilian price band proposals for rice. These “band proposals” were intensely debated within and outside Brazil and were the spur to our developing an analytical framework for evaluating such proposals. The framework entails two steps: first to estimate the free market outcome (removing all current interventions), and second to impose a price band around the free trade outcome. Our analysis suggests two general conclusions: (a) the welfare gains from price stabilization are unlikely to be large relative to the efficiency gains from price reform, and (b) multimarket interactions do not have quantitatively significant effects on the assessment of the impact of the band proposals on the variability of prices.*

ONE OF THE MAJOR POLICY CONCERNS in developing countries is the instability of prices of agricultural commodities. Evaluation of price stabilization policies has been a key concern for a long time. In this chapter we modify and apply a methodology developed by Newbery and Stiglitz (1981) to agricultural price stabilization in Brazil. The results are relevant to policy discussion in that country and elsewhere. The mid- to late 1980s saw a remarkable crystallization of the policy debate in Brazil, in the form of a number of specific proposals to keep the prices of key commodities within prescribed

“bands.” These “band proposals” were the spur to our research into developing an analytical framework for evaluating such proposals.

Newbery and Stiglitz’s insights and methodology had been absorbed into the literature by the mid-1980s (Kanbur 1984). Their analysis had been motivated by a major policy question of the late 1970s—the proposals of the United Nations Conference on Trade and Development (UNCTAD) for an integrated program for commodities. Their evaluation of the proposals—on the basis of the methodology advanced—was negative.

The major result of our analysis is to question seriously the desirability of price stabilization schemes, both from the point of view of the producer and the consumer. (Newbery and Stiglitz 1981, p. 23)

The first aim of our research was to see whether a similar conclusion would hold when the Newbery-Stiglitz analysis was translated from the international sphere to the case of a particular country—Brazil.

One feature of the empirical analysis of Newbery and Stiglitz, and the basis of their negative conclusion, is that it is conducted market by market, in a partial equilibrium framework for six commodities (cocoa, coffee, cotton, jute, rubber, and sugar). However, in a series of papers analyzing agricultural tax and price reform in a deterministic framework, Braverman and others have argued that market-by-market analysis can lead to misleading conclusions when there is substitution in production and consumption (see Braverman, Hammer, and Brandão 1987; Braverman, Hammer, and Gron 1987). Is the same true of the analysis of commodity price stabilization schemes? An exploration of the impact of stabilization in a multimarket framework was thus the second set of methodological issues that motivated our research.

These methodological concerns are, however, to be seen in the context of our basic objective, which was to develop a tool for policy analysis that can be used to improve the policy dialogue in developing countries. The objective is not, therefore, to take the high ground of theory or econometrics—we wish to adopt a framework that can be used in a policy context, updated easily in light of new data and new policy parameters, and implemented by policy economists in developing countries.

It should be clear that this philosophy is closely related to that of the multimarket methodology developed by Braverman, Hammer, and Brandão (1987) and Braverman, Hammer, and Gron (1987) over the past few years. Just as they have eschewed the use of complicated CGE (computable general equilibrium) models (whose calibration and behavioral properties are problematic to say the least) and relied on a simple, linearized model that is nevertheless capable of handling the impact of key policy changes, in this work on commodity price stabilization we have eschewed the use of complicated time-series techniques that filter out the “true” risk from a data series,

and we also rely on linear functional forms for our basic analysis. Just as the multimarket approach is used to demonstrate to the policymaker what would have happened in a reference year if policy had been different, our approach is to demonstrate what would have happened over a series of reference years (say, the previous eight or ten years) if a particular policy change had been made. Both these approaches require clear and strong assumptions regarding the counterfactual. However, it is hoped that showing the policymaker what the previous decade might have looked like under alternative regimes is a useful guide to policy. The assumption that the structure revealed by past data will continue is of course the basis of much policy analysis, and our analysis is no exception to this.

This chapter draws on a much longer report on our research project (Braverman and others 1992). The object of this chapter is to give the reader a flavor of our approach and our conclusions. The first section sets out the policy context in Brazil and discusses the evolution and nature of the Brazilian band proposals. The next section briefly reviews the main elements of the Newbery and Stiglitz methodology. It shows that such a direct application of their methodology to Brazil is unsatisfactory, and it develops a framework for evaluating the band proposals. The third section applies this framework to one market—rice—while the fourth section takes on the “multimarket” issues for the case of rice and beans. The final section pulls together our conclusions.

## **The Policy Problem in Brazil**

### ***Historical Background***

Even a cursory glance at Brazil's postwar history reveals heavy intervention in agriculture, sometimes with contradictory policies. After World War II the development strategy was one of import-substitution. High protective tariffs were imposed on the import of industrial goods, and this combined with export taxation of agricultural products and overvaluation of the exchange rate led to systematic discrimination against agricultural products on the price front. However, at the same time there was an ambitious investment strategy in marketing facilities, and direct subsidies (for example, on fertilizer) were used to expand production. There was also subsidized credit, as well as the implementation of a minimum price policy.

Because of strong economic and population growth in the 1950s, the end of the decade was marked by food crises, particularly in the 1958/59 and 1961/62 crop years. These food crises required prompt government action for commodities such as edible beans. In these circumstances, price controls were introduced together with other strong measures that were adopted in

order to avoid the appearance of a black market. These were the origins of price fixing. Legislation was conceived in order to protect the domestic market against "speculative attack."

Domestic price policy was used as a price stabilization device, because policymakers tended to view any price increase in staples as liable to provoke social unrest (Lopes 1983). However, price controls invariably affected supply adversely (Schuh 1974), further enhancing the food crisis. This cycle of food deficit, price increases, price control, and reduction in supply became a regular phenomenon in the 1970s and 1980s. In addition, it has been argued that government intervention itself *added* to price risk in the market since the sales of official stocks were not subject to any set of rules and trigger prices. Having these stocks hanging over the market created market risk, particularly at the wholesale level.

Due to indexation in the economy and to downward price inflexibility in other sectors, the government has always been preoccupied with the inflationary bias of price fluctuations. In periods of high inflation, food price control tends to be strongly imposed and enforced. Thus, for example, prices of rice and edible beans were frozen for the five years between 1974 and 1979. In order to make this effective, the government off-loaded its stocks at prices below storage and interest costs. However, after a few years, such a policy becomes unsustainable and there is a price surge that makes the adjustment between production and demand.

The experience of the 1980s shows that erratic and short-term policy intervention continues. Some short-lived trade liberalizations occurred in 1981, 1982, and 1985 for soybeans and in 1982 (a year of bumper crops) for maize and cotton. In 1983 supplies of maize were poor because of floods. Prices of almost all commodities started to rise. Food prices reached a record high late in the crop year, with predictable effects on the price index. Not surprisingly, the government reversed the trend toward freeing trade, at a time when the world commodity boom of 1982 was still influencing domestic prices. Although the 1984 crop was in no sense as poor as 1983, the government overreacted to the traumatic upsurge in food prices of 1983 and banned exports. This led to a depression in farmgate prices and to the government's decision to raise minimum prices.

### ***The Proposed Reforms***

This brief review of postwar agricultural price policies in Brazil should make clear that the government has always strived to avoid large price shocks in domestic markets (Lopes 1987; Braverman and others 1992). But the government has often been shortsighted and has overreacted in imposing a system of interventions that has itself caused market uncertainty. Therefore there is strong feeling among analysts and policymakers that the present policy has

to be changed. The distortions between producer prices, consumer prices, and world prices (for traded commodities) have efficiency costs that have been estimated to be considerable (Calegar and Schuh 1988). However, in recent discussions of policy reform (Lopes 1986), the question of price fluctuations has always been to the fore. Thus, although it is recognized that there should be a direct link between domestic and international prices if agriculture in Brazil is to be efficient, and that this would imply the gradual elimination of direct government intervention, the danger of internalizing short-term price fluctuations in world markets has never been out of the picture.

The response to the twin concerns of price reform and price stability has been the development of the so-called price band proposal. Given that the free market solution was not acceptable because sharp variations in prices and real incomes posed a risk of social and political instability, the proposal was to define a preestablished range of price variation—a price band within which markets would be free to function. Some of the details of these proposals are discussed in Lopes (1987) and Braverman and others (1992).

According to the original proposal made by Dias and Barros (1983), for traded commodities the upper and lower intervention prices for each commodity would be expressed as a ratio of basic reference prices. These reference prices might, for example, be a thirty-six-month moving average of past prices. However, the question of how wide the price bands should be and how frequently they should be changed would be a major price policy issue.

For the domestically consumed food items that were generally not traded on world markets, such as rice and edible beans, the proposed system consisted of a set of trigger prices, coupled with an emergency/buffer stock (Lopes 1986). According to this system, given a supply shock, if domestic prices start to rise, there is a first trigger price at which all commodity loans on an existing reserve stock would automatically be suspended in order to force the delivery of private stocks, or at least ensure that domestic speculation would not be financed with government loans. A second reference price would trigger the sale of government emergency stocks (in the case of rice) or buffer stocks (in the case of edible beans). Until market prices reach these limits, the market would be free from any government intervention. A third reference price is set for allowing tax-free imports. Finally, if the need for imports persists, a fourth reference price is established as an upper price limit, which would be enforced at times of very high world prices and for severe domestic shortage, by granting subsidies to imports. The traditional minimum guaranteed price for a commodity would be the effective lower limit to this price band. As is the case now, below that point CFP (Companhia de Financiamento da Produção) would be prepared to enter the market as a buyer. According to Lopes (1986), together with these reference prices there would be established a full set of publicly announced rules qualifying any government intervention. The management of official stocks



would pursue preestablished criteria, thus creating the least possible risk in the marketplace. For some basic staples, such as rice and dry edible beans, government would be prepared to hold emergency or buffer stocks.

It should be clear, then, that the current price band proposals are a response both to the inefficiency and to the ad hoc nature of government intervention in Brazilian agricultural markets. However, it should also be clear that there are *two* elements to the proposal. The first is more in the spirit of price reform—the attempt to remove as many price wedges as possible. The second is in the spirit of price stabilization—the attempt to insulate domestic prices from severe world price fluctuations and domestic shocks. Our analysis will encompass both these aspects, although focusing on the latter. But before proceeding to a detailed analysis for Brazil, we review the general theory of commodity price stabilization.

## The Theory of Price Stabilization: Toward an Application to Brazil

### *The Theory of Price Stabilization*

As we have seen in the Brazilian case, justification for price intervention in agricultural markets is often given in terms of ensuring price stability. Price instability leads to loss of producer welfare because of revenue uncertainty and affects consumers' welfare via their consumption decisions. But how do these welfare gains of stability compare with the costs of price intervention? The best-known recent contribution to this area is the book by Newbery and Stiglitz (1981). While the analysis of the welfare effects of price stabilization goes back at least to Waugh (1944), the Newbery and Stiglitz contribution is widely regarded as representing the state of the art. Moreover, while the early work of Waugh (1944), Oi (1961), and others was concerned largely with qualitative propositions, the Newbery and Stiglitz approach is one directed toward quantifying the various gains and losses to producers and to consumers.

Newbery and Stiglitz view the producer as experiencing income variations as the result of fluctuations in the agricultural market. Let an individual producer's von Neumann–Morgenstern utility function be  $U(y)$ , where  $y$  is income. Let  $\tilde{y}_0$  be the pre-intervention income—where the  $\tilde{\cdot}$  indicates that it is a random variable—and let  $\tilde{y}_1$  be the post-intervention income. The benefit to the producer can be defined as the amount of money he would be willing to give up to see this change take place. In other words, the benefit is  $B$ , where  $B$  is the solution to

$$(22-1) \quad EU(\tilde{y}_0) = EU(\tilde{y}_1 - B)$$

and  $E$  is the expectation operator. This technique is familiar from the insur-

ance literature, where  $B$  is thought of as the “risk premium”—indeed, the Newbery and Stiglitz methodology is essentially constructed around a view of policy intervention as providing insurance to underinsured agents.

As shown in Newbery and Stiglitz (1981) and Kanbur (1984),  $B$  can be approximated as follows:

$$(22-2) \quad \frac{B}{\bar{y}_0} = \frac{\Delta \bar{y}}{\bar{y}_0} - \frac{1}{2} R \Delta \sigma_{\bar{y}}^2$$

where  $\bar{y}_i$  is the mean of  $\bar{y}_i$  ( $i=1,2$ ),  $\Delta$  indicates the difference between the post-intervention and the pre-intervention value of a variable,  $R$  is the Arrow-Pratt measure of relative risk aversion, and  $\sigma_{\bar{y}}^2$  is the squared coefficient of variation of  $y_i$ .

Equation 22-2 gives the monetary value, to producers, of the intervention as a fraction of current average income. The first term on the right-hand side of equation 22-2 is referred to as the “transfer benefit,” while the second term is the “risk benefit.”

The risk benefit depends, rather intuitively, on the extent of risk reduction and on the extent of risk aversion,  $R$ . The quantification of this benefit for any market requires us to specify these two values. Newbery and Stiglitz take  $R = 1$  as a reasonable value, relying on the estimates of Binswanger (1978). For  $\Delta \sigma_{\bar{y}}^2$ , they make the assumption that perfect price stabilization is the objective of the intervention. Then revenue instability post-intervention is simply output instability pre-intervention, assuming *no supply response* to the stabilization. Note that there are conceptual and empirical difficulties in measuring the instability of a time series of prices and quantities. Newbery and Stiglitz use the coefficient of variation of detrended time series and apply their formula to the *international* markets for several commodities.

What about the transfer benefit? This depends on the *level* at which price is stabilized. As argued in Kanbur (1986), with a constant elasticity demand curve, stabilizing price around its average will mean that demand falls short of supply and stocks will accumulate. Stabilizing price around a level such that demand will take up average supply, however, may lead to a *negative* transfer effect for producers. With less than unitary elasticity of demand, which is a characteristic of most agricultural commodities, the transfer benefit is negative.

Turning now to the consumer benefits of price stabilization policies, Newbery and Stiglitz model the consumer in the standard manner, as maximizing utility subject to a budget constraint. The approach is to suppose that one of the prices, say  $\tilde{p}_1$ , is uncertain, and to calculate the amount the consumer would be willing to pay to get rid of this risk. It can be shown (see Newbery and Stiglitz 1981; Kanbur 1984) that the consumer benefit is approximated by:

$$(22-3) \quad \frac{B^c}{\bar{X}} = \frac{1}{2} [1 - \epsilon \sigma_p^2] + \frac{1}{2} \epsilon \sigma_p^2 - R \epsilon \rho(p, l) \sigma_l \sigma_p$$

where  $X$  is average consumer expenditure,  $\epsilon$  is the elasticity of demand,  $\sigma_p$  and  $\sigma_I$  are the coefficients of variation of price and consumer income,  $\rho(p, I)$  is the correlation between price and consumer income, and  $R^c$  is the consumer's relative risk aversion to income variability at given prices.

The first term on the right side of equation 22-3 is simply the consumer transfer benefit, which is, of course, the negative of producer transfer benefit. The second term is referred to as the "arbitrage benefit," which would accrue even if consumers were income risk neutral ( $R^c = 0$ ). It is a pure social gain that we might expect private storage activity to capture. The assumption behind intervention must be that because of market imperfections, arbitrage benefits remain unexploited.

The last term in equation 22-3 is the "risk benefit." In fact, for four of the six commodities considered this benefit turns out to be negative. It is not surprising, then, that Newbery and Stiglitz reach the overall conclusion that the benefits of price stabilization are negligible and perhaps even negative to producers and consumers alike.

To conclude the section, we would like to mention some of the implicit assumptions of the theory: it is a representative agent model, and it assumes that the buffer stock will never run out, that the trend in prices is known, and that producers of a commodity do not consume it.<sup>1</sup> Also, gross and net income are treated as identical, and the theory, as reported above, assumes that producers have no other sources of income.

### ***An Approach to the Band Proposals***

There are several problems with a direct application of the methodology developed by Newbery and Stiglitz to the analysis of rice price stabilization in Brazil. First, the model in the Newbery and Stiglitz analysis is of an authority that intervenes through buffer stock operations that do not drive a wedge between producer and consumer prices. But the reality of government intervention in the Brazilian rice market is that the government carries stocks that it uses to influence urban prices, while it purchases grain from farmers at producer prices. Thus, there is not a single market price for which  $\sigma_p^2$  of the Newbery and Stiglitz formula can be calculated.

Second, the band proposal is really one of allowing a free market within certain limits, and whether or not the limits are hit depends on the potential free market outcome. In order to evaluate the proposals, therefore, we have to characterize the free market outcomes. This in turn depends on how exactly supply and demand curves are specified.

Finally, for rice, the appropriate domestic market specification that corresponds to the Newbery and Stiglitz international market analysis is that of a *nontraded* good.

The methodology we adopt takes its cue from the multimarket methodology of Braverman, Hammer, and Gron (1987). The approach is first to

characterize the current equilibrium in terms of basic supply and demand features, and then to conduct the policy reforms—a movement to a free market followed by an imposition of a band rule on prices. The first step establishes what would have happened if all government intervention was to be removed. In any period  $t$ , the supply is  $S(P_t^s, \gamma_t)$  and the demand is  $D(P_t^c, \theta_t)$ , where  $P_t^s$  and  $P_t^c$  are producer and consumer price at time  $t$ , and  $\gamma_t$  and  $\theta_t$  are supply and demand disturbances. Since we have information on quantity supplied,  $q_t^s$ , and quantity demanded,  $q_t^D$ , we can infer  $\gamma_t$  and  $\theta_t$ :

$$(22-4) \quad \gamma_t = \gamma_t(q_t^s, P_t^s)$$

$$(22-5) \quad \theta_t = \theta_t(q_t^D, P_t^c).$$

Since rice is a nontraded good by assumption, the difference  $q^s - q^D$  is variation in stocks. We make the assumption that all stock is held by the government (in any case, we have no information over a long enough period to distinguish between private and public stocks).

Let us now suppose that all government intervention were to be removed. Then the market-clearing price at  $t$ ,  $p_t^*$ , would be determined by:

$$(22-6) \quad S(P_t^*, \gamma_t(q_t^s, p_t^*)) = D(P_t^*, \theta_t(q_t^D, p_t^*)).$$

It is the price  $P_t^*$  around which the band is constructed. The current proposal is to define the reference price as a moving average of price in the past five years and then to define upper,  $P^u$ , and lower,  $P^l$ , limits of a band as percentages of this price.

Of course, the fiscal deficit with a free market will be zero. But with the band rule, stock operations will have to be undertaken. When the upper band is hit (that is, when  $P_t^* > P^u$ ), the government unloads stocks to defend the limit. Given the information on prices and quantities, producer revenue, producer surplus, and consumer surplus can be worked out.

Perhaps the most controversial aspect of the operationalization of our methodology is that we assume  $S$  and  $D$  to be linear in price. Thus we assume that linear supply and demand curves shift around with unchanged slope. While several commentators have criticized this linearization as being inappropriate for large changes, the basic problem of choice of functional form remains even if we abandon linearity. In addition, the modeling complexity introduced by nonlinear functional forms goes against our objective of producing a tool that is usable in operational settings. We will, therefore, maintain the linearity assumption throughout the analysis. The slopes of the supply and demand curves are determined by assuming values of elasticities evaluated at the sample mean. Sensitivity analysis is then conducted with respect to these elasticities.

## An Analysis of the Band Proposals for Rice

### *The Historical Picture*

As a result of the concerns over the fluctuation of rice prices in the major urban centers, the government has long attempted to control the rice market. Moreover, 70 percent of rice consumed in Brazil comes from rainfed areas, and the crop is therefore subject to severe risks. A detailed account is given in Lopes (1987). The main instruments of control have been compensatory imports, when there existed sharp fluctuations in supply; a "buffer" stock policy, which consisted of having both paddy and milled rice ready to be delivered to millers and to supermarkets; and the administration and control of marketing credit. These policies led government to a permanent involvement in all stages of rice marketing.

The first column of table 22-1 summarizes the historical values of key variables in the rice market for 1971-86. The average values of prices and quantities have to be interpreted with caution because of uncertainties in the margins assumed for distribution costs and so on, to translate producer prices to the chosen marketplace of São Paulo, and because of uncertainties in the margins assumed for spoilage and seed.

The production of rice has fluctuated considerably. As table 22-1 shows, the coefficient of variation ( $\sigma$ ) of the detrended series is 10 percent. The coefficient of variation of consumption over the same period was 7 percent. The table also summarizes the historical data on a number of other variables

Table 22-1. *Summary of Results for Rice, 1971-86*

Series or units		Historical data	Free market	Band rule
Producer revenue (millions of cruzados)	Mean	52.3	22.5	20.8
	$\sigma$	0.16	0.37	0.10
Producer surplus (millions of cruzados)	Mean	42.6	19.4	18.5
	$\sigma$	0.15	0.33	0.11
Consumer surplus (millions of cruzados)	Mean	74.4	95.8	95.5
	$\sigma$	0.13	0.15	0.12
Producer price (cruzados per kilogram)	Mean	7,392.17	3,912.02	3,614.18
	$\sigma$	0.15	0.39	0.09
Consumer price (cruzados per kilogram)	Mean	7,469.90	3,912.02	3,614.18
	$\sigma$	0.14	0.39	0.09
Production (1,000 tons)	Mean	7,140.53	5,929.94	5,826.33
	$\sigma$	0.10	0.08	0.14
Consumption (1,000 tons)	Mean	5,255.87	5,929.94	5,986.37
	$\sigma$	0.07	0.08	0.06

for the rice market. The average real price received by farmers (in 1986 cruzados) was Cr\$7.39. The coefficient of variation of the detrended historical series is 15 percent. The real consumer price over this period was Cr\$7.47 per kilogram, and its instability (as measured by the coefficient of variation of the detrended series) was about the same as that of producer price.

Instability of supply, demand, and prices leads to instability in revenues and incomes for producers. The instability of producer revenue was 16 percent, whereas that of producer surplus was 15 percent. The risk analysis (Braverman and others 1992) indicates that with a relative risk aversion coefficient of 1.00, the risk cost to producers was Cr\$642.34 million, or 1.23 percent of mean revenue over this period. With a risk aversion coefficient of 2.00, this almost doubles to 2.36 percent. The risk analysis for producer surplus shows a risk premium of 1.07 percent of the historical mean with a risk coefficient of 1.00, and 2.08 percent with a risk aversion coefficient of 2.00.

### ***Simulation of a Free Market***

In order to conduct simulations, we need to assume values of supply and demand elasticities. The mean of elasticities of supply in the studies reviewed in Braverman and others (1992) is 0.37. It lies between the high (0.61) and low (0.23) estimates of Pastore (1973), and is closest to the 0.31 estimate by Paniago (1971). Estimated demand elasticities range from 0.60 by Homem de Melo (1982) to 0.10 by Paniago (1971). The mean value is 0.5, which we use for our simulations.

A free market was simulated by assuming equality of producer price and consumer price in the usual way. As table 22-1 shows, the equilibrium price is dramatically lower on average. However, part of this might well be due to neglected margins. More significant is that the coefficient of variation of the free market price is far greater than that of the historical price. The instability associated with revenue and income of producers increased. For producer revenue the risk premium is now 7.23 percent of average revenue for a risk aversion coefficient of 1. Comparing the historical data and the simulated free market series, the monetary value of the increased risk cost is Cr\$982.68 million per year (1,625.02 - 642.34). The same figure for producers surplus is Cr\$654.5 million. Producers clearly lose out on the risk front by free trade. As our data indicate, they also lose out on average, but this has to be interpreted with care because of margins. For consumers, too, there is an increase in variability of consumer surplus, even though on average they are better off.

The major gain from the free market policy is that the inefficiency costs of price distortions are avoided. It can be shown that on average these costs are Cr\$10,367 million per year. This exceeds the risk cost to producers alone of

roughly Cr\$700 million per year—without taking into account consumer instability costs.

### ***Simulation of the Price Band Proposal***

The price band proposal for rice consists of imposing upper and lower limits to the price. The upper limit is 12 percent above the reference price, while the lower limit is the minimum price (Lopes 1986). However, in what follows we simulate a *symmetric* band with a lower limit 12 percent below the reference price. The reference price is the average over the previous sixty months. In the simulation, if a band has been hit within the past sixty months, then it is the band price that enters the moving average (*not* the free market price that would have ruled in the absence of the band).

As can be seen from the summary statistics on table 22-1, producer-consumer prices will be more stable under this policy than under the free market or the historical outcome. The band rule reduces the coefficient of variation from 0.15 to 0.09 compared to the observed data (a reduction of 40 percent) and from 0.39 to 0.09 compared to free market outcomes (a reduction of 97 percent). The average price with the band is not that different from the free market outcome—the real difference is in variability.

The band rule will also stabilize producer revenue and producer income. With a risk aversion coefficient of 1.00, the risk gain from the free market base is equal to Cr\$1,523 (1,625.02 – 102.02); for producer surplus the figure is Cr\$991.01 million. The efficiency loss on average in going from a free market to the band rule is Cr\$227 million. The risk gains are clearly large compared to this. Comparing now the band rule to the historical outcome, we see that the risk gain is Cr\$540.31 million for producer income and Cr\$336.49 million for producer surplus. This compares with an average efficiency gain of around Cr\$11,624. Sensitivity analysis was conducted, but the qualitative results did not change.

## **Multimarket Stabilization Analysis: Rice and Beans**

### ***Introduction and Model***

So far we have considered one market in isolation. But if there are other markets with which the rice market interacts, this may well affect the conclusions on the efficacy of the band proposal. In this section we will explore these “multimarket” interactions in an illustrative way. We take as our case study the beans-rice market interaction, focusing on demand-side relationships between them. Supplies are assumed to be independent of cross-price effects.

Table 22-2. *Beans Multimarket Summary (1977-85, Detrended)*

Series or units		Historical data	Free market	Band rule
Producer revenue (millions of cruzados)	Mean	21,614.21	23,184.34	24,663.06
	$\sigma$	0.26	3 0.41	0.21
Producer price (cruzados per kilogram)	Mean	10.38	10.32	11.00
	$\sigma$	0.28	0.39	0.16
Consumer price (1,000 tons)	Mean	11.36	10.32	11.00
	$\sigma$	0.37	0.39	0.16
Production (1,000 tons)	Mean	2,132.84	2,128.09	2,178.19
	$\sigma$	0.17	0.20	0.21
Consumption (1,000 tons)	Mean	2,092.18	2,128.09	2,080.23
	$\sigma$	0.15	0.20	0.23

In general, the effect of stabilization in one market on price instability in another is ambiguous. It will depend on both the covariance between the supply shock in the beans market and the price of rice and on the sensitivity of beans demand with respect to rice prices. We cannot even say, for example, that complete stabilization in one market is good from the point of view of instability in the other market. Clearly, quantitative analysis is needed.

Our approach in what follows will be to impose a band on one market and analyze its impact with and without multimarket effects. For illustrative purposes, we focus on a band in the beans market.

### Simulations and Results

For the multimarket base run the following elasticities were adopted: 0.36 and 0.37 for the supplies of beans and rice respectively;  $-0.50$  for the own price elasticities of demand;  $-0.20$  for the elasticity of beans demand with respect to rice prices; and  $-0.57$  for the elasticity of rice demand with respect to beans prices. The "single-market" runs are simply those in which the cross-price elasticities for beans and rice are set at 0.

Table 22-2 presents summary results; table 22-3 does the same without rice interaction. Without multimarket interaction the coefficient of variation of producer prices goes from 0.28 historically to 0.36 in the free market, while with this interaction it goes from 0.28 to 0.39. The difference in movement is 10.8 percent of the historical coefficient of variation. The mean producer price increases from Cr\$10.38 per kilogram to Cr\$10.83 in the single-market case, but it decreases to Cr\$10.32 per kilogram with the multimarket interaction. For producer revenue, the mean over the period experiences a 2.2 percent increase from the historical to the free market series with multi-



Table 22-3. *Beans Single-Market Summary (1977-85, Detrended)*

Series or units		Historical data	Free market	Band rule
Producer revenue (millions of cruzados)	Mean	21,614.21	22,963.92	23,541.28
	$\sigma$	0.26	0.43	0.23
Producer price (cruzados per kilogram)	Mean	10.38	10.69	10.90
	$\sigma$	0.28	0.36	0.16
Consumer price (1,000 tons)	Mean	11.36	10.69	10.90
	$\sigma$	0.37	0.36	0.16
Production (1,000 tons)	Mean	2,132.84	2,155.29	2,170.50
	$\sigma$	0.17	0.19	0.21
Consumption (1,000 tons)	Mean	2,092.18	2,155.29	2,135.70
	$\sigma$	0.15	0.19	0.20

market interaction; the figure is 6.2 percent without this interaction. The coefficient of variation of producer revenue goes up by 80.8 percent as the result of a free market when there is rice interaction, and by 65.4 percent as the result of a free market when there is no rice interaction. The quantitative significance of the latter comparison is best brought out by considering risk analysis. With multimarket interaction the monetary value of increased risk cost is Cr\$1,827 million, assuming a risk aversion coefficient of 1.00, while without interaction this cost is Cr\$1,310 million. The "error" that one would make by ignoring the rice interaction is to overestimate the risk costs of a free market, relative to historical series, by Cr\$517 million, which is 2.4 percent of historical revenue (Braverman and others 1992).

A similar set of comparisons can be made between the free market and the band rule outcomes. Using the free market series as the base, the introduction of a 17 percent symmetric band rule on beans increases average bean price by 1.9 percent in the simulation without rice interaction, and by 6.6 percent in the simulation with the interaction. The corresponding figures for the coefficient of variation of prices are -55.6 percent and -59 percent. It is seen, therefore, that while neglect of multimarket interaction can lead to a significant error on comparisons of *averages*, the same is *not* true for *variability*. For producer revenue a similar conclusion can be drawn. While the percentage change in mean producer revenue will have an error of 69 percent (an 8 percent increase with interaction compared with a 2.5 percent increase without), the percentage change in coefficient of variation of producer revenue as the result of imposing a 17 percent band on the free market scenario will have an error of only 9.7 percent (a 51 percent decrease with interaction compared with a 46.5 percent decrease without). With a risk aversion coefficient of 1.00, the risk reduction value of the band rule is

Cr\$1,664 million with interaction and Cr\$1,162 million without. The error, Cr\$502 million, is 0.02 percent of the historical mean revenue.

It would be tedious to rehearse the same arguments for the rice market. It suffices to state that the broad conclusions are similar in nature to those for the beans market. Thus we conclude that for the two goods considered here, beans and rice, the introduction of cross-market interaction has quantitatively significant effects on the comparisons of means, but is not significant for the comparison of the instability effects of the band proposals.

## Conclusions

While the specific results obtained here may be of interest, in this conclusion we would rather emphasize the general features of our approach. The approach follows from the precise policy context of price stabilization—in this case, the Brazilian price band proposals. It tries to understand the institutional features of the proposals and to distill from them the key analytical features in developing a methodology for evaluation. In the case of the Brazilian proposals, this is equivalent to a “two-step” format—first, to remove all current interventions, and second, to impose a price band around the free market outcomes. The next stage of the approach is to model supply and demand relationships in a simple way and to simulate the consequences of each of the two steps over a recent period of a decade or so. Our view is that showing the policymaker what would have happened in recent years, had the proposed policy been followed, is a powerful device for focusing policy dialogue around the important issues.

We hope that this approach will be applied to other commodities and other countries. Braverman and others (1992) show application to several other commodities in Brazil. On the basis of our Brazilian analysis, however, we put forward two conclusions. The first bears on a central policy question: the welfare gains from price stabilization are unlikely to be large relative to the efficiency gains from price reform. The second conclusion is methodological in nature: multimarket interactions do not have quantitatively significant effects on the single-market results so far as stabilization is concerned, but they do have quantitatively significant effects on the estimates of the benefits of price reform.

## Note

1. This assumption is very restrictive if one considers producers of edible beans. In the case of rice producers, it is much less so.

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## Poverty Alleviation through Regional Targeting: A Case Study for Indonesia

Martin Ravallion

*Targeting transfers to poor regions can be an administratively simple poverty alleviation policy. Better regional targeting would reduce poverty in Indonesia. It could also help buffer the poor from aggregate fiscal contractions. But the gains to the poor as a whole from this type of policy may be quite small, even with large regional disparities in poverty. For example, the maximum impact on national poverty from lump-sum regional redistributions across Indonesia's provinces is no more than the impact of a uniform (untargeted) transfer to all persons equivalent to 4 percent of mean consumption. Political constraints on regional redistribution will result in even lower gains in practice. Regional targeting can help, but it is no panacea for poverty.*

THE TARGETING OF DEVELOPMENT RESOURCES toward poor regions is widely thought to be an important policy instrument for alleviating poverty. For example, the location of rural development projects in unusually backward regions of poor countries has been identified as a hallmark of the World Bank's more poverty-oriented agricultural development strategy, as it emerged in the early 1970s.<sup>1</sup>

The attraction of such regional targeting has seemed obvious to some observers, whereas others have been quite critical. It is clearly unlikely that one could eliminate poverty by this means with anything but the most generous budget. Even when there are wide regional disparities, area of residence is not a *perfect* indicator for targeting; there will generally be some

leakage of benefits to the nonpoor within generally poor regions, and there will be poor persons in generally well-off regions who will lose out.

This is an example of a quite general principle: redistributive possibilities are constrained by the policymaker's available information about individuals.<sup>2</sup> With perfect information on relevant individual characteristics and unrestricted policy instruments, one can precisely target transfers. The second fundamental theorem of welfare economics then tells us that, under regular conditions, any optimal distribution of commodities is attainable by lump-sum redistributions of initial endowments. But, as is now well recognized, that theorem is really quite unhelpful as a basis for policy, precisely because we do not have the information needed to implement optimal lump-sum transfers.

This chapter aims to quantify the potential poverty alleviation gains from regional targeting. The spatial variation in the extent of poverty is large in many developing countries, but Indonesia is a particularly striking example. Despite two decades of generally sustained and sizable economic growth, regional concentrations of severe rural poverty persist within the archipelago (Huppi and Ravallion 1991). The administrative cost of regional targeting is also likely to be low, particularly when the regions used for targeting correspond to local political jurisdictions, such as Indonesia's provinces.

These observations suggest that the regional targeting of developmental resources may have a role in the alleviation of poverty in Indonesia. This has been recognized for some time by both the central government and aid agencies. Though past regional allocations have probably been influenced more by politics than poverty, there appears to be some scope in the present political climate for reforming the criteria used for regional distribution.

However, even if politics could be taken out of regional policy, and despite the wide regional disparities currently existing in Indonesia, the *potential* for poverty alleviation by this means remains unclear. How much are poverty alleviation possibilities constrained, relative to "first-best" solutions based on perfect information? What gains from informationally feasible targeting are likely? What further gain is attainable from extra information? Other questions of direct policy relevance arise. How, for example, should informational constraints influence detailed policy design? Do we confine attention to only certain regions to the exclusion of all others, or aim for wider coverage? Taking a somewhat wider view, critics of regional targeting for poverty alleviation have claimed it will divert scarce development resources from more productive areas.<sup>3</sup> What then is the cost in terms of aggregate economic growth of alleviating poverty through regional targeting? I hope to throw empirical light on these questions, or suggest how that can be done in future work.

Two issues about regional targeting that will not be addressed here are its administrative cost and its incentive effects. In particular, a system of

regional subsidies may affect actions taken by regional governments, and they may also affect individuals' decisions about residence and employment. Consider a system of regional subsidies in the form of rural infrastructure projects financed by the central government. If the projects increase the marginal productivity of labor, they will have offsetting income and substitution effects on labor decisions, and the net effect on employment may well be small. In contrast, if regional subsidies are in the form of cash grants to individuals, then they will have only an income effect and the effect on labor decisions may be important. In that case, the estimates presented below will overstate the impact on poverty of regional redistribution.

## The Theoretical Problem

To focus on the poverty alleviation potential of regional targeting, I shall assume that social decisionmaking problems concerning poverty are *separable* into two stages: the stage 1 problem concerns the determination of a socially optimal allocation of resources to the objective of poverty alleviation, while the stage 2 problem concerns the design of policies that attempt to allocate those resources optimally from the point of view of poverty alleviation. In the first stage, we ask: How much should be allocated to redressing poverty? In the second stage we ask: What parameter choices in policy design will minimize aggregate poverty given that allocation? This can also be stated as the dual "cost-effective problem": How does one minimize the cost of a given poverty alleviation impact? My main concern here is with implementation of the stage 2 problem, though I shall later consider briefly some possible implications of the empirical results for the stage 1 problem.

A useful theoretical formulation for the class of targeting problems under imperfect information in stage 2 has been proposed by Kanbur (1987), and this is the starting point for the present inquiry.<sup>4</sup> The basic idea can be simply stated. We do not know the standard of living of any one individual, but each person in a population can be assigned precisely to one of a number of mutually exclusive groups (in this case regions), with fewer groups than people. Thus the information signal each person supplies in the present setting is place of residence, though one can also allow more complex multivariate signals. A distribution of income is assumed to be known for each region or, more generally, each possible value of the multivariate signal. This distribution is empirically derived from a sample survey. The policymaker's problem is then how to regionally target his policy instruments so as to minimize aggregate expected poverty, as measured by a suitable index. Kanbur discusses this problem when that index is any member of the Foster, Greer, and Thorbecke (FGT) (1984) class, and the policy instrument is a set of regionally differentiated lump-sum transfers. This is "pure" regional target-

ing in the sense that all the policymaker is assumed to know is each person's place of residence.

The appendix to this chapter shows how Kanbur's formulation of this problem can be set up in a computationally convenient form and how numerical solutions can be derived for a member of the FGT class of measures that satisfies the main axioms for a desirable poverty measure. The particular FGT measure used here is directly proportional to the sum of the squared poverty deficits of the poor. It is denoted  $P$  and defined in equation 23-4 in the appendix. This measure satisfies the main axioms of Sen (1976), including the transfer axiom, which requires that when income is transferred from a poor person to someone who is even poorer, measured poverty decreases. The measure also has the advantage over Sen's own poverty measure of additive decomposability and hence subgroup consistency in that, when the poverty of any subgroup increases, aggregate poverty also necessarily increases.<sup>5</sup>

The first-order conditions for a solution in this case require that the post-transfer *poverty deficit*, given by the aggregate shortfall of incomes below the poverty line, is equalized across all regions. Thus, an allocation of per capita transfers over  $k$  regions,  $x_1^*, \dots, x_k^*$ , is deemed to be optimal relative to a poverty line and fixed budget  $\bar{x}$  per capita if the total cost of that allocation does not exceed  $\bar{x}$  and:<sup>6</sup>

$$(23-1) \quad \int_0^{z-x_j^*} [z-y-x_j^*] dF_j(y) = \text{a constant for all } j$$

where  $F_1, \dots, F_k$  are continuous income distribution functions across the regions  $j=1, \dots, k$ . Numerical methods are needed to solve the first-order conditions; details are given in the appendix to this chapter.

An obvious measure of the gains from a regional redistribution program  $(x_1, \dots, x_k)$  is the proportionate reduction in poverty that it induces,  $1 - P(x_1, \dots, x_k)/P(\bar{x})$ . However, in policy discussions it is more useful to have a monetary measure of the gains from targeting. Such a measure is the size of the lump-sum grant in excess of  $\bar{x}$  that would have to be provided to each individual to obtain the same poverty reduction achieved by targeting. This is given by the number  $\eta$  such that (for  $P > 0$ ):

$$P(x_1, \dots, x_k) = P(\bar{x} + \eta, \dots, \bar{x} + \eta)$$

where it will be recalled that  $\bar{x}$  is the average value of the targeted transfers  $(x_1, \dots, x_k)$ . I shall term  $\eta$  the *equivalent gain from targeting*. The lower the poverty level attainable by a given targeting program, the greater the value of  $\eta$ . To solve for the value of  $\eta$  associated with any targeting program is also a numerical problem, which is discussed briefly in the appendix to this chapter.



In the following section I shall illustrate how this approach can throw light on the policy questions raised at the beginning of this chapter.

## **An Application to Indonesia**

Central government transfers to the provincial governments of Indonesia are the major source of their revenue and the main channel by which revenues from oil taxation (the country's major revenue source) are redistributed to non-oil-producing provinces. The main institutional vehicle for that redistribution is the INPRES (Instruksi Presiden, or "Presidential Instruction") program of central government disbursements to the provinces.

Regional distributions of real consumption per person for Indonesia have been constructed for the purposes of this study from the data tapes of the 1984 SUSENAS (National Socio-Economic Survey), done by Indonesia's Central Bureau of Statistics. This gives consumption data for 50,000 households over the country's twenty-seven provinces.<sup>7</sup> Details are given in Ravallion and Huppi (1991).

The following three sets of experiments have been conducted.

### ***Revenue-Neutral Redistributions between Provinces***

The first experiment in table 23-1 is not chosen for its realism, but rather as an interesting benchmark case, in that it measures the *maximum* poverty alleviation impact of revenue-neutral redistributions across provinces—that is, redistributions in which there is no aggregate financial gain or loss to the center. Thus the experiment assumes that the policymaker has unrestricted power to tax any provinces and to disburse the revenue as it wishes to other provinces. But recall that the tax or transfer must be the same for all persons within a given region. Optimal redistribution yields about a one-third decrease in aggregate poverty, equivalent to the poverty reduction attainable by an untargeted budget of Rp719 per person per month. This represents a seemingly modest 4.0 percent of mean monthly consumption in Indonesia (about a good year's growth in recent times), though a more instructive comparison is with the central government's mean aggregate INPRES expenditure, which was an average of Rp688 per person per month in 1985–86 (covering all INPRES programs). The potential poverty alleviation gain from optimal redistribution would thus be equivalent to that resulting from an untargeted windfall that is slightly more than the aggregate INPRES budget.

Experiment 2 is an attempt to assess how much the poverty alleviation impact from poverty-minimizing regional redistribution might be dampened

Table 23-1. *Simulated Effects on Aggregate Poverty in Indonesia of Selected Policy Experiments*

Experiment	Budget ( $\bar{x}$ )	Poverty alleviation		Equivalent gain	
		P* ( $\times 100$ )	1 - P*/P ( $\times 100$ )	$\eta$ (rupiah per month)	$\eta/\bar{x}$ ( $\times 100$ )
1 <sup>a</sup>	0	1.58	32.5	719	
2 <sup>b</sup>	0	1.88	19.7	413	
3 <sup>c</sup>	0	2.31	1.28	30.6	
4 <sup>d</sup>	688	1.61	31.2	0	0
5 <sup>e</sup>	688	1.68	28.2	-69.9	-10.2
6 <sup>f</sup>	688	1.31	44.0	360	52.3
7 <sup>g</sup>	-688	3.29	-40.6	0	0
8 <sup>h</sup>	-688	2.34	0.0	688	-100

Note: Initial poverty level:  $P = 2.34 \times 10^{-2}$ ;  $z = \text{Rp}11,000$  expenditure per person per month, Jakarta 1984 prices. In 1984, Rp1,000 was equivalent to about US\$1 at official exchange rates, though this is probably overvalued by a factor of three against purchasing power parity.

- Unrestricted redistribution of expenditure between provinces to minimize aggregate poverty;  $x_i$  unrestricted,  $\bar{x} = 0$ .
- Constrained redistribution;  $x_i \geq -1000$ ,  $\bar{x} = 0$ .
- Redistribution of 1985-86 INPRES allocations to achieve uniformity of receipts across provinces;  $x_i = 688 - I_i$ ,  $\bar{x} = 0$ .
- Untargeted (uniform) allocation of an increase in central government disbursements to provinces equivalent to average INPRES receipts;  $x_i = \bar{x} = 688$ .
- Nonuniform allocation of an increase in central government disbursements in proportion to existing INPRES receipts;  $x_i = I_i$ ,  $\bar{x} = 688$ .
- Targeted allocation of the same increase with all (nonnegative) disbursements chosen to minimize aggregate poverty;  $x_i \geq 0$ ,  $\bar{x} = 688$ .
- Uniform cut in aggregate expenditure equivalent to 1985/86 INPRES;  $x_i = \bar{x} = -688$ .
- Targeted expenditure cut, with unrestricted redistribution;  $\bar{x} = -688$ .

by imposing some ad hoc "political economy" restrictions on the regional tax burdens. Unrestricted regional redistribution in experiment 1 involves a number of quite large average tax burdens on richer provinces. The highest is for Jakarta, where the optimal poll tax of Rp6,950 represents about one-fifth of mean expenditure. Experiment 2 restricts the maximum tax to Rp1,000 per month, which becomes binding on fifteen provinces. Naturally, the poverty alleviation impact is diminished, though redistribution is still capable of achieving nearly a 20 percent cut in aggregate poverty. The equivalent gain from targeting ( $\eta$ ) is now equivalent to 60 percent of the INPRES budget. The restricted redistribution under experiment 2 achieves 60.5 percent of the poverty alleviation impact of the unrestricted allocation under experiment 1.<sup>8</sup>

In the light of these measures of the potential for poverty alleviation through regional targeting, it is of interest to now examine the INPRES program. This is the main existing fiscal program that is capable of such regional

targeting, and, indeed, has this as one of its main objectives, though doubts have been raised about its efficacy in this regard.<sup>9</sup> Experiment 3 focuses exclusively on the INPRES scheme. INPRES involves substantial variation in per capita allocations across provinces, ranging from a disbursement in 1985–86 of Rp339 per person per month (Jakarta) to Rp3,229 (East Timor). Experiment 3 simulates the effect on poverty of replacing the existing INPRES allocation by a revenue-neutral *uniform* outlay. In making this comparison, it is assumed that benefits from the existing scheme are uniform within provinces, so that the program can be formalized as the set of regional transfers:  $I_1, I_2, \dots, I_k$ . The rather striking result of this experiment is the negligible effect on aggregate poverty. Uniformity achieves a decline in poverty, and the monetary equivalent  $\eta$  is about a 4 percent untargeted increase in the aggregate INPRES budget; that is,

$$P(688 - I_1, \dots, 688 - I_k) = P(30.6, \dots, 30.6) < P(I_1, \dots, I_k).$$

If benefits from the INPRES scheme are sufficiently progressive *within* provinces, though this is not a widely held view, then this result will alter. But clearly the existing pattern of regional disbursements does not suggest that regional targeting for poverty alleviation has been particularly effective, though, as the first two experiments demonstrated, the potential is greater.

### **Aggregate Fiscal Expansions**

Experiments 4 through 6 involve various regional allocations of an aggregate fiscal expansion, equivalent to doubling the 1985–86 INPRES budget.<sup>10</sup> Experiment 4 gives a uniform allocation; experiment 5 gives an allocation proportional to existing INPRES receipts; experiment 6 gives an optimally targeted allocation, subject to a nonnegativity constraint so that no province incurs a net increase in tax burden. It is obvious then that all three experiments will reduce poverty in the aggregate, and that poverty cannot increase in any province. The primary interest is in comparing the poverty alleviation gains from the three experiments. By definition of the optimal allocation, that gain is greatest for experiment 6. The monetary gain of Rp360 from optimal targeting, subject to the constraint that no allocation is negative, is equivalent to about a 50 percent increase in the untargeted budget. Note also that the equivalent gain from disbursements that conform to the existing INPRES pattern of doubling each province's 1985–86 receipt as in experiment 5 is negative; it would be better to go for a uniform per capita expansion than to simply expand the existing pattern of regional disbursements.

The budget assumed for these experiments is also close to the budget that would be needed to eliminate poverty with perfect income information; this is given by the per capita poverty gap that was Rp730 per month per capita

for Indonesia in 1984. When optimally targeted by province, as in experiment 6, a budget of Rp730 would achieve about a 50 percent decrease in aggregate poverty ( $P^* = 1.28 \times 10^{-2}$ , with  $\eta = 371$ ). So roughly half of the maximum poverty alleviation impact with perfect income information can be achieved by regional targeting alone.

### **Aggregate Fiscal Contractions**

The last two experiments concern the quantitative effects on poverty of a hypothetical aggregate fiscal contraction of Rp688 per person per month, equivalent to eliminating the 1985–86 INPRES budget. The main aim here is to assess the joint impact of combining aggregate contraction with regional redistribution. The uniform cut in experiment 7 achieves a 40 percent increase in aggregate poverty, while in experiment 8 this is combined with optimal targeting in the form of an unrestricted regional redistribution. It turns out that the same contraction is now approximately neutral in its effect on aggregate poverty, so that the equivalent gain from targeting in this case is approximately equal to the cut in aggregate expenditure. Thus experiment 8 illustrates well how the adverse effects on poverty of macroeconomic contraction can be entirely avoided by contemporaneous regional redistribution.

### **Some Comparative Static Properties of Optimal Targeting**

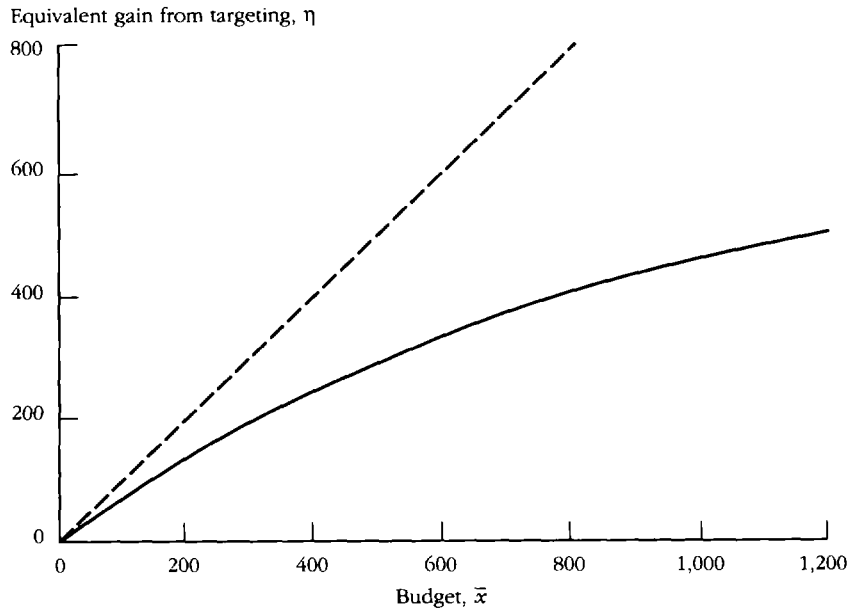
Two comparative static properties will be considered: first, the effects of further changes in the budget constraint on the optimal allocation and the gains from targeting, and second, the potential poverty alleviation gains from expanding the information set used in regional targeting.

#### **Changes in the Budget Constraint**

The main question of interest here concerns the effect on the gains from targeting of changing the budget constraint. Applying the implicit function theorem to the first-order conditions for the above problem, one finds that the sign of  $\partial\eta/\partial\bar{x}$  is indeterminate; the equivalent gain from targeting could increase or decrease with the size of the budget. Quantitative assessments for various budgets in experiment 6 are given in figure 23-1. For these data, the equivalent gain is found to be an increasing concave function of the budget.<sup>11</sup> Thus higher budgets are associated with higher equivalent gains from targeting, though the gain declines as a proportion of the budget.

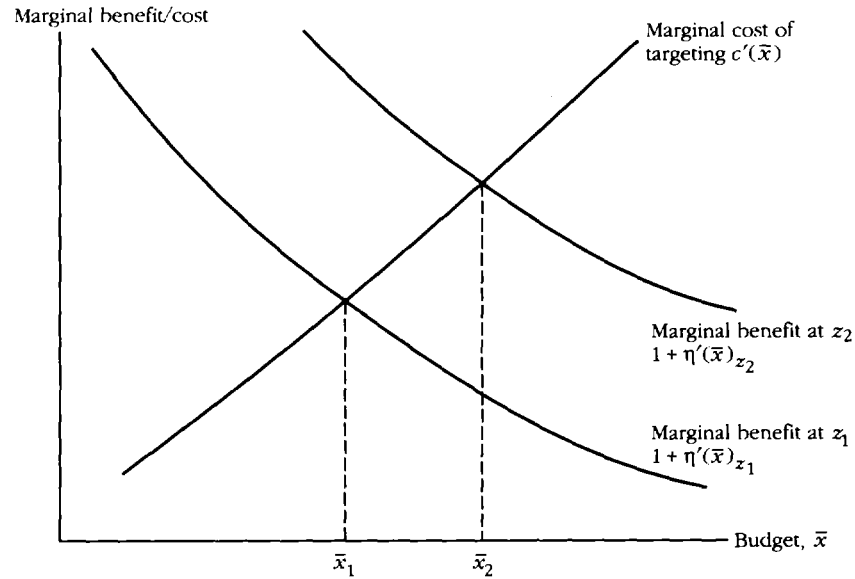
The last property has interesting implications for the first-stage problem mentioned at the beginning of this chapter, namely, that of deciding on the socially optimal allocation of funds for poverty alleviation. The value of  $\bar{x} +$

Figure 23-1. *Gain from Regional Targeting in Indonesia as a Function of the Budget*



$\eta$  is an exact monetary measure of the poverty level that is possible under  $\bar{x}$  when optimally targeted across a given number of regions, with given pre-transfer distributions of income, and for a given poverty line. The marginal monetary benefit from an increase in the budget is thus given by  $1 + \partial\eta/\partial\bar{x}$ . Since (for these data)  $\eta$  is an increasing concave function of  $\bar{x}$ , it follows that the marginal benefit in terms of poverty alleviation of raising an extra rupiah for that purpose is decreasing in the budget. One can postulate an increasing convex social cost function of raising the revenue  $\bar{x}$ , and denote this by  $c(\bar{x})$ ,  $c'(\bar{x}) \geq 0$ ,  $c''(\bar{x}) \geq 0$ . The determination of the socially optimal  $\bar{x}$  can then be represented as in figure 23-2.

There is clearly much more that could be said on this issue, but one further empirical observation is noteworthy. On repeating the analysis of the previous section at alternative poverty lines,  $z$ , I have found that  $\partial\eta/\partial\bar{x}$  is decreasing in  $z$ . Thus lower poverty lines will result in higher optimal allocations to poverty alleviation, since marginal benefit will increase, as illustrated in figure 23-2. For example, attempts to focus policy intervention at the "ultra-poor" in the spirit of Lipton (1983) would motivate higher optimal allocations to poverty alleviation.

Figure 23-2. *The Optimal Allocation of Funds to Alleviate Poverty*

### A Change in the Information Set

There is marked urban-rural inequality in Indonesia, and this is evident in poverty profiles. Ravallion and Huppi (1991) estimate that the average poverty gap in Indonesia in 1984 was about four times higher in rural areas than urban areas. Thus one can conjecture that incorporating sectoral information in the spatial allocation of central government disbursements would considerably enhance their poverty alleviation potential.

An increase in the number of potential target groups cannot reduce the poverty alleviation impact.<sup>12</sup> The quantitative gains from greater information with optimal targeting are less obvious. Suppose that the central government can also target its disbursements to the urban and rural sectors separately within each province. This increases the number of regions ( $k$ ) from twenty-seven to fifty-two (some provinces are solely urban or rural). Experiment 6 in table 23-1 was repeated for this case. Table 23-2 gives the results. Allowance has been made for urban-rural price differentials (Ravallion and Huppi 1991).

The poverty alleviation gain from this extra information seems surprisingly modest. The poverty measure now drops by 48 percent, as opposed to 44 percent when only targeting provinces, and the equivalent gain rises by about one-third. The case for targeting rural areas is, however, borne out strongly by this experiment; no urban area is a recipient under the optimal allocation.

Table 23-2. *Poverty Alleviation Gains from Sectoral Information*

Targeting information	Poverty alleviation		Equivalent gain	
	P* (× 100)	1 - P*/P (× 100)	η (rupiah per month)	η/ $\bar{x}$ (× 100)
Province only (k=27)	1.31	44.0	360	52.3
Province and sector (urban/rural) (k=52)	1.22	47.9	473	68.8

### A Future Step: Nonmarket Goods and the Growth Cost of Regional Targeting

The above formulation has assumed that regional transfers are absorbed additively into the regional economy. For transfers of nonmarket goods, such as investments in rural infrastructure, the above approach must be modified to incorporate valuation functions for those goods. It must be similarly modified if the transfers of traded goods have incentive effects on pre-transfer incomes. To illustrate a simple case, let each person's income additively include the value of the nonmarket good allocation to that person's region of residence; the income gain associated with the allocation  $x_j$  is denoted  $g_j(x_j)$ , and  $g_j$  is assumed to be an increasing concave function. (Additive separability of income in  $g_j(x_j)$  may be restrictive. It is readily relaxed, though with a less neat result.) Analogously to equation 23-1, an optimal allocation now requires that

$$(23-2) \quad g'_j(x_j^*) \int_0^{z-g_j(x_j^*)} [z-y-g_j(x_j^*)] dF_j(y) = \text{a constant for all } j.$$

That is,

$$\left( \frac{\text{local marginal}}{\text{product}} \right) \times \left( \frac{\text{local poverty}}{\text{gap}} \right) = \text{constant over all regions}$$

Poverty gaps may now be unequal at the optimum. For example, to minimize aggregate poverty, higher investment may have to go to sectors where the marginal value of that investment is higher than elsewhere, though the relevant poverty indicator is not.

A further issue arises: what is the cost in terms of national income of regional targeting aimed at poverty alleviation? The cost is zero only for lump-sum transfers of traded goods, and it will be high if the regional marginal products of poverty-minimizing transfers vary widely. The growth cost of regional targeting ( $c$  per capita) is given by

$$(23-3) \quad c = \sum n_j [g_j(x_j^{**}) - g_j(x_j^*)]$$

where  $n_j$  is the population share of region  $j$  and the allocation  $x^{**} = (x_1^{**}, \dots, x_k^{**})$  equalizes marginal products across regions for a given budget; that is,  $x^{**}$  maximizes national income (as distinct from the poverty-minimizing allocation  $x^*$  satisfying equation 23-2), and so  $c$  measures the maximum loss of mean national income from poverty-minimizing regional targeting.

While empirical estimation of the growth cost of regional targeting is beyond the scope of this chapter, one should be cautious of any a priori presumption that the cost is large. For, as can be seen from equation 23-2, the relative productivity of investments in different regions is also an important determinant of the optimal pattern of regional targeting from the point of view of aggregate poverty alleviation. The ideal target regions from this point of view are where poverty is high and investment is productive.

Dealing with the above issues in future empirical work would require estimation of regional income-generation models (the  $g_j(x_j)$  functions above). This does not appear to pose any unusual problems.<sup>13</sup> The methods outlined in this chapter can then be readily adapted.

## Conclusions

Regional targeting can be an administratively simple solution to the often severe informational constraints that governments face in attempting to reduce poverty in developing countries. However, even with large regional disparities, there can be no presumption that the benefits to the poor as a whole from regional targeting will be large; some will lose, while others gain. Political factors will also constrain interregional redistributions. But, even ignoring these extra constraints, the maximum effect on aggregate poverty from lump-sum regional redistributions across Indonesia's provinces is no more than the effect of a uniform (untargeted) transfer to all persons equivalent to 4 percent of mean consumption. Political constraints will result in a benefit to the poor of less than this amount.

The results of this study also suggest that the potential for regional targeting in Indonesia is not being realized by the existing pattern of regional disbursements from the center. Improved targeting could, moreover, greatly mitigate the otherwise adverse effects on poverty of aggregate fiscal contractions. Regional targeting is no panacea for poverty, though it may still be a useful policy instrument.

## Appendix

A budgetary allocation for poverty alleviation given by the vector  $x = (x_1, \dots, x_k)$  is considered to be optimal relative to poverty line  $z$  and fixed



budget  $\bar{x}$  when it minimizes aggregate poverty given by the Foster, Greer, and Thorbecke measure for  $\alpha=2$ :

$$(23-4) \quad P(x) = \sum_{j=1}^k n_j \int_0^{z-x_j} \left[ \frac{z-y-x_j}{z} \right]^2 dF_j(y)$$

(where  $n_j$  is the proportion of the total population living in region  $j$ ) subject to the additively absorbed budget constraint:

$$(23-5) \quad \sum_{j=1}^k n_j x_j = \bar{x}.$$

This problem will have a unique interior solution denoted  $x^* = (x_1^*, \dots, x_k^*)$  satisfying the condition that the post-transfer poverty deficit is equalized across all  $j$ .

The problem is first solved permitting negative values of  $x_j$  for some  $j$ . Then the first-order conditions (FOCs) for an optimum imply that equation 23-1 holds. The second-order conditions automatically hold since  $P$  is strictly quasi-convex in  $x$  and, of course, the budget set in this case is convex. The problem is solved numerically, by linearizing the FOCs at each step around the previous estimate of the optimal allocation  $x^*$  and the Lagrange multiplier  $\lambda$ . The algorithm estimates these variables at each iteration by solving the following system of linear approximations to the FOCs:

$$(23-6) \quad \begin{bmatrix} (H_{t-1}) & zi \\ n & 0 \end{bmatrix} \begin{bmatrix} \hat{x}_t^* \\ \hat{\lambda}_t \end{bmatrix} = \begin{bmatrix} w_{t-1} \\ \bar{x} \end{bmatrix}$$

where  $(H_{t-1})$  is the  $k \times k$  diagonal matrix with diagonal elements given by the values of the headcount index of poverty ( $j=1, \dots, k$ ) implied by the values of  $x^*$  obtained at iteration  $t-1$ ;  $w_{t-1}$  is the column vector of  $k$  elements formed by  $[z - \bar{y}_{j,t-1}^p]H_{j,t-1}$  for  $j=1, \dots, k$ , as obtained at  $t-1$  (where  $\bar{y}_j^p$  is the mean income of the poor in region  $j$ ), and  $n = (n_1, \dots, n_k)$ ; and  $i$  is a  $k$  row vector of ones. Having solved for  $x^*$  to the desired degree of accuracy, the problem can be repeated, constraining the solution to non-negative values of  $x_j^*$  for all  $j$  if this does not already hold.

A Fortran program is available from the author to solve for  $x^*$  for any number of regions and any given poverty line and budget. The program assumes that only discrete points on the distribution functions of income are available for each sector, and it uses linear interpolation between those points. The inputs are the values of  $F_j$  and mean pretransfer incomes at each point on the distribution function, and the outputs are estimates of  $x_j^*$  for all  $j$  and  $\lambda$  to any desired accuracy. A Fortran program is also available to calculate the poverty profile and to calculate the equivalent gain from optimal targeting by the interval-halving method.

## Notes

The author's thanks go to Karla Hoff and Pradeep Mitra for their comments on this chapter, and to Monika Huppi for her assistance with the computations.

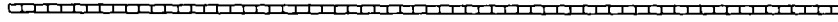
1. See Ayres (1984, chapter 5).
2. In chapter 20 Besley surveys the theoretical issues involved in redistributing incomes without precise income information. A useful discussion can also be found in Roberts (1984).
3. See, for example, Binswanger's (1989, p. 21) recent comments.
4. Though the context is not poverty alleviation, the "tagging" problem discussed by Akerlof (1978) is conceptually similar.
5. See Foster and Shorrocks (1991), who show that Sen's poverty measure does not satisfy this property. The violation of subgroup consistency basically arises because of Sen's use of income weighting according to rank-order below the poverty line.
6. The modification needed for transfers of nonmarket goods is discussed at the end of this chapter. The policy changes are assumed to have lump-sum monetary equivalents, which then become the policy instruments. Notice that pre-transfer incomes are exogenous. Thus, allocations are assumed to be "pure" lump-sum transfers that do not discourage work or otherwise affect pre-transfer incomes. This can be relaxed in principle, but empirical implementation will be difficult.
7. Though the price data are far from ideal, regionally specific price indexes have been used as deflators (Huppi and Ravallion 1991). Likely biases in the deflator, as discussed by Huppi and Ravallion, will probably lead to some underestimation of regional disparities in poverty and, hence, the gains from regional targeting.
8. This is calculated as  $[P - P^*(1)]/[P - P^*(2)]$  where  $P^*(i)$  denotes the poverty level achieved by the  $i$ th experiment.
9. For further discussion, see Ravallion (1988).
10. The budget is arbitrary, though this one is interesting. I shall consider alternatives later.
11. Again, this is an empirical property; it is not implied by the assumptions. Ravallion and Chao (1989) give a counterexample for Sri Lanka in which the equivalent gain from targeting decreases as the budget increases.
12. Though it may increase the administrative cost and also the incentive effects of the transfer program; that, however, is another issue.
13. An example for Indonesia can be found in Aziz (1988).

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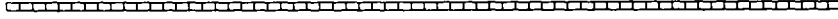
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*Part IV*

# *Technological Change*





*Technological Change, Imperfect  
Markets, and Agricultural Extension:  
An Overview*

*Jock R. Anderson and Karla Hoff*

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IT HAS LONG BEEN RECOGNIZED that the adoption of more productive technology is facilitated by a complex institutional framework, including property rights, credit and insurance markets, and extension services.<sup>1</sup> The two theoretical chapters in part IV illustrate the influence of market failures for water and risk on farmers' technology and crop choices. The case study in chapter 28 considers how best to organize an agricultural extension service.

But the relationship between technology and rural institutions also runs in the opposite direction from technology to institutions. Technological change can widen the scope of markets. Aspects of rural organization that appear to be constraints—for example, indigenous land rights systems or missing markets—may reflect the underlying technological constraints and vanish when technology changes. Chapter 14 provided evidence that the introduction of export crops, by increasing the scarcity value of land, induced changes in African indigenous land rights systems that, in turn, made land markets possible. In this part, chapter 27 argues that in semiarid pastoral environments in Africa, high transaction costs of trade preclude conventional markets for most goods, with the result that policies directed at providing credit or otherwise widening the scope of markets have been misdirected; the binding constraint depended on the technology.

The remainder of this chapter highlights some of the diverse issues raised in part IV. We discuss the choice of irrigation technology, technological determinants of the scope of markets, agricultural extension, and inequality.

## Property Rights Regimes in Water

Whether farmers face correct incentives in their choice of technology depends on property rights regimes. In many parts of developing countries and also in much of the western United States, the rights regime with respect to surface water used for agriculture is essentially a queuing system, not a price system: owners of senior rights can use as much water as they can put to beneficial use, owners of junior rights get whatever is left over, and trading is prohibited.<sup>2</sup> Under this system, profit-maximizing farmers on lands with senior rights apply water until its marginal product is zero, whereas some lands with junior rights go unused for lack of water. It is evident that farmers with senior rights have little incentive to adopt water-saving irrigation technology.

The chapter by Fahred Shah and others (chapter 25) suggests a politically feasible method to create a water market to solve the surface water management problem—namely, to provide owners of senior rights in the initial property rights regime with a large share of the profits from the water utility that would be created to implement the market. Their chapter sets forth a method of calculating the benefits of creating a market for surface water, and illustrates it with data from cotton farms in the San Joaquin Valley in California. In that region, the estimated benefits of implementing a water market would be a 19 percent increase in aggregate incomes, not including the costs of implementing the market.

In some cases, there are efficient low-cost alternatives to implementing a water market. A striking example comes from E. R. Leach's (1961) study of a village in the former Ceylon. In the village of Pul Eliya,

land rights to the rice fields were traditionally parceled out in such a way that the owner of the plot closest to the tank also owned the plot furthest from the tank; the second closest was paired with the second furthest, etc. If an owner wanted to sell all or part of his land, he could do so only by selling equal parts of both plots. The result was an incentive for good water management. When the British opened a new tank in the village without using the local system, the wealthier people simply acquired rights to the lands closest to the new irrigation source. The lands located furthest from the new tank were cultivated by lower-income farmers whose fields often did not receive water (since the farmers with lands nearer the tank used all the water).<sup>3</sup>

In this example, the practical difficulties of rationing water from a water tank were avoided by regulating property rights to land, its complementary resource.



## Technology as a Constraint on the Scope of Markets

Market failures may arise from the intrinsic physical characteristics of goods or technology, as has long been understood for commodities with public-good properties—for example, water in aquifers from which exclusion is difficult. But there are other ways in which technology and physical conditions limit the scope of markets. Trading of highly perishable goods may be discouraged by the costs of storage and risks from loss. The services of factors, such as farm animals, that require constant care cannot readily be rented if the quality of care is difficult to monitor.

Chapter 27 by John McIntire explores the consequences for factor markets of a particularly harsh physical environment—the semiarid regions of Africa where people earn their living from livestock production. No conventional markets for labor, land, or capital exist there. Nonstorability of milk encourages self-sufficiency. High transportation costs preclude an active labor market. Credit transactions are limited because the main form of wealth (animals) is not useful as collateral: animals can be consumed, and, in any case, their value depends greatly on the level of care provided. The difficulty of observing the quality of animals precludes an active market in animal stock.

Instead of conventional markets, a complex network of family obligations and contracts allocates factors. For example, a form of animal tenure exists through which breeding stock are loaned from one herdsman to another with rental payments in the form of a share of offspring. By linking the tenant's income to the stock as well as the calves, this arrangement lowers supervision costs.<sup>4</sup>

Technological progress may take the form not only of increases in outputs from given inputs, but also of reductions in the transaction costs of trade. For example, increases in the storability of outputs have been a key to the expansion of agricultural markets in many developing countries (for example, the export market for Chilean grapes). Economists have only begun to consider how to model technology in ways that take into account the effect of modern inputs in increasing quality and uniformity, lowering storage costs and susceptibility to damage, or in other ways reducing the costs of trade (however, see Zilberman 1989).

## Research and Extension

Agricultural technology is highly location-specific. What works well in one place may not do so in another that is characterized by different climate,

soils, access to inputs and markets, and culturally specific practices among the rural population. To deal with location specificity, it is necessary to undertake testing and transfer activities across the whole range of environments in which a new technology might be used.

Agricultural research and information services will normally be undersupplied in the private market since information has public-good properties. Moreover, farms are often too small, and sell in markets that are too competitive, to capture positive returns to research and development through their own sales. Until recently, legal systems of intellectual property rights (such as patents, copyrights, and trademarks) did not cover plant and animal improvements.<sup>5</sup> To make up for the undersupply of research and development by the private sector, public-sector experiment stations originated more than a century ago. By the 1950s most countries had established agricultural experiment stations (Judd, Boyce, and Evenson 1986). Most governments had also established agricultural extension programs to disseminate technical information to farmers and, in some cases, to supply inputs (Birkhaeuser, Evenson, and Feder 1991).

Typically, governments organize the agents involved in the production and dissemination of agricultural technology into two broad groups—researchers and extension agents. Research personnel are charged with generating improvements in crops and techniques, and extension personnel with transferring knowledge of these research products to farm households. Both services are characterized by scale economies. Chapter 26 by Avinash Dixit examines the tradeoff between the scale economies obtained through specialization in a few crops and the risk reduction benefits of diversification across crops. Economies with missing risk markets cannot take full advantage of the risk reduction benefits of diversification across crops. For that reason, specialization in a few crops to take advantage of scale economies in research and extension might be especially important.

Governments face many choices and pitfalls in implementing extension services. The working relationship between research and extension personnel is often compromised by differences in their terms and conditions of service and incentive structures. The typical pattern is that (a) research personnel have the best information on available technologies, (b) it is shared very imperfectly with the intermediary extension services, and (c) the farmers have the least adequate base of information of the three groups. Communication problems between extension agents and farmers have many causes. Extension agents are often disproportionately chosen from the dominant groups, and their salaried status may be resented by farmers. In general, professional staffs of extension services are largely male, whereas in many communities, especially in Africa, a high and sometimes larger proportion of farm decisionmakers are female. In some cultures, it is a social taboo for a male outside the household to approach individual females in a direct

manner, with obvious consequences for the ability of a male extension agent to provide information.

There are also problems of information flow in the opposite direction—from the farmers to the extension agent and to the research staffs. The remote and typically elite members of the research staff may be too distant from the farmers' circumstances they are intended to improve. As a result, their research priorities may not reflect farmers' greatest needs, and techniques developed by farmers may not be transmitted to researchers.

Farming systems research (FSR) was designed in the 1960s and 1970s by international agricultural research centers in a number of developing countries, including Colombia, Mexico, the Philippines, and Syria, to narrow the gap between the farmer and the research and extension services. The institutional innovation in FSR was to foster teamwork in diagnosing farmers' technological problems and in developing and testing solutions. This approach has been widely implemented, but its high cost and mixed success leaves unclear whether FSR is on balance beneficial (Anderson 1991).

An innovation in the delivery of extension, initiated in Turkey and later adopted in parts of Asia, Africa, and Latin America, is the training and visit (T&V) system. Its implementation in India is the subject of chapter 28 by Gershon Feder and Roger Slade. In this system, extension agents play only a technical assistance role, providing agronomic information but not providing inputs or assisting the poor. Feder and Slade suggest that the more specialized service yields a higher social return than the less specialized extension services. Agents' work effort is more easily monitored, and their technical knowledge is greater, than in the more specialized extension services.

Specialization of function also helps avoid the distortion of incentives that arises in less specialized extension services. A simple example illustrates a problem widespread in some Asian countries. An extension agent, whose job it is to provide inputs as well as information, dispenses credit that is tied to prepackaged inputs that have been designed for land type A, but not types B and C. Farmers cultivating land types B and C are "persuaded" to adopt the package by extension agents who are evaluated by their ability to meet fixed adoption targets. Such perverse incentives could be avoided if it were feasible to evaluate extension agents on the basis of output growth in a region, as might ultimately be possible under the T&V system.

### **Case Study of Palanpur, India**

Chapter 29 by Peter Lanjouw and Nicholas Stern analyzes the distribution of incomes and landholding in the north Indian village of Palanpur on the basis of four surveys undertaken between 1957 and 1984. This period saw

the introduction of high-yielding cereal varieties and the growth of jobs outside the village. Surprisingly, the survey period saw few land sales, but bigger and better farmers took on more land from smaller farmers under sharecropping arrangements. Such arrangements are called "reverse tenancy." The pattern of land leases reflects (a) the absence of a market for farm managers and of a rental market for bullocks and other fixed factors and (b) the high cost of credit (see Bliss and Stern 1982).

By 1974–75, almost all the farmers in Palanpur had adopted high-yielding wheat varieties, despite little apparent help from government in the form of credit, insurance, or extension. Indian credit markets range along a continuum from competitive to monopolistic (chapter 9). Palanpur is on the competitive end of the continuum. This helps to explain the finding that agricultural intensification in Palanpur occurred broadly over the entire size distribution of farms, and led to increases in incomes over the entire income distribution. De Janvry and Sadoulet's case study of Colombia (chapter 16, especially table 16-1) provides a contrasting case. The authors concluded that Green Revolution technology in Colombia benefited mostly large farmers because the institutional environment (public subsidies and access to markets) was highly skewed in their favor. These two case studies bear out the critical role of advances in agricultural technology in driving change in rural societies, and the fact that their impact on income distribution depends on the organization of the rural sector.

## Notes

1. See, for example, Ruttan (1982), Feder, Just, and Zilberman (1985), and Thirtle and Ruttan (1987).

2. This system is known as the "prior appropriation" doctrine in the United States and by other names elsewhere. See the references in chapter 25, note 2, regarding that doctrine in developing countries. In the United States, the doctrine of prior appropriation was developed in California gold-mining communities during the mid-nineteenth century gold rush, and spread throughout the western United States as miners, irrigators, and herders took possession of the public domain before territorial governments were organized. Territorial and state governments later adopted and transformed this doctrine through administrative law governing water used for irrigation (Cuzan 1983, pp. 17–19). In California, legal barriers to market transfers of water exist at the irrigation company level, at the state level in laws protecting areas of origin of water supplies, and at the federal level in reclamation law (Gardner 1983).

3. We are indebted to an anonymous referee for this summary of Leach (1961).

4. Robertson's (1987, pp. 156–57) study of share contracting in breeding stock in Lesotho describes a similar practice.

5. The status of U.S. law on plants and animals is reviewed in U.S. Congress,

Office of Technology Assessment (1989). Intellectual property rights for technological improvements in agricultural chemicals, animal pharmaceuticals, and farm machinery are discussed by Evenson (1990).

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*Water Rights Doctrines  
and Technology Adoption*

*Farhed Shah, David Zilberman, and Ujjayant Chakravorty*

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*This chapter argues that prevailing water rights institutions lead to underinvestment in water-efficient irrigation technologies—both in surface water and groundwater systems. For surface water systems, the current water rights regimes, which queue water users and restrict water trading, remove any incentive for farmers with senior rights to conserve water. In general, a transition to water markets would increase efficiency and adoption of modern irrigation technologies. Such a transition might be politically feasible if senior water rights holders under the initial rights systems received ownership shares in the agency that would sell water under the new rights system.*

*In the case of groundwater—that is, water in aquifers—inefficiency in the use of water arises from the “common-pool” problem. Small competitive farmers have no incentive to take into account that excessive use of water today reduces water availability in the future. Since water markets for groundwater are generally infeasible, an alternative second-best policy is to set a discriminatory tax or subsidy based on irrigation technology and crop choices. Farmers who use traditional furrow irrigation would pay a higher tax (or receive a lower subsidy) than those who use drip irrigation.*

IN THE PAST FEW DECADES, substantial investments in agriculture have resulted in significant increases in productivity and expansion of food production in the developing countries. However, the intensification of agricultural practices has also caused deterioration of the natural resource base that sustains agricultural productivity. Examples of such deterioration are

the steady drawdown of groundwater stocks and the increases in soil salinity and waterlogging in many parts of the world. The problem of excessive resource depletion can be mitigated by adoption of new resource-conserving agricultural technologies—especially those that increase the effectiveness of agricultural inputs. However, existing institutional arrangements that dictate the allocation of many agricultural resources have slowed the rate of adoption of such technologies. Agricultural water use provides important examples of inefficient resource allocation resulting from outmoded institutional arrangements.

This chapter examines the adoption of agricultural irrigation technology under a variety of institutional settings. The first section presents a simple analytical framework of technology adoption. The remainder of the chapter builds on this framework to consider systems for allocating surface water and groundwater to farmers. By drawing on recent literature in political economy and the economics of information, we examine policies and institutional mechanisms that would move existing allocative arrangements toward greater efficiency.

### A Simple Model of Technology Adoption

Most farms in the developing world rely on rainfall for water. However, irrigation based on surface water or groundwater has become increasingly widespread. Irrigation is used to augment rainfall (especially in dry years), to prolong the growing season, or to allow farming in dry seasons. Two types of technologies are generally practiced for crop irrigation—*traditional technologies*, which rely on gravity to deliver water to the crop, and *modern technologies*, which use energy and equipment for water delivery. Traditional technologies, such as furrow and flood-and-border irrigation, require a relatively large volume of water over a short period of time. For traditional technologies, a typical value of *irrigation efficiency*, the ratio of effective to applied water, is about 0.6 (Stewart and others 1977). This indicates that, on the average, only 60 percent of the water applied with these technologies is utilized by the crops. The remaining 40 percent ends up as surface runoff or percolates to the ground below the crop root zone. Greater irrigation efficiency with a traditional technology may be obtained for land that is leveled or has a greater water-holding capacity, such as heavier soil, whereas irrigation efficiency will be lower in locations with steep hills and sandy soils.

Modern irrigation technologies, such as sprinkler and drip irrigation systems, achieve a more uniform spatial distribution of water and enhance the water-retention capacity of the soil. They require higher capital costs and extra energy to maintain pressure, but they use less labor and may augment the application efficiency of water and agricultural chemicals, such as fertilizers and pesticides. The model we develop in this section describes the

adoption of a modern irrigation technology by farms that vary in their inherent ability to utilize water productively. We show first how a farm with a given quality chooses its optimal technology and water use, and then we discuss the pattern of technology adoption across the entire region.

The key features of our basic model of irrigation technology choice are as follows (Caswell and Zilberman 1986). Consider a region with a fixed amount of heterogeneous-quality land where a single crop may be grown using either traditional gravity-based (furrow) irrigation or modern (drip) irrigation technology. Let  $y$  denote the yield per acre and  $e$  the effective water per acre (that is, water actually absorbed by the root system of the crop) for a constant returns-to-scale production technology given by  $y = f(e)$ , where  $f(\cdot)$  has the regular properties of a neoclassical production function:  $f(0) = 0$ ;  $f' > 0$ , and  $f'' < 0$ .

The land quality index,  $\alpha$ , is a measure of the capability of the land to utilize irrigation water. This index ranges from zero (worst) to one (best). The relationship between effective water,  $e$ , and applied water,  $a$ , is assumed to depend on land quality  $\alpha$  and irrigation technology  $i$ , according to

$$e_i = h_i(\alpha) a_i$$

where  $h_i(\alpha)$  is the irrigation efficiency of technology  $i$  on a farm of quality  $\alpha$ . In the case of the traditional technology,  $i$  equals one, and  $i$  equals two in the case of the modern technology. We suppose that  $1 > h_2(\alpha) > h_1(\alpha) = \alpha$  for  $0 < \alpha < 1$  and  $h_2(1) = h_1(1) = 1$ , which implies that the modern technology has a higher irrigation efficiency than the traditional technology as long as land quality is less than the very best.

Each technology has a fixed setup cost per acre given by  $c_i$ , and we assume that  $c_2 > c_1$ . Let  $P$  denote the output price and  $w$  the price per unit of applied water. The maximum competitive profit with technology  $i$  on farm quality  $\alpha$  is obtained by solving for the optimal level of applied water,  $a$ :

$$(25-1) \quad \Pi_i^*(\alpha) = \max_a \{Pf(a_i h_i(\alpha)) - \omega a_i - c_i\}, \quad i = 1, 2.$$

The strategy for maximizing profits from irrigation follows a two-stage process. First, the optimal water use level,  $a_i$ , is chosen to maximize profits for each technology. Then the profits  $\Pi_i^*$  from each technology are compared. The modern technology is selected if  $\Pi_2^*(\alpha) > \Pi_1^*(\alpha)$  and  $\Pi_2^*(\alpha) > 0$ . The traditional technology is chosen if  $\Pi_1^*(\alpha) > \Pi_2^*(\alpha)$  and  $\Pi_1^*(\alpha) > 0$ . The first-order condition for maximizing profit with technology  $i$  is given by

$$(25-2) \quad Pf'(e_i) h_i(\alpha) - \omega = 0, \quad i = 1, 2.$$

Note that  $w/h_i(\alpha)$  is the price of effective water, and that equation 25-2 can be written as

$$(25-3) \quad Pf'(e_i) = w/h_i(\alpha), \quad i = 1, 2$$



Equation 25-3 states that profit maximization under technology  $i$  occurs where the value of the marginal product of effective water is equal to its price. Now define the elasticity of the marginal product of effective water (EMP) as  $-f''(e) e/f'(e)$ . We will assume that  $EMP > 1$ . This assumption is consistent with the empirical evidence that, as one moves farther into the economic region of the production function, the marginal product of effective water falls rapidly as effective water inputs increase. If  $EMP > 1$ , Caswell and Zilberman (1985) have shown that adoption of modern technology will decrease water use and produce higher yields. It can also be shown that a switch from the traditional to the modern technology may occur if (a) the price of water rises, (b) the output price increases, or (c) the fixed cost of the modern technology decreases.

Now consider the pattern of technology adoption across farms of differing quality. On farms of high quality, the difference in irrigation efficiency between the modern and traditional technology is likely to be quite small and, given the higher fixed cost of installing the modern technology, it seems plausible that the traditional technology will be adopted on farms of the best quality. As farm quality decreases, the gain in irrigation efficiency associated with the use of the modern technology increases. Hence, there may exist a particular level of quality (call it  $\alpha^s$ ) above which the traditional technology is profit-maximizing and below which the modern technology is preferred. There also may be a level of quality,  $\alpha^m$ , below which profits are negative and land with lower quality is left fallow. In such cases, the modern technology would be used for the quality range  $\alpha^m < \alpha < \alpha^s$  and the traditional technology would be used in the interval  $\alpha^s < \alpha < 1$ .<sup>1</sup> When continuing our discussion of technology adoption under conditions of heterogeneity later in this chapter, we will assume that the worst land quality in the region,  $\alpha_L$ , is such that  $\Pi_2^*(\alpha_L) > 0$  for all parameter changes that are likely to occur. That is, we will assume that all the land in the region will be utilized.

## Surface Water Systems

Surface water systems may include rivers and lakes as well as dams and water projects. Surface water systems divert water to a region and allocate it to farmers for irrigation. Typically, the allocation and pricing of surface water have been determined by water rights doctrines based on queuing systems that restrict transactions among water users. In such queuing systems, water rights are based on the prior appropriation doctrine, in which "(1) first come, first served, or priority of right is acquired by virtue of discovery or possession, but (2) a person's right is limited to what he or she puts to beneficial use" (Cuzan 1983, p. 17). Starting with units of land that have the most senior rights and proceeding successively to units of land with junior

rights, each unit has the right to take as much water as it needs for its own production; however, water trading is not permitted.<sup>2</sup>

The literature on the economic motivation for the emergence of water rights doctrines is sparse. In essence, water rights systems should be viewed in the context of settlement and growth policy. Historically, in economies with underutilized water resources and severe constraints on government spending for growth and development, farmers were encouraged to settle in previously unsettled areas and to move upstream along rivers and waterways. New settlers were assured that, if they invested resources in settlements, they would be provided with water. Similarly, when water projects were established, the public sector wanted to induce settlements financed by private sector monies. The solution was a priority system that required very little investment in irrigation equipment and resulted in a very rapid expansion of the irrigated land base. Currently, however, all the water in most of these projects is accounted for. Hence, water is no longer abundant and the old water rights systems are now inefficient.

The history of land rights systems in the United States (Cochrane 1979) provides an interesting parallel to the history of water rights systems. In the eighteenth and nineteenth centuries, land was abundant and was allocated by a squatter system. Yields per acre did not change, but output increased as the land base increased. There was very little investment in yield-increasing farm technology during this period. By the 1890s, the West was won, land became scarce, land markets were introduced, and new yield-increasing technologies were adopted. Investments in research and development resulted in new, more productive crop varieties. We can see that what happened with land in the 1890s is now occurring with water. Because water has become increasingly scarce and there is a growing demand for it, water productivity must increase. Existing water rights doctrines may have to be replaced with an alternative allocation mechanism, but there may be much resistance to the proposed alternative if it is perceived as reducing the welfare of current water rights holders (even though it may increase total social welfare). Therefore, proposals for alternative water allocation mechanisms need to be developed, while keeping in view their political feasibility. The model presented below illustrates this point and identifies situations where moving to a resource allocation system that is more efficient than the existing water rights regime may be politically feasible.

### **The Model**

Suppose that a region of  $L$  acres is supplied annually with  $A$  units of water from a surface water source (such as a lake, dam, or river). To simplify the analysis, we assume a unique source of water to the region, no uncertainty in water supply, and homogeneous quality of land in the region and of other

fixed endowments (such as farmer ability). Using the notation from the first section, the latter assumption is that  $\alpha$  is uniform for all land parcels. We suppose that  $\alpha$  is less than 1, so that the irrigation efficiency coefficient associated with the modern technology is larger than the one associated with the traditional technology (that is,  $h_2 > h_1$ ). We also assume that there is no fixed cost in using the traditional technology (that is,  $c_1 = 0$ ). Finally, we assume a fixed output price,  $P$ , and zero water conveyance costs when water is distributed under a water rights regime that queues water users and restricts trading.

The absence of water trading means that every profit-maximizing farmer who has access to water will apply water until its marginal productivity is zero. Furthermore, he will use only the traditional technology, since water is not costly or scarce for people who end up receiving it. Let  $a_1^*$  denote the amount of water applied that makes  $f'(\cdot) = 0$ . In other words,  $a_1^* = e^*/h_1$ , where  $e^*$  is effective water per acre that maximizes yield with the production function  $y = f(e)$ . Suppose the land area  $L$  is large enough to ensure that not all land is irrigated under the existing water rights regime. In this case, the irrigated area is  $A/a_1^* (< L)$ ; per acre profit on irrigated land is  $P f(e^*)$ ; and per acre profit for land with junior rights is zero.

Now consider the alternative case where water is marketed, and suppose that only the traditional technology is available. Since output  $f(e)$  has decreasing returns to scale, the entire region gets irrigated after the water is allocated using a price system. The equilibrium levels of applied water per acre, effective water per acre, and value of marginal productivity of applied water per acre are  $A/L$ ,  $h_1 A/L$ , and  $P h_1 f'(h_1 A/L)$ , respectively. The equilibrium price of water is, of course, the value of the marginal product of applied water. Output increases as more land is brought into production with the transition to a competitive water market. The overall gain in output is:

$$\Delta Q = L f(h_1 A/L) - [A/a_1^*] f(e^*).$$

The move to water markets will usually require improvements in the monitoring and conveyance system, which may involve expenditures for measuring devices and water pipes. In addition, upstream users may need policing to prevent them from stealing water (Wade 1984). Suppose the monitoring and conveyance costs are proportional to the acreage of the region so that the per acre cost is  $u$  dollars. Then the net income gain in moving from the water rights system to a competitive water market system is:

$$\Delta W = P \Delta Q - u L = P \{L f(h_1 A/L) - [A/a_1^*] f(e^*)\} - u L.$$

The gain increases with  $L$  and decreases with  $h_1$  and with  $u$ , the per acre conveyance and monitoring cost. The cost of conveyance and monitoring may be a crucial factor in preventing the move to water markets: if laying

pipes or policing water users is too expensive, society may be better off with the queuing system.

But if the transition to a water market would improve efficiency, its distributional effects may make it infeasible from a political point of view. These effects depend on the assignment of property rights. If a water market is implemented and the agency that controls the distribution of water and bears the enforcement cost receives all proceeds from the sale of water, then landowners who had senior rights lose since they must now pay for the water they use. Their loss per acre has two components: a revenue loss of  $P [f(e^*) - f(h_1 A/L)]$ , and a loss due to the cost of buying water at its marginal value product, namely,  $P h_1 f'(h_1 A/L)$ . These landowners are likely to oppose strongly the move to a water market. However, if the market operates with a different property rights assignment, and landowners with senior rights receive the net proceeds from the sale of water, then their profit per acre will consist of the sum of the revenue from sales of output and net revenues from sales of water to individuals who originally had junior water rights. This profit per acre is equal to:

$$P \{ f(h_1 A/L) + f'(h_1 A/L) h_1 [a_1^* - A/L] \} - u$$

(since junior land now receives a total of  $[L - A/a^*]A/L$  units of water, and the payments are prorated among  $A/a^*$  acres of senior land).

If  $u$  is low enough, this profit will be greater than the profit of senior right lands under the initial water rights system. To see this, note that if  $u$  is zero, then the income from the sale of extra water has to be greater than the value of output it would generate if used on senior right lands and not sold. Thus, landowners with senior rights may well support the institutional change to a water market when they are allowed to retain proceeds from the sale of water.

The change to a water market system may, in turn, induce water-conserving technological change. Under the water rights regime, the holders of senior rights have no incentive to adopt new irrigation technology. But under a water market system, the modern technology will be adopted if the added revenue it provides can cover its fixed cost and the cost of monitoring; that is, if  $P f(h_2 A/L) - P f(h_1 A/L) > c_2 + u$ . The lack of incentive to adopt the modern technology is another source of inefficiency associated with the water rights regime. We argued above that, when only the traditional technology is available, there exists a sufficiently high value of the conveyance cost,  $u$ , which makes it socially inefficient to move from the water rights regime to a system of water markets. Let this value of  $u$  be  $\bar{u}$ . In other words,  $\bar{u}$  is such that  $\Delta W = 0$ , where

$$\Delta W = P \{ L f(h_1 A/L) \} - [A/a^*] f(e^*) - \bar{u}L.$$

Now, if the modern technology is such that the added revenue generated

by its use exceeds its fixed cost and the cost of conveyance and monitoring, then

$$\Delta \hat{W} = P \{L f(h_2 A/L)\} - [A/a^*] f(e^*) - c_2 L - \bar{u} L > 0.$$

In other words, the social gain from institutional change may be positive with the existence of the modern technology even though it was zero in the absence of this technology. Let  $\hat{u}$  be the value of  $u$  such that  $\Delta \hat{W} = 0$ . Then, provided the conveyance cost per acre is between  $\bar{u}$  and  $\hat{u}$ , institutional change will be socially desirable when the modern technology exists, but not otherwise. If the initial conveyance cost exceeds  $\hat{u}$  but is decreasing over time, then the transition to water markets will be made socially efficient earlier with the availability of the modern technology than it would in the absence of this technology.

These results can be illustrated with a numerical example based on Caswell, Lichtenberg, and Zilberman's (1990) analysis of cotton production in California's San Joaquin Valley. Under conditions prevailing in this area, yield per acre of cotton is approximated by the following quadratic relationship in effective water ( $e$ ):

$$y = -1,589 + 2,311 e - 462 e^2.$$

The output-maximizing level of effective water with that production function is 2.5 acre feet (AF) per acre, and the corresponding value of maximum output per acre is 1,300 pounds per acre. Under the initial water rights regime, which queues water users and prohibits trading, only furrow irrigation will be used and water will be applied until output per acre is maximized in the irrigated area. Irrigation efficiency with the traditional technology for the region is 0.6. Consequently, applied water per acre is  $2.5/0.6 = 4.17$  AF per acre and, if the available water supply is 20,000 AF, then the irrigated area is  $20,000/4.17 = 4,796$  acres, which means that total output in the

Table 25-1. Predicted Cotton Production in the San Joaquin Valley, California, under Alternative Water Rights Systems

	Queuing system	Market system	
		Furrow irrigation	Sprinkler irrigation
Water applied per acre irrigated (acre feet per acre)	4.17	3.33	3.33
Irrigation efficiency	0.6	0.6	0.8
Area irrigated (acres)	4,800	6,000	6,000
Total output (pounds)	6,235,012	7,110,000	7,730,000

region under the initial water rights regime is  $1,300 \times 4,796 = 6.2$  million pounds (see table 25-1).

Now suppose that there is a water market, but only the traditional technology is available. Suppose also that there are no conveyance or monitoring costs (that is,  $u = 0$ ), and that the size of the region,  $L$ , is 6,000 acres. Under these assumptions, applied water per acre is  $A/L = 3.33$  AF per acre, output per acre is 1,185 pounds per acre, and total output in the region is  $6,000 \times 1,185 = 7.1$  million pounds. The gain in total output is about 14 percent. If the price of cotton,  $P$ , is \$0.85 per pound, then the value of this gain in output is \$743,740. Note that we assumed  $u = 0$ . The maximum value of  $u$  at which the move to water markets with a traditional technology is socially desirable is  $\bar{u} = \$743,740 \div 6,000 = \$124/\text{acre}$ .

Finally, let us consider the move to a water market when a sprinkler system is available. The additional cost per acre of using sprinklers is \$48 per acre, and irrigation efficiency through their use increases to 0.8. The rise in efficiency of applied water causes yield per acre to jump to 1,288.33 pounds per acre and total output of the region to rise to 7.7 million pounds. The increase in total output represents a gain of about 24 percent over total output under the initial water rights regime. Assuming  $u = 0$ , the net income gain over the water rights regime is \$982,739, an increase of about 19 percent. The maximum value of  $u$  at which the move to water markets with the availability of sprinklers is socially desirable is  $\bar{u} = 982,739 \div 6,000 = \$164$  per acre. Thus, if conveyance and monitoring costs exceed \$124 per acre but are less than \$164 per acre, then the move to water markets will be desirable from a social point of view only if the more efficient sprinkler irrigation technology is available.

The issue of how the transition to a water market regime might actually take place needs to be examined further. We suggested above that a Pareto improvement over the water rights regime based on queuing can be achieved under certain circumstances by a bureaucratically initiated assignment of tradable water rights to landowners who have senior rights under the initial regime. That is, senior water rights holders would receive ownership shares in the agencies that would sell water.<sup>3</sup> Given the Coase theorem, one may well ask why owners of senior and junior rights under the water rights regime do not initiate such trading on their own. Indeed, there is evidence of bargaining situations like this, especially among farmers at the margin, and there have been instances of successful collective action by downstream farmers. (For a case in India, see Wade 1984). The likelihood of success may be expected to increase with higher output prices. But because large numbers of farmers usually have access to surface water systems, the transaction and monitoring costs of bringing about and maintaining a regime of tradable water rights may be high. For these reasons, water trading usually has to be preceded by legal and institutional reform.

## Extensions

The above analysis considered the case of a small price-taking region. If the region under consideration is relatively large and faces a negatively sloped demand curve for its output, then the transition to a water market system would benefit consumers by reducing the output price, but it might also reduce producers' surplus. This would happen for a sufficiently low elasticity of demand. In such cases, owners of land with senior water rights may be expected to oppose the introduction of a water market even if they control the proceeds from sales of water, since the loss of revenues from the output price reduction would exceed the gains from sale of water.

Now consider farms of heterogeneous land quality. The general observation that land quality near water bodies such as dams and rivers (where the soil is heavier and the terrain flatter) is usually high relative to locations further away leads us to suggest that the switch from traditional to modern water conservation technologies might occur in peripheral lands. The low land quality combined with junior water rights may induce the water users on the periphery to initially adopt modern irrigation technologies under a traditional water rights regime. When water trading becomes feasible, upstream farms might also adopt the new technology so that surplus water is available for trading.

Our discussion has taken into account neither uncertainty in water supply nor the possibility of conjunctive use of groundwater and surface water. There exists a literature in these areas (for example, Burness and Quirk 1979; Burt 1964), and its findings could be used to extend our analysis.

## Groundwater Systems

We now return to the model of the first section, where a large number of profit-maximizing farmers with varying abilities to use any given technology occupy a region with heterogeneous land quality. Land quality (the ability of soil to retain water) is assumed to go continuously from  $\alpha_L$  (worst quality) to 1 (best quality). In this section we assume additionally that farmers in the region pump the water they use from a commonly owned groundwater aquifer. To make matters simple, we suppose that there is no recharge to the groundwater; in other words, we view groundwater as a nonrenewable resource.<sup>4</sup> This section is divided into two parts. The first part derives the socially optimal pattern of resource depletion and technology adoption, and then compares it to the pattern obtained under competitive behavior by farmers with respect to water use. Our work is closely related to Kim and others (1989), who examine the shift to less water-intensive crops as the stock of groundwater gets depleted. The second part of the section points out a first-best policy to correct the inefficient outcome that occurs if farmers

behave competitively, discusses the limitations of this first-best policy, and suggests some second-best alternatives.

### *Socially Optimal and Competitive Outcomes*

Let us say that, at any time  $t$ , the social planner knows the magnitude of the stock of water,  $S_t$ , and that its equation of motion is given by:

$$\dot{S}_t = -A_t$$

where  $A_t$  is the total applied water in the region at time  $t$ . The unit cost of pumping water,  $w(S_t)$ , is assumed to increase over time as the water in the aquifer,  $S_t$ , falls (that is,  $w'(S_t) < 0$ ). We also assume that the fixed cost per unit land,  $I_i$ , associated with technology  $i$  ( $i = 1, 2$ ) is incurred in every period that technology  $i$  is used.<sup>5</sup>

Let  $U(Y)$  be the area under the demand curve for agricultural output, that is, the integral of the inverse demand function between zero and  $Y$ . Then the social optimization problem may be stated as follows:

$$\max \int_0^T e^{-rt} [U(Y_t) - A_t w(S_t) - I_i L] dt$$

subject to

$$\dot{S}_t = -A_t$$

$$S_t \geq 0, S_0 \text{ is given,}$$

where  $Y_t$  is aggregate output at time  $t$  and  $T$  is the terminal time. (Recall that, by assumption, it is socially profitable to utilize all the land.) The above is an optimal control problem (involving an exhaustible resource of given initial size,  $S_0$ ) that may be solved in a two-step procedure analogous to one used for solving the corresponding static problem in the first section. Here, we will restrict ourselves to a heuristic discussion of some of the necessary conditions.<sup>6</sup>

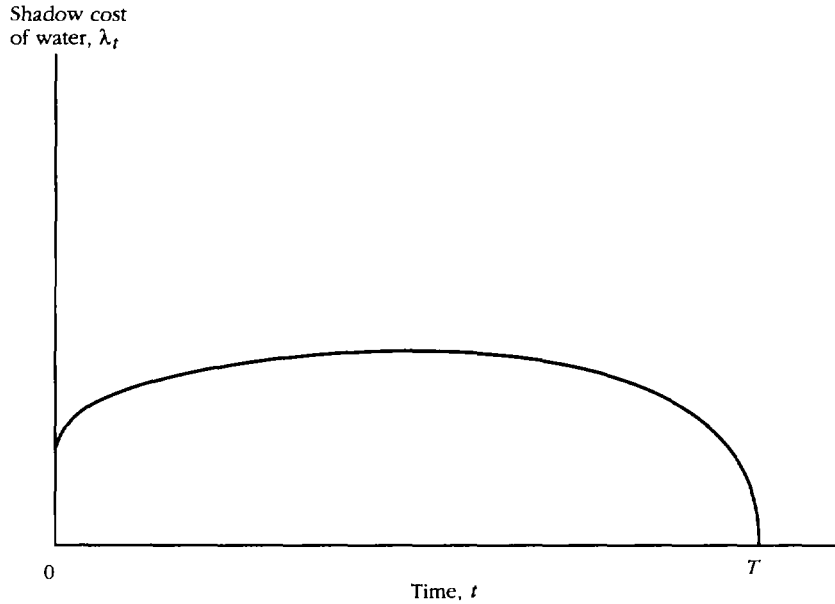
Let  $\lambda_t$  be the co-state variable associated with the equation of motion;  $\lambda_t$  may be interpreted as the shadow cost of the water stock. ( $\lambda_t$  is also known as marginal user cost in the economic literature on exhaustible resources.) The co-state equation given below describes the behavior of  $\lambda_t$ :

$$\dot{\lambda}_t = r\lambda_t + A_t w'(S_t).$$

Since  $w'(S_t) < 0$  and  $\lambda_t \geq 0$ , the right-hand side of the above equation cannot be signed unambiguously. However, if  $S_t$  is relatively large, then a marginal change in  $S_t$  is unlikely to cause a substantial change in the unit pumping cost. Hence, at least in the initial stages,  $w'(S_t)$  may be negligible,



Figure 25-1. Behavior of Shadow Price of Water over Time



and  $\lambda_t$  may be rising at a rate close to the rate of interest. As time goes by, however,  $\lambda_t$  may start to rise at a lower rate and ultimately may even decline to zero. A likely time path of  $\lambda_t$  is shown in figure 25-1.

From society's point of view, the marginal cost of depleting the groundwater stock,  $v_t$ , is equal to the sum of the pumping cost and the shadow cost of the stock; in other words,  $v_t = w(S_t) + \lambda_t$ . Note that, although  $\lambda_t$  may start to decrease at some point in time,  $w(S_t)$  will increase as time goes by and the stock of groundwater is depleted. In fact, it is easy to see that  $v_t$  must rise over time since

$$\dot{v}_t = w'(S_t) \dot{S}_t + \dot{\lambda}_t = -w'(S_t) A_t + r\lambda_t + w'(S_t) A_t = r\lambda_t \geq 0.$$

(The above simplification is obtained by using the equation of motion and the co-state equation.)

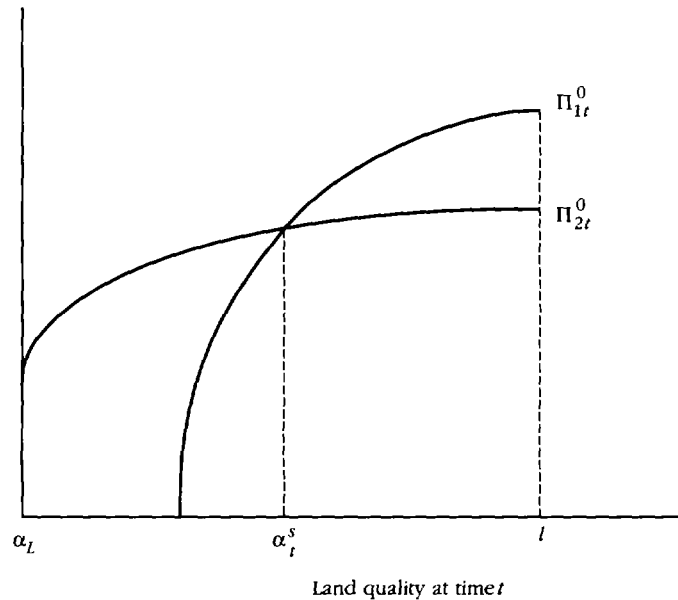
Using  $v_t = w(S_t) + \lambda_t$ , let us define the value of output per acre at the social optimum as:

$$\Pi_{it}^0(\alpha) = P_t f(e_{it}(\alpha)) - v_t a_{it} - I_t.$$

Clearly, at quality level  $\alpha$ , the problem is reduced to the one already discussed in relation to surface water systems. The first-order conditions for

Figure 25-2. *Profits as a Function of Land Quality under Alternative Technologies*

Profits per unit land from using technology  $i$  at time  $t$  ( $\Pi_{it}^0$ )



profit maximization with technology  $i$  at time  $t$  require equating the marginal product of effective water with its marginal cost (which now includes a shadow cost term), and the rest of the analysis is also as before.

Figure 25-2 shows the determination of the optimum technology. Since all the land is utilized by assumption, the traditional technology is used where  $\alpha \geq \alpha_t^s$  (that is, on higher-quality farms) and the modern technology is used where  $\alpha < \alpha_t^s$  (that is, on lower-quality farms). It should be noted that the effect of the increasing social cost of water,  $v_t$ , is to cause  $\alpha_t^s$  to increase over time. As water cost increases, water use and output decrease for any given technology and land quality. Now, output does jump up for quality  $\alpha_t^s$  where the technology switches from traditional to modern, but if the distribution of quality is continuous and smooth, then aggregate output will be continuous at all points in time. Furthermore, aggregate output may be expected to decline over time but, since modernization is continuously occurring, it will not decline as rapidly as in the case of a pure Hotelling-type world where there is no technological change. Nonetheless, as long as aggregate output is declining, output price will be rising, and this has the effect of reinforcing the increasing trend in  $\alpha_t^s$ . Hence, it seems quite plausible, under the assump-

tions made here, that the area irrigated by modern technology will increase over time, while the area irrigated by traditional technology will fall. Aggregate water use should be expected to decline over time, as well.

The socially optimal solution described above assumes that water use decisions are made by a social planner who takes into consideration a shadow cost of depletion of the water stock, in addition to the direct effect on unit pumping costs of the declining water stock. In a competitive economy, however, the underground water stock is usually owned commonly by a large number of producers, each of whom has little or no private incentive to take into account the effect of depletion of the water stock beyond its direct impact on unit pumping costs. We now make some observations about this case, where individual farmers are assumed to behave competitively with regard to resource use decisions, and make a comparison with the case in which the situation is socially optimal. Formal proofs of many of our results will be omitted as they can be found in Shah, Zilberman, and Chakravorty 1989.

In the competitive equilibrium (denoted with a superscript  $e$ ), the profit of a farm with land quality  $\alpha$  using technology  $i$  at time  $t$  is

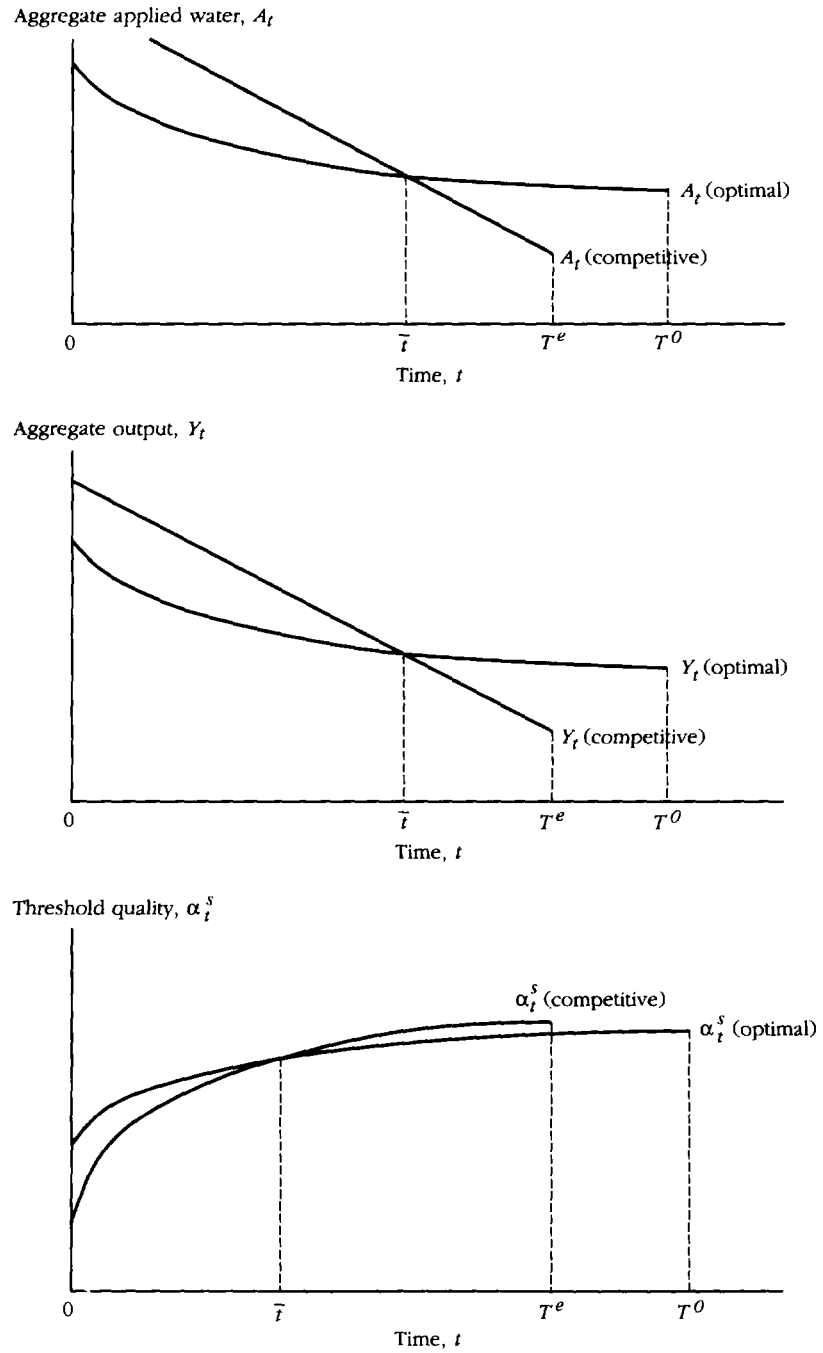
$$\Pi_{it}^e(\alpha) = P_t f(e_{it}(\alpha)) - w(S_t) a_{it} - I_i, \quad \text{for } i = 1, 2$$

Note that  $w'(S_t) < 0$  implies that the unit cost of pumping rises over time as the water stock gets depleted. Consequently, applied water and output must decline over time as long as a given technology is being used. Observe, however, that since the social cost of using water,  $v_t \equiv w(S_t) + \lambda_t$ , exceeds the private pumping cost,  $w(S_t)$ , the optimal levels of output and water use on farm quality  $\alpha$  will be lower than the corresponding competitive levels for the same value of  $S_t$ , provided the same technology is being used in both cases.

In fact, it is possible to show that the aggregate levels of applied water and output under competition will be higher than their corresponding values under the social optimum in earlier periods, and also that, under competition, the extent of adoption of the modern technology in these periods will be less than the optimum. The top part of figure 25-3 shows the likely behavior of aggregate water use over time in the two cases. The water stock is depleted more rapidly in the competitive case, and therefore the "doomsday" occurs sooner in this case.

The middle part of figure 25-3 shows a likely comparative pattern of output in the two situations, and the bottom part illustrates the likely comparative behavior of  $\alpha_t^*$ . The time  $t$  indicates the instant when exactly the same number of farms will be using the modern technology in both situations: the competitive water stock,  $S_t^{comp}$ , will be sufficiently lower than the optimal water stock,  $S_t^{opt}$ , at this time to equate  $w(S_t^{comp})$  with  $w(S_t^{opt}) + \lambda_t$ . At this particular instant, the magnitude of all the key variables (except

Figure 25-3. *The Dynamics of Water Use, Output, and Diffusion of Irrigation Technology Under Competitive and Optimal Regimes*



the water stock  $S_t$ ) will be the same in both models because the unit "cost" of water is equated in both models at this point, and the magnitude of this cost is fundamental to the determination of the magnitude of variables such as output and water use. After  $\bar{t}$ , the unit cost of water to the competitive farmers will be higher than the corresponding value in the optimal model at the same instant, and a more widespread use of the modern technology will be made by them. However, this late-stage increase in adoption will not prevent the "doomsday" from occurring sooner in the competitive model than in the optimal model.

At this point it should be emphasized that the mere existence of modern technologies is a blessing, even if they are not adopted at the right time and put to use in the optimal manner. Compared to the situation when no modern technology is available, we generally have more output and less water use when modernization is occurring myopically. Thus, the availability of new technologies is important in prolonging the use of an exhaustible resource such as groundwater and in increasing production, even in the absence of some sort of government intervention to bring out the efficient exploitation of a common property resource.

### ***Informational Problems and Policy Alternatives***

The comparison of the optimal and competitive programs of resource depletion provided in the above discussion makes it clear that, if the price of water to competitive farmers is raised by the amount  $\lambda_t$  at each instant  $t$ , then the technology adoption and water use decisions made by these farmers will be optimal from a social point of view. In practice, however, this first-best solution to the problem may be infeasible for two types of reasons. First, it may be politically unacceptable. As Buchanan and Tullock (1975) have emphasized, the direct taxation of pollution (or of the use of any depletable common property resource) is unpopular with polluters because it reduces their net income. Farmers may be expected to oppose any regulatory legislation that purports to increase water prices. One could think of subsidy schemes to compensate the farmers for their loss due to taxation, but the nature of the problem is such that any fair and reasonable tax-subsidy scheme is likely to be quite complicated.

A second, and perhaps more fundamental, reason for the infeasibility of the first-best solution to this common-property problem is that in most situations it is difficult and very costly to monitor the usage of groundwater at the level of an individual farm. Furthermore, individual water use is generally hard to infer from yields because, even where there is access to good information about the overall distribution of land quality in a region, information on the level of  $\alpha$  for any given farmer is rarely available.

It is evident that we have here a classic situation of market failure where the first-best interventionist solution is difficult to attain. Consideration of a

feasible second-best policy alternative is, therefore, necessary. One possibility is to charge farmers a tax based on the average amount of water applied in the region with the technology they use. Such values of average amounts of water may be obtained with the help of agricultural extension agents and from data collected by agricultural field stations. It should be noted that water use usually changes much more drastically when there is a change in technology or in irrigation practice than it does when farmers respond to water price variations while using a given technology or irrigation practice.<sup>7</sup> Under our proposed scheme, farmers using drips or sprinklers would be charged a substantially lower tax than farmers using traditional furrow irrigation.

As an illustrative example, consider the case of cotton production in the San Joaquin Valley of California. Assuming the production function, price, technology cost, and irrigation efficiency parameters used in table 25-1 and a value of pumping cost of water of \$25 per AF, the average water used with furrow irrigation comes to 4.1 AF per acre, with sprinkler irrigation it is 3.1 AF per acre, and with drip irrigation it is 2.6 AF per acre. If the shadow price of the water stock at any given time is, say, \$50 per AF, then the proposed per acre taxes on users of the three technologies at that time would be \$205, \$155, and \$130, respectively. At these rates, the profit from using furrow irrigation, net of the tax, is about \$297 per acre; with sprinklers, the after-tax profit is about \$324 per acre; and with drip, it is about \$277 per acre. These numbers suggest that if the tax is levied, then sprinklers will be used on average-quality farms when the remaining stock of groundwater is of a size that warrants a shadow price of \$50 per AF (note that furrow irrigation would have been more profitable in the absence of the tax). As the remaining stock of groundwater shrinks and its shadow price and pumping cost rise, one may expect drips to be used on the average-quality farms at some point in time. In our example, this would happen, for instance, when the shadow price of the water stock is \$60 per AF and the cost of pumping water is \$50 per AF.

It should be noted that the *differences* among the technology-based taxes are more important from a policy perspective than their absolute magnitudes. In the above example, if users of drip irrigation pay no taxes, users of sprinklers pay \$25 per acre, and users of furrow irrigation pay \$75 per acre, then it would still turn out that profits on the average-quality farms would be highest with sprinkler irrigation. As a practical matter, political opposition to the tax scheme may be reduced if the tax rates are kept as low as possible. It should also be noted that the idea of having different tax rates for different technologies is quite analogous to levying charges for surface water that vary by crop. This is a common practice in parts of India and Pakistan, where surface water charges are assessed on the basis of irrigated acreage and crop planted, and higher water charges are assessed on crops that tend to use more water.

We now sketch a procedure for calculating the optimal technology taxes. Any given region in the world may well be using up to ten different irrigation practices (such as furrows of different lengths or sprinklers of different types). Regional extension offices usually prepare crop budgets, and from these it would be possible to estimate the average amount of water used by each irrigation practice employed in the region. Data collected by agricultural experiment stations and expert interviews conducted by extension agents could be utilized to continually update these estimates. This information could be used to compile a schedule of tax rates for the different practices in the following manner. Policymakers may be expected to have a reasonable idea of the region's quality distribution, but they normally would not know the exact quality level of every farm. Knowledge of the distribution, combined with knowledge about aggregate water use and stock size obtained from hydrological data for the region, could be used to solve an optimal control problem for deriving a socially optimal tax on each irrigation practice. Of course, the policy would only be second-best (or optimal in the constrained Pareto sense because of the nature of the informational and institutional constraints).<sup>8</sup> As improved information on average water used with a technology is made available through observing farmer responses and the actual changes in the groundwater level, the parameters of the problem could be updated and the time path of the tax revised accordingly. Such updating may improve efficiency, but since the scheme is second-best by nature, it should not be expected to produce first-best results (except, perhaps, in some special circumstances).

The tax on users of the inefficient technology would cause their irrigation costs to go up, and this would encourage adoption of the more efficient technology. The new adopters at each point in time may be expected to be those farmers with lower land quality relative to others employing this technology. It follows that the increase in adoption of the modern technology may be expected to cause the average water used with the inefficient technology to decrease, and since the tax on the inefficient technology is determined on the basis of average water applied in the region with this technology, there may well be a decrease over time in the tax rate based on this average. In this case, rising water-pumping costs would tend to play an increasingly important role over time, relative to the tax, in sustaining and promoting technological change. Thus, our proposed scheme would increase the incentive to adopt the modern technology in initial time periods when the shadow cost of the groundwater stock is high, and then die out in later time periods when it is no longer needed.

One might consider using the tax revenues (generated by levying a tax on users of the inefficient technology) to subsidize users of the efficient technology. This would further increase the incentive to adopt the modern technology in initial time periods. The optimal rates of taxation and subsidization

could be determined subject to the constraint that aggregate taxes equal aggregate subsidies for the entire region. The scheme would then pay for itself.

The above schemes have an interesting *truth-revealing* feature (Green and Laffont 1976): Since adopters at the margin would tend to be the less conservative water users in the class of farmers employing inefficient technologies in previous periods, they reveal some information about their land quality when they decide to adopt. This information about  $\alpha$  may prove valuable to the policymaker in developing an individualized tax or subsidy scheme at some later date.

In the future, cost reductions and improvements in monitoring technologies may also make it feasible to require or induce the use of monitoring equipment at the farm level. A policy that would induce installation of this equipment by farmers themselves could be as follows: Farmers are given the option of installing a device that would measure their water use and allow them to pay for water on a volumetric basis; if they do not install such a device, they must pay a flat rate for water determined on the basis of average water used with their technology in the region. Naturally, the more water-efficient farms may be expected to choose the first option. Incorporation of the information on water used by monitored farms would permit updating of the policymaker's assessment of water used by less water-efficient farms. It should be noted that this policy is also truth-revealing: The more efficient farmers are separated from the less-efficient ones when the former decide to install water-measuring devices.

## Conclusions

In this chapter we have argued that existing institutional arrangements lead to underinvestment in water-conserving technologies and inefficiencies in water use. This worldwide phenomenon is particularly severe in developing countries. We considered institutional settings for water allocation in both surface and groundwater systems.

In the case of surface water systems, prevailing water rights regimes may have been adequate when water was plentiful relative to the demand for it; but now that water is becoming scarce, they lead to great inefficiency. Any move to a market-based allocation system for surface water is likely to be opposed by those who own senior water rights under the initial regime and who get their water for free. We have argued that one politically feasible solution to the problem would be to allow the holders of senior rights to own shares in the profits made from the sale of water. If successful, the move to a water market would increase water use efficiency with any technology, and would also encourage adoption of water-conserving technologies. We have



emphasized that improvements in water conveyance systems are essential, and farmers should be given every incentive to invest in these improvements.

For groundwater, the primary problem is that the resource is usually commonly owned by a large number of producers. This leads to overexploitation from the social point of view and to suboptimal rates of adoption of resource-conserving technologies. Although one can think of first-best tax schemes to solve this problem, these schemes are generally not feasible because water use at the farm level is very costly to monitor, and there may also be political difficulties in levying taxes. We proposed some second-best tax-subsidy and incentive schemes that would be feasible in the circumstances of most countries. Our proposed schemes would rely on information and data obtainable with the help of regional extension offices. A key feature of these schemes is that they encourage adoption of water-conserving technologies. The schemes also reveal information about land qualities that may assist policymakers in updating corrective tax and subsidy rates. This feature may ultimately enable the second-best schemes to achieve results that are reasonably close to the ones expected with first-best schemes. We have also emphasized the importance of providing inducements to farmers to bear the expense of installing water-monitoring equipment.

The analysis in this chapter is considerably simplified. We have not taken into account the uncertainty that plagues all water systems, nor have we considered conjunctive use of groundwater and surface water. Our primary message here is that institutional change is the key to achieving efficiency in water use, and policies that aim to bring it about must be compatible with existing political and economic realities. Although we have restricted attention to the case of water, our model could be modified to discuss other resource-use cases, such as pesticide use and agricultural drainage, where common property problems arise.

## Notes

1. There is ample empirical evidence verifying that modern irrigation technologies are more likely to be adopted on lands having a lower water-holding capacity when output prices and water prices increase (see Caswell 1991).

2. Allocation of water under queuing systems that are consistent with the prior appropriation doctrine is prevalent in both developing and industrial countries. See Easter (1986), Chambers (1988), Lee (1990), and Cuzan (1983).

3. Gardner (1983) discusses the organizational and legal barriers that would have to be crossed in the transition from a prior appropriation rights system to a water trading system in the western United States.

4. Chandler (1985, p. 53) provides several important examples of major water

aquifers that are being depleted in the United States, India, China, the former U.S.S.R., and Israel.

5. This fixed cost may be viewed as including a rental charge for the technology if renting is possible, or one may suppose that there is a perfect resale market for the finitely lived technology, in which case a fixed instantaneous rent can be imputed.

6. See Shah, Zilberman, and Chakravorty (1989) for a more complete statement of the problem and of its solution.

7. This fact is documented by Highstreet, Nuckton, and Horner's (1980) survey of agricultural water use in California, by Abbott's (1984) worldwide survey of drip irrigation, and by Caswell and Zilberman (1985).

8. See Shah, Zilberman, and Chakravorty (1989) for technical details.

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## Scale Economies, Technological Change, and Diversification

Avinash Dixit

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*Both scale economies and risk affect the adoption of technology. External economies of scale may arise from the fixed-cost element in extension services or from learning spillovers among farmers. The optimal response to scale economies is specialization. The optimal response to risk is to pool it with other, less than perfectly correlated risks (diversification). This chapter explores the tradeoff between these two responses. It contrasts an equilibrium in which risk markets are absent and a social optimum with perfect risk-sharing. In some cases, the full social optimum entails more diversification, hence less exploitation of scale economies, than does the equilibrium. The reason is that in the equilibrium without risk markets, farmers do not take account of the effect of their actions on aggregate social risk.*

RISK IS AN IMPORTANT COMPONENT of agricultural activities. It becomes all the more significant for new crops or projects in developing countries. The reasons are almost self-evident. Most farmers in these countries lack the general education and skills that would facilitate their adoption of new farming practices. The success of new varieties of crops often hinges on associated inputs of fertilizer and irrigation, whose supply is subject to many disruptions and bottlenecks. While new crops or methods of cultivation are extensively tested by experts under laboratory conditions, their performance in actual widespread use is a matter of great uncertainty.

Scale economies are also important for new technologies in developing countries. Farmers struggling to understand and master new ideas and techniques need the backup services of advisers. Such a service is of an overhead

or public good nature; its size need not grow proportionally with the number of farmers it serves, at least over a substantial initial range of expansion of the activity. Some types of irrigation also have large set-up costs and low marginal costs over a wide range of use. Finally, farmers can learn much more easily by observing their neighbors, so the larger the number of farmers engaged on a new project in a locality, the faster each will master the necessary skills, and the productivity of each will be higher.

When risk and scale economies coexist, a tradeoff arises. One standard economic response to risk is to pool it with other, less than perfectly correlated risks (diversification). This clashes with the standard response to economies of scale—greater specialization. My purpose in this chapter is to study this tradeoff, from the perspectives of both market equilibria and social optima. The comparison depends on the working of the other standard economic response to risk—spreading it over a large number of people. In the context of agriculture in developing countries, we expect most markets for risk-sharing to be imperfect or missing altogether. Therefore I shall model the market equilibrium with no risk markets, and contrast it with a full social optimum with perfect risk-sharing. The former is meant as an extreme manifestation of the market imperfection, and the latter is meant as an ideal benchmark and not a realistically achievable outcome. There are reasons, usually to do with asymmetric information, for the imperfections of risk markets. The same reasons will rule out or constrain the use of ideal policy instruments and explain the emergence of private arrangements like sharecropping that perform some functions of risk-sharing while coping with the information problem. A proper and fair comparison would be of imperfect markets and contracts in contrast to imperfect policies with common information limitations on both.<sup>1</sup> But in this exploratory exercise I shall confine myself to the simpler albeit unfair comparison of missing markets and ideal policies, leaving better treatments for future work.

The exploratory treatment is needed because most of the literature on risk-bearing leaves out scale economies, and vice versa. The voluminous literature on diversification was developed with applications to financial markets in mind. There an investor experiences naturally constant returns to scale with respect to his holdings of shares in a risky opportunity (company). This model has been applied to the issue of diversification across crops (and risky projects more generally) in developing countries, and some promising results have been obtained (Hazell, Pomareda, and Valdés 1986, chapter 3; Dixit and Williamson 1989). But scale economies are kept out of these models. International trade theory has quite sophisticated general equilibrium models based on scale economies and risk separately, but not together (see the chapters by Helpman and Pomery in Jones and Kenen 1985).

The only joint treatment of risk and scale economies I have been able to

find is in Nalebuff and Varian (1983). They construct a model focusing on the question of risk-sharing for a single project and its implications for the scale at which the project will be undertaken. They have a simple geometric example where individuals cannot share risks with others, and the response of each is to undertake too many and too small projects. In a different and in some respects richer model, I find just the opposite tendency.

I shall consider two issues. The first is the most natural generalization of the portfolio choice setup. There are several crops or projects, each with some scale economies and risk. The aim is to examine the "portfolio" choice from this set of crops in an equilibrium without risk-sharing, and to contrast it with the optimum where full risk-sharing occurs. The results are ambiguous; privately chosen portfolios can have too little or too much diversification, that is, too large or too small a scale of cultivation for each crop. The second issue concerns the introduction of a new crop or project with scale economies in an economy where the preexisting activities have constant returns to scale. Once again I shall contrast the results with full and zero risk-sharing. Here the result is simple; the social incentive to adopt the new crop unambiguously exceeds the private incentive.

## The Basic Model

A common idea links all the models that I shall consider: the output of each farmer cultivating a crop is a random variable whose distribution depends on the total number of farmers engaged on the same crop. Specifically, if  $n_i$  farmers cultivate crop  $i$ , then the output of the  $j^{\text{th}}$  such farmer is given by

$$(26-1) \quad x_{ij} = \mu_i + b_i r + s_i + \epsilon_{ij}$$

where  $\mu_i$  is a function of  $n_i$ , and  $r$ ,  $s_i$  and  $\epsilon_{ij}$  are normally distributed variables with mean zero, whose significance will be discussed shortly. The dependence of  $\mu_i$  on  $n_i$  is intended to be the main reflection of the nonconstancy of returns to scale; the important feature is the existence of a range of economies of scale, where  $\mu_i$  increases with  $n_i$ .

The random variable  $r$  represents an *economywide risk*—for example, a general drought or exchange rate fluctuations. This is the analog of systematic or undiversifiable or market risk in financial economics. Each crop may be affected to a different degree by this risk, hence the coefficients  $b_i$ . But the shock is perfectly correlated across all crops. Let  $V_r$  denote the variance of  $r$ .

The term  $s_i$  is a *crop-specific risk*. Examples are variations in the quality of seeds, or the efficacy of a fertilizer under local conditions, or the working of the particular irrigation system chosen for that crop. The parallel in financial economics is the idiosyncratic risk of each security. The  $s_i$  are uncorre-

lated across crops, and also uncorrelated with the economywide shock  $\tau$ . Let  $V_{s_i}$  be the variance of  $s_i$ .

Finally,  $t_{ij}$  captures the *individual risk* of each farmer for each crop, independent across individuals and crops. This has no parallel in financial economics, since the returns on two shares of a company held by two different individuals do not vary independently. But in the agricultural context, individual farmers' outputs can easily have components of independent variation. Let  $V_{t_i}$  be the variance of each  $t_{ij}$ , the same for all  $j$ .

Scale effects can show up in the variances as well as the means. Of the three random variables, the crop-specific variance  $V_{s_i}$  is the one most likely to be a function of the number  $n_i$  of farmers cultivating crop  $i$ . The variance of the individual risk,  $V_{t_i}$ , may also depend on  $n_i$ , but the argument is less compelling. For the economywide risk there is no reason to allow dependence on the numbers engaged on one particular crop. To sum up, crop-specific risk is the most important source of risk for my analysis of the relation between risk and scale effects. In the second section of this chapter the other sources of risk do no harm, and so I shall carry them along. But in the third section they would complicate the analysis unduly, so I will leave them out.

There is a basic indivisibility—each farmer must devote his entire labor to one crop. Some such restriction is essential in a model of limited risk-sharing: if each farmer can diversify his labor across crops, he can achieve full diversification of the crop-specific risk without the need for any markets for risk-sharing. In practice, diversification by each farmer across crops is likely to be limited, and the extreme assumption of indivisibility is the simplest that serves my purpose. Of course, the economy as a whole diversifies when groups of farmers cultivate different crops.

In the rest of this section I shall examine some different sources of scale economies. To keep the notation simple during this discussion I shall drop the crop subscript  $i$ .

Perhaps the simplest case is where  $k$  people are needed to provide training and general oversight to the whole group of farmers. Suppose these experts can be hired at the wage  $w$ , and every member of the group of  $n$  farmers using this service bears an equal  $(1/n)$ th share of the cost.<sup>2</sup> Then

$$(26-2) \quad \mu(n) = \mu_0 - wk/n$$

where  $\mu_0$  is the constant average productivity that is possible with this arrangement. Of course this implies a lower limit,  $wk/\mu_0$ , to the size of each group, and in fact the group size will be higher to exploit the economies of scale. Even then, with normally distributed random variables, there is a probability of negative output, but I shall follow common practice and ignore that problem.

More generally, we can allow some congestion in the provision of this overhead expert service. Then  $k$  can increase with  $n$ , but so long as it does not increase proportionately, some scale economies will persist.

In this model of overhead costs, the variances can be constant, in which case a change in  $n$  is essentially a shift of the whole distribution of  $x$  to the right or to the left. This constitutes an interesting special case, and I shall use it below, under the name of the constant-variance case. But it is conceivable that for a given number of experts  $k$ , as the number  $n$  of farmers increases, the quality of supervision slips and the variance increases.<sup>3</sup> A simple way of modeling this is to make the random shocks multiplicative, so their variance is proportional to the square of  $\mu(n)$ .

That brings us to a more general multiplicative case, where

$$(26-3) \quad x = \mu(n)q$$

where  $q$  is a random variable with mean 1. But with normally distributed random variables, I cannot easily include separate multiplicative economy-wide, crop-specific, and individual shocks, so I shall keep only the important crop-specific risk in this context. The multiplicative case is particularly well-suited for modeling external economies where each farmer learns by observing his neighbors engaged on the same project.<sup>4</sup> To reconcile equation 26-3 with equation 26-1, we can let  $s = [q - 1]\mu(n)$ , and then the variance of  $s$  increases as the square of  $\mu(n)$ . This fits the externality interpretation quite well—when each farmer observes his neighbor, mistakes are propagated just as good practices are. The multiplicative case is another useful illustrative example and a source of interesting special results, and I shall use it as such.

I shall assume that all farmers are identical, and maximize expected utility with constant absolute risk aversion,

$$(26-4) \quad E[-\exp(-Ay)]$$

where  $y$  denotes the random income.

The passage from output  $x$  to income  $y$  depends on the risk-sharing arrangements in the economy. That in turn has important consequences for the pattern of diversification in the economy. As discussed before, in this chapter I shall merely compare the extremes of full risk-sharing and no risk-sharing.

### Diversification with Identical Projects

The economy has a large number  $N$  of identical farmers and a range of possible crops indexed by  $i = 1, 2, \dots$ . I assume symmetry in the sense that the dependence of the distribution of returns on the number of farmers is



the same for all  $i$ . Thus the functional forms of  $\mu_i$ ,  $V_{si}$ , and  $V_{ti}$  are independent of  $i$ , and we can write

$$(26-5) \quad \mu_i = \mu(n_i), \quad V_{si} = V_s(n_i), \quad V_{ti} = V_t(n_i).$$

The variance of the economywide shock  $V_r$  does not depend on the number of farmers in sector  $i$ . Also, the coefficients  $b_i$  of the economywide risk are all assumed equal for symmetry, and I set them equal to one without loss of generality. Asymmetry among crops raises the interesting question of possible biases in the selection of crops; I leave this for future work.

### Market Equilibrium without Risk-Sharing

Begin with the market equilibrium. Each farmer chooses the crop he will cultivate, and there is no risk-sharing by assumption. Therefore the income of farmer  $j$  in sector  $i$  is just the  $x_{ij}$  of equation 26-1. His expected utility is

$$(26-6) \quad E[-\exp(-Ax_{ij})] = -\exp\left[-A\mu(n_i) + \frac{1}{2} A^2 \{V_r + V_s(n_i) + V_t(n_i)\}\right].$$

In equilibrium, all crops that are actually chosen must yield the same expected utility to the participants. Therefore for all  $i$  with  $n_i > 0$ , we must have

$$(26-7) \quad \mu(n_i) - \frac{1}{2} A [V_r + V_s(n_i) + V_t(n_i)] = u$$

where  $u$  is independent of  $i$ . Further, to rule out the incentive for any one of these people to go and start a new crop on his own, it must be true that

$$(26-8) \quad \mu(0) - \frac{1}{2} A [V_r + V_s(0) + V_t(0)] < u.$$

Note that since the expected utility of each farmer is now  $-\exp(-Au)$ , we can think of  $u$  as the equivalent sure income, and therefore itself a valid object for comparing different outcomes.

It would seem that for any value of  $u$  satisfying equation 26-8, we can find a solution  $n_i = n$  from equation 26-7, and there will be an equilibrium with  $(N/n)$  crops actively cultivated, each by  $n$  people. In fact, a stability argument helps us rule out all but one of these candidate equilibria. If the left-hand side of equation 26-7 is not maximized with respect to  $n_i$ , then a slight reallocation of farmers from crop 1 to crop 2 will raise the expected utility for the participants in one of these two, say crop 1, and lower it for the other group. This will set up a further migration to crop 1, not just from crop 2 but also from crops 3, 4, and so on. Ultimately some crop will drop out of cultivation, and there will be a higher common value of  $u$  among the rest.

The same test can be applied to that set again.

Therefore define

$$(26-9) \quad \Phi_e(n) \equiv \mu(n) - \frac{1}{2}A [V_r + V_s(n) + V_t(n)]$$

and

$$(26-10) \quad u_e \equiv \text{Max}_n \Phi_e(n).$$

Let  $n_e$  denote the maximizer. Then the symmetric stable equilibrium will have  $(N/n_e)$  crops, each cultivated by  $n_e$  farmers. This is the equilibrium I shall consider.<sup>5</sup>

The maximization in equation 26-10 can be problematic for three reasons. First, if the scale economies never run out, and are not offset by increases in risk as  $n$  increases, then the maximum will be at the extreme, with  $n_e = N$ , implying complete specialization to one crop. Second, even if there is an interior maximum,  $(N/n_e)$  is not in general an integer. Finally, there is no clear reason to impose concavity on  $\mu(n)$  and convexity on  $V_s(n)$  and  $V_t(n)$ , so there can be multiple local maxima. While these problems are worth more attention in future work, in this chapter I keep things simple by assuming that the maximization has a unique solution, where sufficiently many crops are actively cultivated that we can ignore the integer problem. The same remarks apply to the social optimum with full risk-sharing.

### **Social Optimum with Perfect Risk-Sharing**

In an ideal social optimum with perfect risk-sharing, each person has income

$$(26-11) \quad y = \frac{1}{N} \sum_i \sum_j x_{ij}$$

$$= \frac{1}{N} \left\{ \sum_i n_i \mu(n_i) + Nr + \sum_i n_i \rho_i + \sum_i \sum_j t_{ij} \right\}.$$

This yields expected utility

$$(26-12) \quad -\exp \left\{ -\frac{A}{N} \sum_i n_i \mu(n_i) + \frac{1}{2} \frac{A^2}{N^2} \left[ N^2 V_r + \sum_i [n_i^2 V_s(n_i) + n_i V_t(n_i)] \right] \right\}.$$

Note that the variance of the economywide shock is multiplied by  $N^2/N^2=1$ , that of the crop-specific shock is multiplied by  $n_i^2/N^2$ , and that of the individual shock by  $n_i/N^2$ . The last disappears when large numbers cultivate one crop, but the second needs diversification across crops, and the

first is of course undiversifiable. Now the optimum allocation will be chosen to maximize the equivalent sure income

$$(26-13) \quad u = \frac{1}{N} \sum_i n_i \mu(n_i) - \frac{1}{2} \frac{A}{N^2} \left[ N^2 V_r + \sum_i [n_i^2 V_s(n_i) + n_i V_i(n_i)] \right]$$

subject to

$$(26-14) \quad n_i \geq 0 \text{ for all } i, \quad \sum_i n_i \leq N.$$

To solve this problem in a way that facilitates comparison with the equilibrium, define

$$(26-15) \quad \Phi_o(n_i) \equiv \mu(n_i) - \frac{1}{2} A \left[ V_r + \frac{n_i}{N} V_s(n_i) + \frac{1}{N} V_i(n_i) \right].$$

Then the maximand is

$$(26-16) \quad u = \frac{1}{N} \sum_i n_i \Phi_o(n_i).$$

The first-order conditions for  $n_i$  are

$$(26-17) \quad \Phi_o(n_i) + n_i \Phi_o'(n_i) \leq \lambda \text{ with equality if } n_i > 0$$

where  $\lambda$  is the Lagrange multiplier for the population constraint in equation 26-14. The second-order conditions require that the expression in equation 26-17 should be a locally decreasing function at a positive optimum  $n_i$ , that is,

$$(26-18) \quad 2\Phi_o'(n_i) + n_i \Phi_o''(n_i) < 0.$$

As explained before, I shall ignore problems of multiple local maxima, and assume that equation 26-17 defines  $n_i$  uniquely—that is, independent of  $i$ .

Then the optimum has the same number of farmers allocated to each actively cultivated crop, and writing  $n$  for this common number, the maximand reduces to  $u = \Phi_o(n)$ . Therefore the equivalent sure income for the optimum becomes

$$(26-19) \quad u_o = \text{Max}_n \Phi_o(n);$$

let this be attained at  $n_o$ . Once again, I am assuming that  $(N/n_o)$  is large enough to justify neglect of the integer problem.

The first-order condition is

$$(26-20) \quad \Phi_o'(n_o) = 0.$$

Comparing this with equation 26-17, we see that

$$(26-21) \quad \lambda = \Phi_o'(n_o) = u_o.$$

The second-order condition is

$$(26-22) \quad \Phi_o''(n_o) < 0.$$

Given the first-order condition, this agrees with equation 26-18.

Before I proceed to compare the equilibrium with no risk-sharing and the optimum with full risk-sharing, it is useful to point out how the existence of scale economies makes a difference. Consider the familiar model of portfolio choice in financial economics with no scale effects. An individual allocates his wealth  $N$  equally among  $m$  securities. For simplicity, suppose that the securities have identically and independently distributed returns. A dollar invested in security  $i$  gets the random return

$$x_i = \mu_0 + r + s_i$$

where  $\mu_0$  is the mean. The marketwide (systematic) risk  $r$  has variance  $V_r$ , and the security-specific (idiosyncratic) risk  $s_i$  has variance  $V_s$  for all  $i$ . There is no individual risk for the separate dollars, so there is no  $V_i$  term. The expected utility-equivalent sure rate of return is

$$\mu_0 - \frac{1}{2}A [V_r + [1/m] V_s].$$

Since  $m = N/n$ , this is exactly like equation 26-15. It is an increasing function of  $m$ . By plotting this function, we can show the gains from greater diversification. As  $m$  goes to infinity, the effect of the idiosyncratic component disappears and only the systematic risk remains. This is found in many financial economics texts (for example, Malkiel 1985, p. 198).

Increasing returns to scale alter the picture. If the mean return rises with  $n$ , then greater diversification across securities is not desirable beyond a point. I illustrate this using the example where there are fixed costs of an expert service. We can use equation 26-2 to write the above expression for the equivalent sure rate of return as

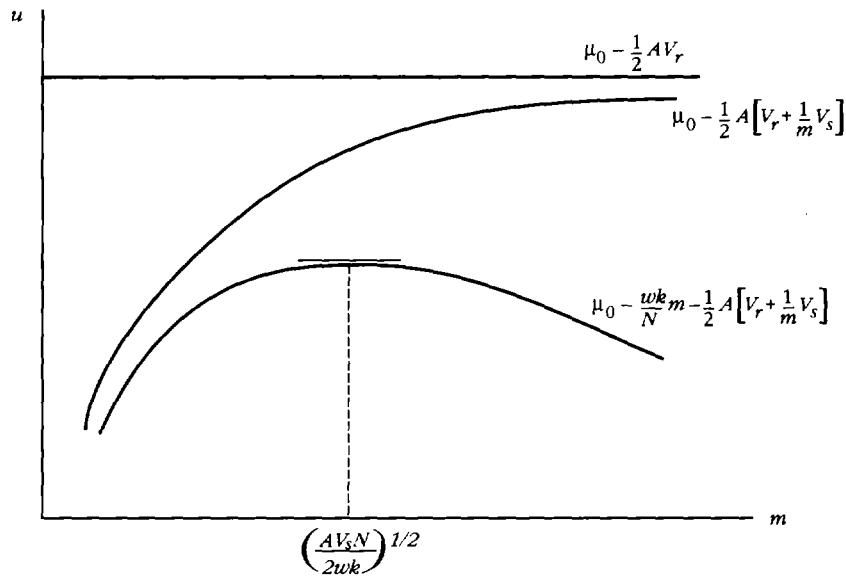
$$\mu_0 - \frac{1}{2}AV_r - \frac{wk}{N} m - \frac{1}{2} \frac{A}{m} V_s.$$

This is sketched in figure 26-1. It attains a maximum at

$$m = \left[ \frac{AV_s N}{2wk} \right]^{1/2}.$$

If more securities than this number are available, the extra ones will not be selected. As one would expect, the optimum degree of diversification is an

Figure 26-1. *Diversification with and without Scale Economies*



increasing function of the size of the risk ( $V_s$ ) and the risk aversion parameter ( $A$ ) and a decreasing function of the overhead cost ( $wk$ ).

**Comparison of the Market Equilibrium with the Social Optimum**

Now return to the crop choice problem, and contrast the expressions for the equivalent sure incomes, equation 26-9 in the equilibrium and equation 26-15 in the optimum. Evaluated for the same  $n$ , they show that in the optimum the farmer bears only a fraction ( $n/N$ ) of the common risk of his crop, and only ( $1/N$ ) of his individual risk. The more interesting observation is that the extent of risk-sharing changes with  $n$ , and this has implications for the optimum  $n$ . As  $n$  increases, the common risk,  $nV_s/N$ , increases and, hence, each farmer has to bear more risk. In contrast, in the equilibrium, farmers are unable to take advantage of the pooling benefits that diversification across farmers provides. Each farmer has to bear more of the common risk of his allotted crop. Therefore, in the optimum there is a tendency toward a smaller  $n$  than the equilibrium, that is, to exploit scale economies less fully and achieve more diversification.

To make this more precise, note that

$$\Phi'_c(n_e) = \mu'(n_e) - \frac{1}{2} A[V'_s(n_e) + V'_i(n_e)] = 0.$$

I use this to sign  $\Phi'_o(n_e)$ . If this turns out to be negative, then knowing that  $\Phi'_o(n)$  is decreasing and equals zero at  $n_o$ , we conclude that  $n_o < n_e$ .

We have

$$(26-23) \quad \begin{aligned} \Phi'_o(n_e) &= \mu'(n_e) - \frac{1}{2} \frac{A}{N} [V_s(n_e) + n_e V'_s(n_e) + V'_t(n_e)] \\ &= \frac{1}{2} A \{ [1 - n_e/N] V'_s(n_e) + [1 - 1/N] V'_t(n_e) - [1/N] V_s(n_e) \}. \end{aligned}$$

This shows the two opposing forces mentioned before. The common risk is reduced with smaller  $n$ ; this aspect works to make  $\Phi'_o(n_e)$  negative, and so  $n_o < n_e$ . But to the extent that either kind of risk increases with  $n$ , the fact that it is better shared in the optimum works in the opposite direction.

A better understanding of the two forces and their net effect can be obtained by examining some special examples, and I shall use the two mentioned in the previous sections.

*Case 1: constant variance.* When  $V_s$  and  $V_t$  are constants, equation 26-23 shows that  $\Phi'_o(n_e)$  is negative, and therefore  $n_o < n_e$ . Relative to the social optimum, the equilibrium has fewer crops, with each one undertaken on a larger scale. We saw the intuition behind this result a moment ago. But further examination of this case proves illuminating.

The equilibrium  $n_e$  maximizes

$$\Phi_e(n) = \mu(n) - \frac{1}{2} A [V_r + V_s + V_t]$$

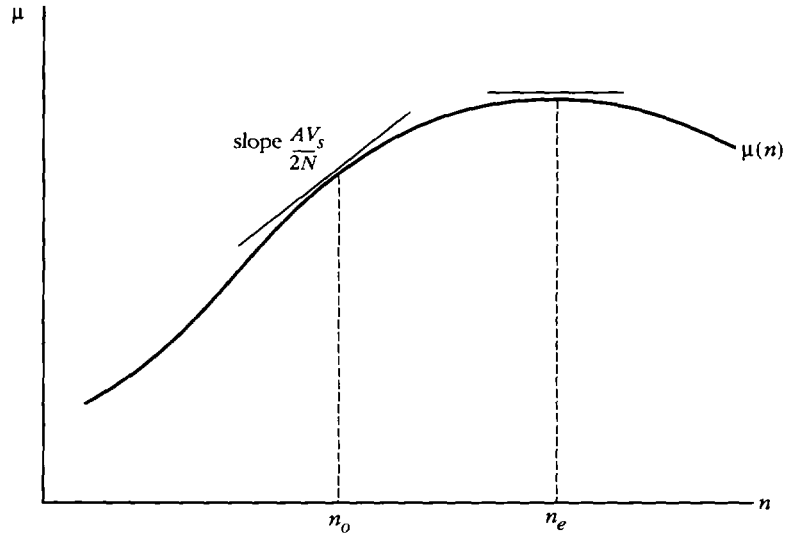
and therefore maximizes  $\mu(n)$ . In other words, an individual farmer who is unable to share risk will act as if he is unconcerned about risk. This may seem surprising, but the reason is simple. Each farmer merely decides which group to join. The groups may be of unequal size, but he faces the same risk in all groups, so his choice is governed solely by the comparison of the means.

Risk matters in the optimum because the size of the group affects the size of the common risk to be shared. The optimum  $n_o$  maximizes

$$\Phi_o(n) = \mu(n) - \frac{1}{2} A \left[ V_r + \frac{n}{N} V_s + \frac{1}{N} V_t \right].$$

We can compare the two solutions in a simple diagram. Figure 26-2 shows the function  $\mu(n)$ ; it is single-peaked by assumption. The equilibrium occurs where the economies of scale run out. The optimum is to the left, where the function has slope  $(AV_s/2N)$ . Of course this does not mean that the equilibrium provides greater expected utility (or greater equivalent sure income); a much larger correction for risk has to be subtracted from  $\mu(n)$  in the equilibrium than in the optimum.

Figure 26-2. *Equilibrium versus Optimum with Constant Variances*



The result is that the equilibrium has less diversification than the social optimum: a seemingly counterintuitive result. The larger the coefficient of risk aversion  $A$  and the larger the magnitude of the common risk  $V_s$ , the larger the difference will be between  $n_e$  and  $n_0$ . The larger  $N$  is, the smaller the difference is. In the limit as  $N$  goes to infinity,  $n_0$  converges to  $n_e$  and the crop portfolios coincide. Of course risk is allocated differently, and the expected utility in the optimum remains above that in the equilibrium.

*Case 2: multiplicative risk.* Recall that for this example I consider only the common or crop-specific risk. Using the multiplicative formulation in equation 26-3, let  $V_q$  denote the variance of  $q$ . Then  $V_s = \mu(n)^2 V_q$ . The expression for the equivalent sure income in equilibrium becomes

$$(26-24) \quad \Phi_e(n) = \mu(n) - \frac{1}{2} AV_q \mu(n)^2,$$

while that for the social optimum is

$$(26-25) \quad \Phi_o(n) = \mu(n) - \frac{AV_q}{2N} n\mu(n)^2.$$

It is easy to see that  $\Phi_e(n)$  is maximized when  $\mu(n) = 1/[AV_q]$ . This defines the equilibrium number  $n_e$  of farmers per crop.<sup>6</sup> Using the procedure of equation 26-23, we see that

$$\Phi'_e(n_e) = [1 - n_e/N] \mu'(n_e) - \frac{1}{2ANV_q}.$$

Since nothing can be said about the magnitude of  $\mu'(n_e)$ , we cannot in general pin down the sign of  $\Phi'(n_e)$ . The best we can do is to say that if economies of scale are still strong at the equilibrium point in the sense that  $\mu'(n_e)$  is large, then  $\Phi'_o(n_e)$  will be positive and  $n_o > n_e$ . If scale economies are weak at the equilibrium, the opposite will be the case.

For clearer results, I consider two interesting parametrizations of the source of scale economies. The first is the power case,

$$(26-26) \quad \mu(n) = cn^\theta$$

where  $\theta$  is a positive parameter whose magnitude measures the strength of the economies of scale. The other is the case of a fixed cost of undertaking a new crop—for example, because of the fixed cost of setting up an extension service (as in equation 26-2).

In the power case, we find that

$$(26-27) \quad n_e = \left[ \frac{1}{AcV_q} \right]^{1/\theta}$$

and

$$(26-28) \quad n_o = \left[ \frac{2\theta}{2\theta+1} \frac{N}{AcV_q} \right]^{1/(1+\theta)}$$

The problems of multiple local maxima and so on do not arise in this case.

Note that  $n_e$  is independent of  $N$ . As the economy gets larger, in the equilibrium without risk-sharing we see proportionally more crops introduced, each farmed by a group of the same privately optimal size. In contrast, in the full social optimum,  $n_o$  increases with  $N$ , the elasticity of the relationship being  $1/[1 + \theta]$ . This is shown in figure 26-3.

We see that economies below a certain size have  $n_e > n_o$ ; that is, the privately optimal group farming each crop is larger than it is at the social optimum. Correspondingly, fewer crops are cultivated, or there is too little diversification. In economies beyond this size, the opposite is true. The critical size is given by

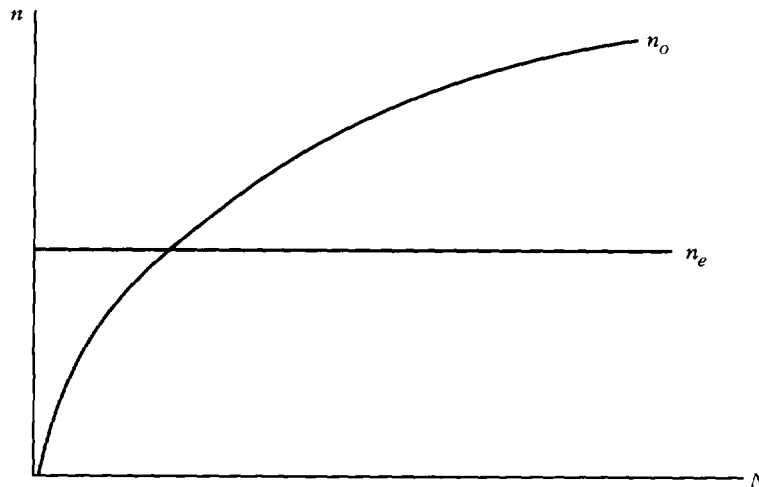
$$(26-29) \quad N = \frac{2\theta + 1}{2\theta} \left[ \frac{1}{AcV_q} \right]^{1/\theta} = \frac{2\theta + 1}{2\theta} n_e.$$

Interestingly, the critical value can be expressed very simply in terms of the number of crops that are cultivated in equilibrium,  $N/n_e$ . If this number is smaller than  $[2\theta + 1]/2\theta$ , then  $n_o < n_e$  so there is less diversification at the equilibrium than at the optimum; otherwise, the opposite holds.

Next consider the case where the source of scale economies is a fixed cost. Generalizing the notation of equation 26-2 somewhat, write

$$(26-30) \quad n\mu(n) = \begin{cases} 0 & \text{when } n \leq b \\ c[n-b] & \text{when } n > b \end{cases}$$



Figure 26-3. *Equilibrium versus Optimum with Multiplicative Risk*

Using this in the maximization of equation 26-24 yields

$$(26-31) \quad n_e = \frac{AbcV_q}{AcV_q - 1}$$

and similarly from equation 26-25, we have

$$(26-32) \quad n_o = b \sqrt{1 + \frac{2N}{AbcV_q}}$$

Note that we need  $AcV_q > 1$  for a meaningful solution. Given this, there are no further problems of multiple local maxima and the like.

Once again  $n_e$  is independent of  $N$ , while  $n_o$  increases with  $N$ . Note that  $n_e > b$ . Near  $N = 0$ , we have  $n_o \approx b$ , and for large  $N$ ,  $n_o$  behaves like the square root of  $N$ . Therefore the picture is in most respects like figure 26-3 once again.

### Introduction of a New Crop

Here I consider the adoption of a new crop, from the perspectives of both a group of farmers who cannot share risk with others and an ideal society that can share risk optimally. In either case the decision is trivial unless the decision entails some cost—the crop can be added to the set of available activities and need not actually be used. Therefore the fixed-cost model is the natural one for addressing this issue.

Suppose the economy initially produces a crop labeled 0, whose per capita output is a random variable  $x_0$ , normally distributed with mean  $\mu_0$  and variance  $V_0$ . The randomness is common to all the farmers cultivating this crop. Hence, whether in equilibrium or in the social optimum, each farmer has the equivalent sure income

$$(26-33) \quad u_0 = \mu_0 - \frac{1}{2} AV_0.$$

By using up the overhead labor of  $F$  people, it becomes possible to cultivate a new crop. The output of each farmer engaged in this activity, excluding overhead workers, is another random variable  $x_1$ , normally distributed with mean  $\mu_1$ , variance  $V_1$ , and covariance  $C$  with the old crop. The scale economies are entirely captured in the fixed cost, so  $\mu_1$ ,  $V_1$ , and  $C$  are constants. By analogy with equation 26-33, define

$$(26-34) \quad u_1 = \mu_1 - \frac{1}{2} AV_1.$$

This notation will be useful later.

The economy as a whole has  $N$  people. Consider a group of  $P$  of them getting together to consider switching to the new crop. They can share the overhead cost among themselves, but cannot share risk with farmers cultivating the old crop.

They can proceed in one of two ways. They can hire overhead labor from the outside at a sure wage of  $u_0$ , or they can divert some of their own members to overhead work and share the output of the rest equally among all. The first method gives each member a random income of  $x_1 - [F/P]u_0$ , and this is equivalent to a sure income of

$$u_1^1(P, F) = \mu_1 - [F/P]u_0 - \frac{1}{2} AV_1 = u_1 - [F/P]u_0.$$

The second method gives each member a random income of  $x_1[P - F]/P$ , and this has the equivalent sure income

$$u_1^2(P, F) = \frac{P-F}{P} \mu_1 - \frac{1}{2} A \left[ \frac{P-F}{P} \right]^2 V_1.$$

Now I show that

$$u_1^1(P, F) > u_0 \quad \text{implies} \quad u_1^2(P + F, F) > u_0.$$

This means that if a new crop is adopted when the first arrangement prevails, then it will also be adopted under the second arrangement. Instead of  $P$  insiders hiring  $F$  outsiders, a larger group of  $(P + F)$  people will designate  $F$

of themselves to do the overhead work and share the income and the risk with them. To see this, note that

$$u_1^1(P, F) > u_0 \text{ is equivalent to } u_1 > u_0 [P + F]/P.$$

Then

$$\begin{aligned} u_1^2(P + F, F) &= \frac{P}{P + F} \left[ u_1 + \frac{1}{2} AV_1 \right] - \frac{1}{2} AV_1 \left[ \frac{P}{P + F} \right]^2 \\ &= \frac{P}{P + F} u_1 + \frac{1}{2} AV_1 \frac{PF}{[P + F]^2} \end{aligned}$$

The first term exceeds  $u_0$ , and the second is positive.

The next question is when such a group will form under the second arrangement. That is, can we find a  $P \leq N$  such that the resulting  $u_1^2$  exceeds  $u_0$ . The best chance for this is when  $P = N$ . Therefore the condition for the new crop to be adopted is

$$(26-35) \quad \frac{N - F}{N} \mu_1 - \frac{1}{2} A \left[ \frac{N - F}{N} \right]^2 V_1 > \mu_0 - \frac{1}{2} AV_0.$$

If  $F = 0$ , this reduces to  $u_1 > u_0$ ; otherwise it is more stringent.

Next consider the situation with full risk-sharing. If the new crop is adopted, the  $N$  people can be divided into three occupations:  $Z$  cultivating the old crop,  $F$  providing the overhead labor for the new crop, and  $(N - F - Z)$  cultivating the new crop. The fully shared per capita income is

$$(26-36) \quad y = \{Z x_0 + [N - F - Z] x_1\} / N.$$

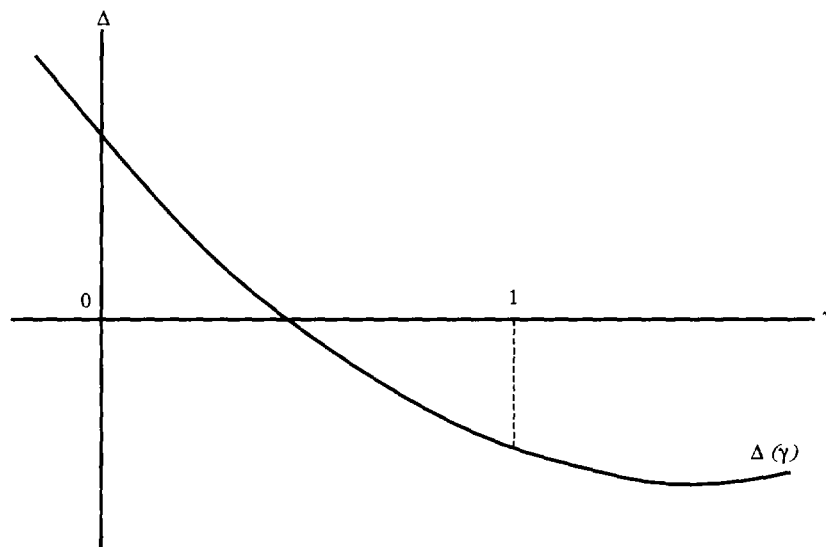
The sure income equivalent to this is

$$(26-37) \quad U(Z) \equiv \{Z \mu_0 + [N - F - Z] \mu_1\} / N - \frac{A}{2N^2} \{Z^2 V_0 + 2Z [N - F - Z] C + [N - F - Z]^2 V_1\}.$$

Of course  $Z$  will be chosen to maximize this. The new crop will be adopted if the resulting maximum exceeds  $u_0$ .

If  $Z$  is chosen equal to zero,  $U(0)$  is simply the left-hand side of equation 26-35. An optimal  $Z$  can do no worse. Therefore if a private group unable to share risk with outsiders, and using the second method of providing overhead labor, finds it desirable to adopt the new crop, its adoption is also desirable from the point of view of a society that can optimally share risk.<sup>7</sup> But the converse is not true, because risk-sharing increases the gain.

For example, a crop with mean and variance identical to the old one would never be adopted by a private group, but may be socially desirable. To see this, calculate the sure income equivalent in the social optimum when

Figure 26-4. *Equilibrium versus Optimum New Crop Adoption*

the maximization in equation 26-37 occurs at an interior point. After some tedious algebra we find

$$(26-38) \quad \text{Max}_Z U(Z) = \frac{1}{2A} \frac{[\mu_1 - \mu_0]^2}{V_0 + V_1 - 2C} \\ + \frac{[V_0 - C]\mu_1 + [V_1 - C]\mu_0}{V_0 + V_1 - 2C} \frac{N - F}{N} \\ - \frac{A}{2} \frac{V_0 V_1 - C^2}{V_0 + V_1 - 2C} \left[ \frac{N - F}{N} \right]^2$$

Consider the special case where  $\mu_1 = \mu_0 = \mu$ ,  $V_1 = V_0 = V$ , and define the correlation coefficient  $\rho \equiv C/\sqrt{V_0 V_1}$ . Then the right-hand side of equation 26-38 simplifies to

$$\mu\gamma - \frac{AV[1 + \rho]}{4} \gamma^2$$

where  $\gamma \equiv [N - F]/N$ . The condition for this to exceed  $u_0$  becomes

$$(26-39) \quad \Delta(\gamma) \equiv \frac{1 + \rho}{2} \gamma^2 - k\gamma + k - 1 < 0$$

where  $k \equiv 2\mu/[AV]$ . We need  $k > 1$  to have the equivalent sure income positive, else total inactivity would be preferable. The correlation coefficient  $\rho$  of course lies in the range  $[-1, 1]$ . Then

$$\Delta(0) = k - 1 > 0, \quad \Delta(1) = -[1 - \rho]/2 \leq 0.$$

Figure 26-4 shows the function  $\Delta(\gamma)$ . So long as  $\rho < 1$ , there is a range of  $\gamma$  sufficiently close to 1—that is, when  $F$  is sufficiently small in relation to  $N$ —where the inequality in 26-39 holds. Thus a crop that has an identical pattern of returns to the existing crop, but provides some diversification benefit, is worth the expenditure of some overhead labor. In the extreme case  $\rho = -1$ , when the new crop has ideal insurance properties, the social criterion for its adoption is simply

$$\mu F/N < \frac{1}{2} AV.$$

But since the private adoption criterion is independent of  $\rho$ , it is possible that even this crop fails to get adopted in the absence of policy intervention.

## Concluding Comments

This chapter is intended as a very preliminary exploration of the consequences of the simultaneous presence of economies of scale and risk. The examples worked out suggest some interesting possibilities, such as less diversification in the absence of risk-sharing than in the social optimum with perfect risk-sharing. But more general theory needs to be developed before we can have a proper understanding of the issues. I hope that the examples will prove suggestive for such work.

## Notes

The author thanks Barry Nalebuff for useful discussions, and Timothy Besley and Burton Malkiel for many perceptive comments on an earlier draft.

1. See Newbery and Stiglitz (1981, 1984), Eaton and Grossman (1985) and Dixit (1987, 1989a, 1989b) for elaborations on this point in the context of using trade policy as a partial substitute for missing risk markets.

2. In a richer model, the group's public good problem in hiring the experts would be treated explicitly.

3. This possibility gives rise to another interesting question, namely the optimum choice of the number of experts servicing a group, but I shall leave that for future work. Chapter 28 presents an empirical study of alternative systems of agricultural extension in India.

4. In reality, learning externalities have important dynamics. Once again I leave these for future research.
5. When  $u$  is the maximum as in equation 26-10, condition 26-8 becomes redundant.
6. If  $\mu(n)$  peaks at a value less than  $1/[AV_q]$ , then  $n_c$  is the maximizer of  $\mu(n)$ .
7. We saw earlier that if private adoption is desirable using the first arrangement, then it is also desirable using the second.

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## 27

*Markets and Contracts in African Pastoralism*

John McIntire

*This chapter explores the nature of contracts and institutions in semiarid regions of Africa where individuals earn their living from animal production. The central characteristics of semiarid pastoralism—low productivity, high variability of rainfall, low population density, and very high transaction costs—prevent the existence of conventional markets in land, labor, and capital. Government interventions that have targeted market imperfections—for example, in credit or breeding stock—or that have encouraged or imposed private property rights to land have not, in general, been successful. The binding constraints on development are not imperfections in markets—contracts provide good substitutes for them—but the low productivity of resources and the high transaction costs of trade.*

EXTENSIVE PASTORALISM WAS HISTORICALLY the basis of most livestock production in Sub-Saharan Africa. Major efforts have been made to develop African pastoralism through development of new breeds, forage production, fertilizing, enclosing, oversowing pastures, and supplementing forage with grain, but these development projects have usually yielded small or even negative rates of return. Production systems still achieve low output per animal and per unit of pasture and are very unstable. Growth has occurred from herd expansion with largely traditional techniques, not from new techniques giving higher yield per animal.<sup>1</sup> Techniques raising yields per unit of land or per animal have so far turned out to be less profitable in land-abundant areas than expansion of herd numbers.

While research continues on technology, recent efforts to increase

incomes in land-abundant pastoral areas have concentrated on the complementary issues of reforming policies, changing institutions, and providing credit. Whatever the underlying technical relations, it is thought that such measures can stimulate growth by allowing markets to operate better, thereby reducing barriers to efficient resource allocation and to technology transfer.

Information and risk problems pose significant barriers to public policies complementing technical change. These problems, arising from the mobile nature of extensive pastoralism, are generally resolved by producers in sophisticated contracts. Those relations substitute for the factor markets through which policies are intended to operate. Hence, it is essential that policies consider the relationship between such contracts and markets. The objective of this chapter is to explore the consequences of the semiarid pastoral environment for characteristic relations in the labor, land, and capital markets. Past and proposed policy interventions in land and credit markets are then outlined and critiqued.

## The Pastoral Countries

While the economies of many African countries depend to a great degree on animal production (table 27-1), that dependence is exceptionally high in Botswana, Chad, Mali, Mauritania, Niger, Somalia, and Sudan. In these countries, the value of livestock production may be as high as one-half of agricultural GDP, and much of export earnings derives from livestock. The agroclimates of these countries are largely arid or semiarid, with short crop-growing seasons and low primary production, in which livestock have a natural comparative advantage. These countries have as much as 30 percent of all African livestock and have been the focus of numerous development interventions to raise herders' income.

Within these countries there are specialized groups of producers dedicated largely, and sometimes exclusively, to animal production. Pastoral groups typically subsist on extensive cattle raising, though other species, such as camels or goats, may be common. "Pastoralists"—typically defined as deriving at least 50 percent of their total income from animal production—may number as many as 15–20 million people, but their number is declining. They are dispersed among many ethnic groups, of which the most important are the Fulani and Touareg in West Africa and the Nilotic and Sudanese groups in east and central Africa (Jahnke 1982).

The principal economic changes in modern pastoralism have been the advent of mechanized transport, growth of urban and export markets for livestock products, availability of public veterinary services, and widespread groundwater development. Only the last development has had a large effect on technical conditions of pastoral systems. Purchased inputs are few, and none except veterinary drugs require modern technology.



Table 27-1. *Agricultural Environments in Sub-Saharan Africa*

Characteristic	Semiarid <sup>a</sup>	Highland <sup>b</sup>	Humid <sup>c</sup>	Subhumid <sup>d</sup>	Mixed <sup>e</sup>
Main location in Africa	West	East	Central	West-Central	—
GNP per capita (dollars)	309	208	415	404	—
Length of crop-growing period (days)	90–180	More than 180	270–365	180–270	—
Range of altitude (meters)	200–1,500	More than 1,200	0–300	0–1,000	—
Share of livestock GDP in agricultural GDP (percent)	37	27	6	7	15
Trypanosomiasis threat <sup>f</sup>	Low	Almost none	Very high	High	Moderate
Total agricultural area (millions of hectares)	501	101	312	114	345
Rural population (millions)	73	72	42	26	118

Note: Countries are classified as having a particular environment if more than 50 percent of their rural population lives in that environment.

a. Includes Botswana, Burkina Faso, Chad, The Gambia, Guinea-Bissau, Mali, Mauritania, Mozambique, Niger, Senegal, Somalia, Sudan, and Zimbabwe.

b. Includes Burundi, Ethiopia, Kenya, and Rwanda.

c. Includes Cameroon, Congo, Gabon, Ghana, Liberia, Sierra Leone, and Zaire.

d. Includes Benin, Côte d'Ivoire, Guinea, Malawi, Togo, and Zambia.

e. Includes Angola, the Central African Republic, Madagascar, Nigeria, Tanzania, and Uganda.

f. Trypanosomiasis is a livestock disease affecting productivity in the more humid regions of the continent.

Source: McIntire, Bourzat, and Pingali (1992).

### Basic Production Relations

Arid and semiarid pastoral environments have characteristic comparative advantages, production techniques, and levels and variabilities of production. Rainfall is sparse, ranging from 0 to 600 millimeters per year in one short rainy season. Temperatures are hot throughout most of the year. Production of crops and pastures per unit of land is low (see Penning de Vries and Djiteye 1982). This meager biomass production makes livestock production the principal activity, but one that has inherently limited productivity.

Because land productivity is so weak, viable herds can only be maintained at low stocking rates, of the order of five to twenty adult cattle per square kilometer (Coulomb, Serres, and Tacher 1980). Incomes are little more than

subsistence. In contrast, stocking rates and incomes are higher in the African highlands—for example, in Kenya and Ethiopia, the other important areas of livestock production in the subcontinent. Population density and human support capacity are directly related to the length of crop-growing period, rainfall, and soil characteristics.

The high relative variability of rainfall—in amount, timing, and location—within and between years (Cocheme and Franquin 1967) induces corresponding annual and seasonal variations in pasture production. The coefficient of variation of rainfall is from 25 to 40 percent, with similar variations in pasture yields. Such variation in rainfall and primary production is much higher than in the more humid areas of the subcontinent.

The low average productivity and great variability of pasture productivity give rise to patterns of animal mobility as a means of spreading risks and exploiting seasonal pastures and water. While mobility varies among production systems, it is a general characteristic of African livestock systems in the semiarid and subhumid environments, and one that defines much of the nature of pastoral factor markets.

Another defining characteristic is high transaction costs. With sparse population density, unit transport costs are high. High transport costs, compounded by the perishability of animal products, raise the costs of trade, encourage self-sufficiency, and necessitate continuous production of staple milk (Monod 1975; Dahl and Hjort 1976). This is different from grain cropping systems, in which subsistence goods are less perishable and more cheaply traded and stored.

Costs of information are also high. These include the costs of information about pastures and water, of developing the social alliances necessary to manage animals in widely separated places, and of learning about animal management. These costs make it difficult, if not impossible, for outsiders to manage animals directly or to invest in them independently of pastoral groups.

### **Contracts as a Response to Incomplete Markets**

The central characteristics of semiarid pastoralism—low productivity, high variability, low production density, and, especially, high transaction costs—prevent the existence of conventional markets in land, labor, and capital. Pastoralists have instead devised contracts to provide labor at widely separated points, to manage land without exclusive land rights, and to allocate their breeding stock capital without financial markets.

#### **Labor**

Pastoralists rely almost exclusively on extended family labor because sources of external labor, on which a market would draw, are absent. First, barriers

to becoming an owner-herder are low within the pastoralist ethnic groups. Workers can easily begin to accumulate their own animals and to become independent herders.<sup>2</sup> In the absence of slavery, there is no class within the pastoral groups, which, for lack of assets, can only sell their labor, as landless workers in agrarian societies do. Second, the great distances over which pastoralists work, the low population density, and the seasonality of jobs make migration by external laborers into pastoral areas prohibitively costly. Therefore, labor supply is highly inelastic and a well-functioning pastoral labor market does not exist.

Three aspects of animal production determine the allocation of the relatively fixed numbers of workers: economies of scale, supervision costs, and seasonality. Economies of scale encourage large herds. With low primary production from the range, large herds must be managed at widely separated places to avoid overstocking. Because the accumulation potential of individuals is limited, the large herds include the animals of several different owners. This multiple ownership creates a principal-agent problem in monitoring the effort of the different partners.

The perishability of animals and the imperative of maintaining a constant flow of staple milk necessitate constant supervision of stock. Pasture and water variability, by encouraging mobility, further raises animal supervision costs by putting animals at a distant remove from some of their owners.

The principal-agent problems caused by multiple ownership and mobility are resolved in two ways. One is to contract labor within lineages, notably via intricate systems of joint animal ownership between and within generations. The very indivisibilities that create economies of scale make it costly to dissolve extended family production units as a way of resolving the conflicts of multiple ownership. In contrast, crop farmers regularly divide land and grain stocks (Binswanger and McIntire 1987; Binswanger and Rosenzweig 1986) where economies of scale do not arise.

A second means to resolve principal-agent problems is for owners to entrust animals, almost always cattle, to herders.<sup>3</sup> Because of stock mobility, the animals can be distant from their owners, who may see them only rarely. The herder supervises all management and may even make decisions about sale or other disposition of stock. The herder, because he consumes milk that is also an input into the growth of the owner's calf, has a conflict of interest. The problem is resolved by tying the herder's payment to the calf as well as to the milk.

Seasonality also affects the demand for labor. Increases in demand are not met by a labor market, but by increases in hours worked per person, especially in dry-season stock watering (Swift 1981 for Mali; Delgado 1979 for Burkina Faso).

Wage labor and apprenticeship are other means of obtaining additional labor while resolving incentive problems, but are chosen only in special circumstances. Wage herding labor develops for immobile herds, especially

of sheep and goats, in which the performance of the herder can be cheaply monitored, the potential conflict between milk for the herder or for the offspring is less important, and skill requirements are simple enough that children can acquire them.

Where farming and herding groups live proximately, farming boys are apprenticed to herding families and are paid in animals. This contract provides capital and livestock experience to farmers and labor to herders. The contract is found in more densely populated areas in which animal mobility is curtailed, so that livestock knowledge is more cheaply obtained.

### ***Land***

A land market does not develop for two reasons. The first and main reason is that the inherently low productivity of pastoral land makes it uneconomic to create individual rights. The costs of privatization are greater than the benefits given indigenous technologies. Access remains open as long as the return to investment is low.

The second reason is that high variability in pasture production makes knowledge of range conditions vital. As this knowledge is costly to acquire and to transmit, it creates what Rosenzweig and Wolgin (1986) call plot-specific capital. In the pastoral context, one herder can more profitably exploit a pasture than others. Because the information about range conditions is costly to transmit, except through child rearing, it creates a degree of exclusivity to rights in pasture land.

Restrictions under indigenous law on access to land include seasonal or local barriers. Many farming areas restrict access by herders' animals to crop residues or to village pastures. Throughout West Africa, there are traditional livestock passages established to protect crops from damage by animals. In many areas, there are complex exchanges involving land, animal management, grazing rights, water rights, and manure. All such interactions provide flows of resources from land, but without private property rights in land and without a formal land market (McIntire, Bourzat, and Pingali 1992).

### ***Capital***

Financial markets did not develop in pastoral systems because external capital was scarce, financial intermediation was absent within the system itself, and the market for breeding stock was undeveloped. These relations were due to factors affecting both the supply and demand of credit. Simple technology and an undeveloped market for breeding stock meant that there was no demand for credit. Nevertheless, as long as population density was low and product markets were few, there was little incentive for external invest-

ment. Such investment only grew with the genesis of urban or export markets. Hence, sources of capital were historically restricted to what the system could generate itself.

Financial intermediation within pastoralism did not develop because of the high covariances of financial flows, imposed by the sharp seasonality of animal production, and because of lack of collateral. Unlike land, livestock are poor collateral because of moral hazard problems and because their prices can fall to zero when they die. In contrast, the price of land cannot fall to zero because its future productivity is, in general, only slightly affected by current use. Therefore, land can be borrowed against in bad years, while animals must be sold.

Another barrier to financial intermediation is the positive relation between environmental shocks and price in pastoral systems. In good years, pasture yields rise and herders withhold animals because the expected return to future sales rises, causing current prices to rise. In bad years, pasture yields fall and herders sell animals because they cannot store animals or feed, causing current prices to fall. Therefore, when herders need to sell, prices are likely to be low. This makes herders less creditworthy and impairs financial intermediation.

The market for breeding stock is thin, for two reasons. First, few animals are traded within the system because of the high positive covariances among the incomes of different herders. Few animals can be 'imported' because of the negative covariance between income from sales of animals and demand for breeding stock; when herders need to buy animals, they have no cash, and when they have cash their purchases of animals are quickly limited by their capacity to maintain them. Second, adverse selection exists in the breeding stock market, because of the cost of discovering the true condition of what might be diseased or infertile animals.

The most general response to the absence of financial markets is to accumulate reserves of animals.<sup>4</sup> Associated with herd growth is holding animals for apparently excessive periods. Because of low feed and labor costs, it is usually profitable to hold animals until they are old; hence there is no inconsistency between holding animals as a store of wealth and as a productive asset (Jarvis 1986). This suggests that demand conditions do not limit the offtake rate (Ariza-Nino and Shapiro 1984), as exogenous price changes do not affect the incentive to accumulate stock.

A second response to the lack of financial instruments and of external capital is loans of breeding stock. The rich lend breeding stock to the poor, who repay in offspring while keeping a share for themselves. This provides capital to poor borrowers. There are several advantages to the lender: hired labor at little supervision cost because the borrower has an incentive to maintain the breeding stock, and reduction in risk because the stock are spread out among different herds. This contract between the established and

the aspirant pastoralist substitutes simultaneously for the thin capital and labor markets.

### **Consequences of Environmental Conditions for Land and Credit Policies**

Various policies have been proposed to improve pastoral productivity. Those with the greatest expected effects on factor markets include grazing reserves, group ranches, credit, and producers' organizations. Such policies confront the same fundamental information problems that limit the scope of private markets and contracts in pastoralism.

#### ***Land Markets***

A criticism of extensive herding has been that it fails to create exclusive property rights and thus discourages investment. The justification for policies affecting pastoral land use is that appropriate reforms—to define herders' land rights or to reserve grazing areas are common proposals—would establish the legal basis for greater investment in land and ultimately lead to higher output per unit of land and per animal.

I have argued that the absences of exclusive property rights and of a land market are endogenous responses to limited land productivity and sparse population. While it is true that investments in range productivity are very low, this is not because the property rights regime has failed, but because available technology does not stimulate investment.

Investments in pastoral land and water do occur after technical, demographic, or market change raises the return to investment. An example of technical change is private well investment in Niger after improvement of well-digging methods (Republic of Niger 1982). An example of market pressure on pastoral resources leading to spontaneous range enclosure occurred in the Sudan (Behnke 1986). These cases, and many others like them, suggest that there is no insurmountable property rights barrier to improving pastoral land or water resources once the technical or market conditions are propitious for reforms. Attempts to encourage or to impose private rights are not, in general, desirable unless technical change causes a fall in the costs of privatization or a rise in the benefits per unit of land.

#### ***Financial Markets***

Credit is often viewed as a means of raising pastoral income and asset distribution, aiding the recovery from stock losses after drought and financing technical change (Sutter 1983 for Senegal; White 1984 for Niger). Credit might permit investments by small herders or by those with no animals at

all. After a drought, credit might finance the more rapid restoration of stocking rates or, if it finances consumption, might reduce distress sales.

Pastoral credit programs have been unsuccessful, as measured by repayment rates and by the ability to survive the withdrawal of external funding. The principal reasons are the misperception of constraints to the stocking rate and the erroneous assumption that credit substitutes do not exist. Both these mistakes are related to a central misunderstanding about the absence of financial intermediation in pastoral regions.

The principal constraint to the stocking rate is not further capacity to finance investments; it is breeding stock, pasture production, and animal health. Therefore, unless credit relieves those constraints, it can have little or no effect on the distribution of herds or on the speed with which herds recover from droughts (White 1984). The supply of breeding stock is highly inelastic because of the natural gestation periods and because stock brought in from other areas is unlikely to be suited to local conditions. Hence, the provision of loans for animal investments simply drives up the price of breeding stock. Given available technology, credit is not in general a constraint on productivity; experience has shown that pasture yields and animal health do not improve when more credit is made available. Credit may also aggravate the inherent adverse selection problems in breeding stock markets by encouraging buyers to be less selective.

The assumption that credit substitutes do not exist is also erroneous. Animal borrowing is a viable credit substitute because it enforces borrower performance with appropriate incentives and, being highly localized, it reduces the costs of gaining information about the borrower. Public credit will fail unless means are developed to provide investments uncorrelated with animal production in pastoral regions, and to develop technology that overcomes the physical constraints—breeding stock, pasture production, and animal health—that limit the scope for productive investment.

## Notes

1. Jahnke 1982; McIntire, Bourzat, and Pingali 1992; Sandford 1983; World Bank 1985.
2. Slaves were formerly kept as labor reserves.
3. Entrustment is also known as animal tenure.
4. Insurance in pastoral systems also consists of hoarding precious commodities.

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## *Institutional Reform in India: The Case of Agricultural Extension*

*Gershon Feder and Roger Slade*

*This chapter assesses the experience of India in moving from an extension service in which a single agent has the job of disseminating technical information, distributing inputs, and processing credit applications, toward a single-function agricultural extension service based on the training and visit (T&V) system. It finds that the level of contact between farmers and agents is much higher under the new system. The new system has led to greater awareness of new techniques and higher agricultural productivity. The estimated rate of return to India's increased investment under the new system exceeds 15 percent.*

THE GROWTH OF WORLD AGRICULTURAL OUTPUT is attributable not only to the cultivation of more land and the expansion of irrigation and drainage facilities, but also to new or improved technology. Technological change allows the production of more output per unit of land, or production of the same output with smaller amounts of variable inputs. However, the generation of new technology is not a sufficient condition for increased farm productivity. If there is a gap between available knowledge and typical farmer practices, it is not even a necessary condition in the short run. A crucial element in the process linking the generation of new technology to increased farm productivity is the diffusion of new knowledge among its potential users, the farmers, and its subsequent adoption by a significant proportion of them.

When farmers become aware of new technology, they tend to have inaccurate perceptions regarding its costs and benefits, simply because of limited

information. Both social welfare and private utility are higher when farmers base their technology choice and resource allocation decisions on the true distribution of net benefits. Therefore, a market for information should exist. However, information on new technology in the agricultural sector is often a public good, because the provider of information to one user cannot exclude others from obtaining the information without charge and the value of the information is not affected by the number of users. The result is that farmers underinvest in the acquisition of information because they fail to consider the potential benefits to others. While these are grounds for public provision of the good (information), there are exceptions. For example, information that is more specialized and farmer- or location-specific is less of a public good, and may thus be provided by private entrepreneurs. Similarly, there are situations when new technology is embodied in the proper utilization of new or improved inputs that are commercially marketed. In such cases, input suppliers will have incentives to provide information about the utilization of these inputs (or about new crops making use of these inputs).

The availability of publicly sponsored sources of agricultural information tends to lower the overall cost of information acquisition and thereby bring the allocation of resources closer to a social optimum, as rigorously demonstrated by Feder and Slade (1985). An important public sector channel for disseminating agricultural knowledge is the extension service, which links the agricultural research system and its clientele.

### **Extension Experience in Developing Countries**

Agricultural extension activities in developing countries mostly grew out of the rural administration of colonial governments. Broadly speaking, the extension systems inherited by former colonies from the early 1960s onward shared a number of common features. They were primarily government services, subject to a high degree of central direction (especially through production targets) and hierarchical in structure. Generally they had poor links with agricultural research and allowed little farmer participation in the design and content of extension work. As a consequence, the technologies promoted by extension services often had little relevance to traditional farming systems and they did not pay much attention to farmers' access to resources (Judd, Boyce, and Evenson 1983).

The difficulty of establishing an institutional structure responsive to farmer demands was made worse by post-independence changes in rural development administration. In many countries the agricultural field service was given a range of additional functions as governments increased their role in the rural economy. These functions included input supply and credit

disbursement as governments (often with external assistance) instigated a number of crop production programs supported by subsidized credit and inputs.

A common approach to extension organization, particularly in East Asia and Latin America, is to view the dissemination of agricultural knowledge as only one part of a wider government involvement in changing rural attitudes and promoting community self-reliance. This tradition of extension is often termed rural extension (Rolls, Jones, and Garforth 1986). Rural extension was particularly well developed in India, where village-level workers were especially directed to assist poorer rural groups—those generally disadvantaged in their access to land and other resources. The administration of agricultural input supply and credit was also the direct responsibility of rural extension workers.

The multifunction extension approach (multifunction in the sense of handling other services in addition to agriculture, or services related to agricultural production in addition to information) has advantages, especially where rural welfare services are poorly developed and there is little reliable private provision of agricultural services. The system offers governments a relatively low-cost and flexible administrative instrument. There are also benefits from having an extension agent whose acceptability in the community is enhanced by performing useful nonagricultural roles.

Yet there are also disadvantages to the rural extension approach. The most important is that extension agents generally receive a low and irregular level of technical (agricultural) direction; yet they are expected to develop recommendations appropriate to their area of operation (Lamb and Muller 1982). This lack of direction can normally be attributed to the range of tasks expected of the extension agent and the difficulty of incorporating agents with such broad responsibilities into the work of research departments and the specialized services of agriculture ministries. A second disadvantage is the difficulty of controlling and monitoring rural extension agents. When they are the providers of supplies as well as the purveyors of information, the opportunities to engage in rent-seeking behavior are large, and supervisors find tasks unrelated to information diffusion (for example, quantity of fertilizers distributed and number of credit applications processed) much easier to monitor. As a result, extension agents often devote most of their time to tasks unrelated to information diffusion.

Many countries simultaneously support a mix of extension approaches reflecting diverse farmer requirements and agricultural policy objectives. Large and heterogeneous countries such as India and Brazil, for example, have always maintained some diversity in their approaches to extension. However, since the mid-1970s a number of countries, including both India and Brazil, have adopted measures to reorganize their field services based on training and visit (T&V) principles. Taking these countries together, it is

possible to distinguish an approach to extension that differs from rural extension (Baxter, Slade, and Howell 1989).

### T&V Extension

The T&V system was first tried in Turkey in the late 1960s. Since then it has been implemented in Bangladesh, India, Indonesia, Kenya, Nepal, Pakistan, Sri Lanka, Thailand, and other countries in Africa, South America, and Asia. India began to experiment with T&V in 1974. In 1977 the first statewide investments were started, and T&V is now the dominant form of extension in all but one of India's principal states.

Under the T&V system the extension organization deals exclusively with extension work, eschewing all other activities (for example, direct involvement with input supply or community organization). Personnel are organized in a unique line of command such that officers at each hierarchical level have a sufficiently small number of staff under them to allow the provision of effective and personal guidance, supervision, and training. At the bottom of the hierarchy are village extension workers (vews), who cover areas typically containing 700 to 800 farming families, divided into about eight groups. In each group, about 10 percent of the farmers are selected as "contact farmers," with their names recorded at local extension headquarters. The extension agent is required to visit each of the eight farmers' groups once every two weeks, on a prespecified and fixed date. These visits mostly take place in the fields of contact farmers, but other farmers are expected to participate (Benor and Baxter 1984).

During the visit, the agent passes on information regarding improved practices that are relevant at that particular stage of the season. Occasionally, the extension worker may organize a large group meeting, but most farmer-extension agent contacts take place individually or in small groups. The fixed schedule of visits facilitates the effective supervision of agents' activities by their superiors and thus helps to induce agents to perform their duties responsibly. It also helps to maintain farmers' interest and confidence in the extension agent. These organizational features make T&V extension more easily monitorable than the less structured multipurpose system.

Obviously, since noncontact farmers can freely participate in extension agent visits, they become *de facto* contact farmers if they attend visits regularly and if they experiment with the practices recommended by the extension worker. With time the composition of the formal group of contact farmers may be changed; noncontact farmers who have shown interest in extension visits often become formal contact farmers while others are dropped.

These changes in organization and work methods and the scale of agri-

cultural extension field services usually mean that the introduction of T&V entails substantial costs and institutional adjustments. In India the costs of T&V extension are typically 25 to 40 percent higher than multipurpose extension. The next section describes the institutional reforms in India during the years after 1977.

### **T&V and Institutional Change in India**

The most fundamental change has been the transfer of responsibility for extension within each state from the Community Development Department to the Agricultural Department, and the concomitant introduction of a single line of command. This change required the transfer of many staff (mostly multipurpose village-level workers) from the Community Development Departments to the Departments of Agriculture, and the transfer of the supervision and management of extension operations to the line staff of the Departments of Agriculture.<sup>1</sup>

Other changes involved the creation of a specialist cadre of subject matter specialists (SMSS) within extension services to act as links to the research system and to ensure that technically sound information is imparted by the extension service. The concept of a two-way flow of information underlies the institution of regular fortnightly and monthly training workshops designed to ensure that information disseminated by extension agents is current and consistent. The requirement that extension workers be exclusively devoted to extension work has resulted in the dissociation of input supply and many other duties from extension. This separation has been compensated, at least in principle, by the institution of close coordination with input supply agencies.

Several observers (for example, Cernea 1981 and von Blanckenburg 1982) claim that these structural changes in the organization of extension, although increasing investment and operating costs, have led to improvements in the quality of extension work and a more professional and informed view of the role and purpose of extension. Prior to the introduction of T&V, these writers argue, field staff lacked confidence and orientation. They had an enormous task but were rarely provided with even the necessary minimum administrative and technical support (Baxter, Slade, and Howell 1989). Where extension has been reorganized, the situation has changed. Given achievable tasks and the means, time, and training to do it, extension workers can see clear results from their work after years of achieving little. They have a new pride in their work and in their role as professional extension workers; they have begun to gain the confidence of farmers and to become respected figures in their localities (Benor, Harrison, and Baxter 1984).

Such claims are based on informed but subjective observations. Von Blanckenburg and Hoepfer (1985) carried out detailed field studies of extension staff attitudes in the states of Haryana and Orissa to test some of these conclusions. Their results, in part, can be summarized as follows:

- More than 75 percent of extension staff at all levels preferred the active extension approach (T&V) to the more passive community development system.
- Nearly 90 percent of VEWs and their superiors believed that the extension recommendations given to farmers are now more specific and suited to varied local environments.
- All the extension personnel interviewed in Orissa and 93 percent of those in Haryana who had previous extension work experience felt that they were getting better training than they did before the introduction of T&V.
- The majority of extension workers felt that the fortnightly training frequency was appropriate to their needs. However, resistance to this frequent training increased, the higher the status of the officer.
- More than 80 percent of VEWs and 90 percent of their immediate superiors in Haryana and 100 percent in Orissa deemed it necessary to visit farmers on a fortnightly schedule.
- Of experienced field extension workers in Haryana and Orissa, 68 percent and 93 percent, respectively, stated that T&V had improved the way that they were supervised. In Haryana, however, 56 percent of VEWs also wanted more assistance from and visits by their superiors in the field.

These findings point to positive changes in attitudes among VEWs and their superiors and tend to support the more subjective observations noted above. However, remnants of attitudes prevailing in the community development era survive. The same study reported that at least 70 percent of lower-level staff complained of being separated from input supply. Moreover, there are some indications that, overall, the approach to system and personnel management remains characterized by an excessive concern with job security and the personal consequences of any given action. Confidential reports are still used as sticks rather than carrots, form is still widely confused with function, administration remains unstreamlined, and local administrators can disrupt (for well-intentioned reasons) extension operations. World Bank sources also show that the links between extension and research are still imperfect, the scope and quality of training need improvement, management methods are deficient, and the funding of extension services is insufficient to sustain fully effective field operations.

## **Institutional Indicators of the Performance of T&V in India**

In principle, T&V extension has been operating on a statewide basis in India since 1977-78. In practice, statewide operations were nowhere effectively implemented until 1979-80. In some states experience with T&V has been much shorter. In this section available data are examined to determine whether the system has become established and the extent to which its central features are being maintained over time.

### ***Farmers' Knowledge of the VEW***

T&V extension requires that most farmers know their vew, since those who do not know him are unlikely to regard him as the personalized and specialized source of information that he is intended to be.

Column 2 of table 28-1 shows that the proportion of contact farmers who know their vew is above 80 percent in eleven of twelve states and above 90 percent in seven states. As for noncontact farmers, column 6 shows the proportion knowing the vew to be above 50 percent in nine of the twelve states and above 75 percent in five. However, in some states the proportions are much lower. In Kerala, for example, over the four years that data are available, the number of noncontact farmers knowing the vew has generally stayed below 20 percent, while in Maharashtra, where T&V was introduced at the same time as in Kerala, the corresponding figure has generally remained above 50 percent. Data from Bihar and West Bengal reveal declining trends, a probable reflection of the acute administrative and legal problems encountered in implementing the system. In most states, however, the proportions of contact and noncontact farmers knowing their vew are either increasing with time, or at least not decreasing. This, however, is not fully satisfactory because even a small proportion of contact farmers not knowing their vew suggests that contact farmer selection procedures are imperfect. If, as is the case in some states, the majority of noncontact farmers do not know their vew, efforts to publicize the availability of extension advice need to be enhanced.

### ***Visit Frequency and Regularity***

Regular and frequent visits to farmers by vews are key features of the T&V extension system, and the extent to which these are implemented and maintained over time is an important indicator of the system's effective establishment and efficient operation. Regularity in visits reflects the quality of extension management and commitment on the part of the vew, and is a key determinant of the level of confidence that farmers have in the extension



Table 28-1. *Farmers' Contact with Village Extension Workers (VEWs), by State*

State	Contact farmers				Noncontact farmers			
	(1) Mean sample size	(2) Know their VEW	(3) Visited regularly <sup>a</sup>	(4) Not visited <sup>b</sup>	(5) Mean sample size	(6) Know their VEW	(7) Visited regularly <sup>a</sup>	(8) Not visited <sup>b</sup>
	Percent				Percent			
Andhra Pradesh (1984) <sup>c</sup>	106	97	80	6	1,446	30	10	70
Assam (1984)	563	89	54	20	593	82	36	44
Bihar (1984)	1,226	69	43	33	1,216	45	19	58
Gujarat (1984)	1,096	84	44	24	1,118	77	22	47
Haryana (1984)	567	84	51	23	569	59	16	51
Karnataka (1984)	2,060	91	41	18	2,192	78	15	35
Kerala (1984/85)	1,111	93	55	20	1,156	21	2	92
Madhya Pradesh (1982/83)	2,937	96	63	13	2,938	90	45	25
Maharashtra (1985)	2,306	95	68	9	4,570	68	25	43
Rajasthan (1983/84)	1,566	90	—	17	1,533	81	—	20
Tamil Nadu (1984)	1,363	91	75	7	1,345	65	34	37
West Bengal (1984/85)	3,540	85	67	18	3,562	67	49	36

— Not available.

a. On the same day in each two-week visit period.

b. Not visited during the four weeks preceding the interview.

c. One season only for Andhra Pradesh. For all other states, data are arithmetic averages of the last two seasons reported. Knowledge in this context implies that farmers are familiar with the VEW and his function but not necessarily that farmers know the VEW's name.

Source: Slade, Feder, and Chhikara (1988).

system. Frequent visits increase farmers access to the VEW and allow problems to be addressed and corrected as they arise. Regular and frequent visits tend to reduce the time and effort farmers must devote to acquiring information and, therefore, help to speed up the adoption of improved technology.

In table 28-1, columns 3 and 7, a visit is defined as a meeting between a VEW and one or more farmers, whether planned or not, during which agricultural matters were discussed. Regular visits (once every two weeks) by VEWs to contact farmers are a system imperative and, hence, whether or not these visits take place with the prescribed regularity is an important measure of operational efficiency. This is not the case for noncontact farmers, because for them interaction with the VEW is largely self-determined. However, if noncontact farmers report poor regularity in VEW visits, this may suggest a lack of awareness of T&V operations. From table 28-1 it seems that contact farmers in eight states currently report visit regularity rates above 50 percent and that the rates exceed 70 percent in only two states.<sup>2</sup> Slade, Feder, and Chhikara (1988) show that in Gujarat, Haryana, Karnataka, and West Bengal the regularity rates noticeably declined over the two to three years before 1986 and that other states recorded little improvement with time. As for noncontact farmers, table 28-1 shows that nine out of twelve states report visit regularity rates below 30 percent. In Kerala, the regularity rate stayed around 2 percent for three of the four years before 1986. These results clearly reflect an unsatisfactory situation, especially for contact farmers, and suggest that the field management and supervision of VEWs are inadequate.

Obviously some irregularity in VEW visits will be the result of normal friction (sickness, transfers, and vacancies), but if the system is working well, this should not reduce the regularity rate to less than 80 percent for contact farmers. Hence, in all states except Andhra Pradesh and Tamil Nadu, the low regularity rates suggest that the system is performing below its potential. The low visit regularity rates for contact farmers in Gujarat, Haryana, and Karnataka, three of the earliest states to adopt T&V on a statewide basis, are particularly worrying. The poor regularity of visits to contact farmers is mirrored and magnified in the rates for noncontact farmers. Hence, it appears that extension management must greatly improve the supervision and guidance of field staff, because persistently low visit regularity will rapidly undermine farmers' confidence in the T&V system. In some states this requires the filling of vacant posts, most notably in Bihar, Gujarat, Jammu and Kashmir, and Madhya Pradesh.

In examining the frequency of VEW visits, it is easier, and perhaps more meaningful, to concentrate on the frequency that no visits are reported. Currently, contact farmers in nine out of twelve states (table 28-1, column 4) report a zero-visit rate of 20 percent or less, meaning that in these states at least 80 percent of contact farmers were visited by the VEWs at least once during the four-week period preceding the interview. Although a few states show an increasing trend in zero-visit rates for contact farmers, the magni-

tudes involved are not large enough to be a cause for concern, and for the most part, zero-visit rates are being maintained at fairly satisfactory levels. The evidence for noncontact farmers is mixed. Column 8 shows that five states have zero-visit rates below 40 percent (conversely visit frequency, that is, the proportion of noncontact farmers receiving at least one *VEW* visit in a four-week period, is above 60 percent). In the remaining seven states, zero-visit rates are higher, and in six of them the rates have increased with time.

### *Trends in Performance*

Slade, Feder, and Chhikara (1988) assembled data on the items shown in table 28-1 for the entire period since T&V was introduced on a large scale. Their data show that as experience with T&V increases, knowledge of the *VEW* by contact farmers changes little, fluctuating around 85 percent. That it is not 100 percent can be explained by contact farmer replacement. This, however, is unlikely to account for the full 15 percent, and hence there must be a presumption that there is a (fairly small) constant level of imperfection in the selection of contact farmers. Nevertheless, the vast majority of contact farmers know and continue to know their *VEW*. For noncontact farmers, the study provides evidence that the proportion of such farmers knowing the *VEW* increases the longer the T&V system has been operating, as one would expect.

Zero-visit rates for contact farmers tend to remain roughly constant (about 20 percent) as system experience increases. For noncontact farmers, the zero-visit rate tends to decrease steadily as system experience increases. Nevertheless, even after six years, about 40 percent of all noncontact farmers do not interact with *VEWs*. This is well below the potential of T&V extension, but it is much better than the performance achieved under the earlier system of extension. In a small study in western Uttar Pradesh, which at the time (1982-83) still employed multipurpose village-level extension workers (*VLW*) under the old community development system, 89 percent of farmers were found not to know their *VLW*. Depending on the season, only 4 percent or fewer had received a visit during the month prior to the survey, between 3 and 11 percent had been visited at least once during the entire season, and there was no discernible pattern in extension visits (Feder, Lau, and Slade 1985).

Among contact farmers, the Slade, Feder, and Chhikara (1988) study indicates that visit regularity tends to decline with system experience. The reverse seems true for noncontact farmers. This may reflect growing disinterest among contact farmers, perhaps because too little that is new and attractive to them is being offered by the *VEW*. However, the tendency toward increased regularity in the interactions of the *VEW* with noncontact farmers as experience with T&V increases suggests that the farmers find *VEW* advice to be valuable.

## Impact of T&V on Knowledge and Adoption of New Technology and on Productivity

Given the evidence that the reformed extension system has been reasonably well established throughout most of India but is operating less than optimally, what economic impact has this investment in more intensive extension had?

The first element in the process that links extension to farm productivity is the enhancement of farmers' awareness and knowledge of improved practices. Farmers tend to learn about most practices that do not involve specialized technical knowledge or major expense from other farmers, whereas knowledge about practices that are more complex or more expensive is typically acquired from specialized sources of knowledge such as extension agents or company sales agents (Feder and Slade 1984). This suggests that diffusion of knowledge regarding the more complex practices will be much faster in areas covered by intensive extension methods such as T&V, where there are more agents and more regular contacts with farmers.

A detailed study of T&V extension operations in parts of the northwestern Indian state of Haryana provides some evidence on knowledge diffusion. Feder and Slade (1986) estimated logit equations identifying factors contributing to better knowledge of two improved practices in the cultivation of HVV (high-yielding variety) rice, namely, seed treatment with antifungal chemicals and inclusion of the trace element zinc sulphate in fertilizer applications. Farmers in villages that were visited regularly by workers of the reformed extension system had a significantly higher probability of being aware of these practices than did farmers in villages not covered by extension services.

These results in themselves do not demonstrate that the more intensive methods of T&V extension speed up knowledge diffusion more than a less-intensive form of extension, such as was common in India before extension reform. Evidence comparing the two forms of extension is provided in Feder and Slade (1986), who estimated diffusion curves for ten improved practices in each of two major crops from two neighboring areas, one served by T&V extension and the other served by traditional (less intensive) extension. The results, using two alternative models, showed that for nine out of ten improved wheat cultivation practices, diffusion of knowledge was faster in the T&V area. For rice practices, the results were less conclusive: diffusion was faster in the T&V area for seven out of ten practices with one model, but only for three practices using the alternative model.

If extension is effective in diffusing improved knowledge among farmers, then this will be reflected in a faster rate of adoption of improved practices (provided that these practices are relevant and profitable). A study of

farmers in one area of the state of Haryana (Feder, Slade, and Sundaram 1986) confirmed that adoption of pesticides and weedicides was significantly higher in villages visited by T&V extension workers compared to villages in the same district where no extension staff had been assigned. There is also evidence from an all-India sample that shows farmers who were visited frequently by T&V extension agents to have significantly higher adoption rates for six wheat and rice practices than comparable farmers who had not been visited frequently. However, the data are not sufficiently detailed to rule out the possibility of selection bias among farmers visited by extension agents (Slade, Feder, and Chhikara 1988). A similar qualification applies to results showing a positive association between T&V extension workers as a main source of information and farm productivity in Indian states that adopted the T&V extension principles (Feder, Slade, and Sundaram 1986; Slade, Feder, and Chhikara 1988). This is because farmers whose main source of information is extension agents may be systematically different from other farmers in ways that are correlated with their performance.

Direct evidence on the link between intensive extension and farm productivity is provided in an analysis of productivity differentials between two neighboring areas in north India—one of which had T&V extension for four years while the other had an older multipurpose extension system. In all other respects the two areas were very similar. The analysis, based on rather conservative assumptions and reported in detail in Feder, Lau, and Slade (1987), demonstrates that the T&V area had significantly higher wheat yields, that this difference could be attributed to the impact of more intensive extension, and that, with a 90 percent probability, the return to the additional investment in T&V extension exceeded 15 percent.

## Notes

1. The staff transfers were on a large scale, involving nationwide perhaps one-third of the 88,000 VEWs now active in agricultural extension. These transfers were often resisted by staff associations and other mutual interest groups, who frequently sought redress through the courts. Such recourse to judicial process materially slowed the reform process in some states, for example, West Bengal.

2. That is, more than half the respondents reported that the agents visited them as scheduled.

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## *Agricultural Change and Inequality in Palanpur, 1957–84*

*Peter Lanjouw and Nicholas Stern*

*This chapter analyzes changes in the distribution of income and land in the North Indian village of Palanpur on the basis of four surveys conducted over a twenty-seven-year interval. Average per capita income from agricultural activities during 1957/58 and 1962/63 was roughly constant, grew by 74 percent between 1962/63 and 1974/75, and then declined by roughly half between 1974/75 and 1983/84. The increase in incomes between 1962/63 and 1974/75 was spread over the entire income distribution, with the largest rise among those around the median, so that inequality between these two years decreased. In the decade after 1974, there was a substantial increase in the leasing out of land by small landholders, which may in part reflect the cost of, or lack of access to, credit. The largest impact on income inequality in the decade after 1974/75 came from outside jobs, the source of one-third of total income in Palanpur by 1983/84.*

THE ECONOMY OF THE VILLAGE OF PALANPUR, in Moradabad District of West Uttar Pradesh, changed radically from the late 1950s to the mid-1980s. There were three major forces at work. First, the population grew from a little over 500 to nearly 1,000. Second, agriculture intensified greatly with increased irrigation, the use of chemical fertilizers, and the adoption of new varieties of seed, particularly of wheat—the process often known as the “Green Revolution.” Third, job opportunities outside the village, mainly in local towns within commuting distance, expanded very substantially, changing from nine regular outside jobs in 1957 to fifty-four in 1983. Outside jobs contributed around one-third of village income in the mid-1980s, compared

with less than one-tenth in the 1950s. The purpose of this chapter is to examine how the distribution of income and of land has altered under the influence of these demographic, technological, and economic changes and to indicate how these processes and their outcomes have been related to the operation of village markets and institutions.

In so doing we shall be examining for our village the operation of two kinds of theory. The first concerns the broad-brush descriptions of the way in which development processes take place. Two key aspects of standard development stories—technical change and sectoral transfer as the relative importance of agriculture declines—are involved here. The second concerns the way in which certain markets work, particularly those for land, labor, and agricultural inputs. We shall thus be dealing with issues that are at center stage in development economics, although we shall be viewing them in a rather microscopic way through their power to explain distribution in a particular village.

The analysis is based on data from four household surveys of the village for 1957/58, 1962/63, 1974/75, and 1983/84. In each case 100 percent of village households were involved and information was collected on family structure, land owned and cultivated, outputs, incomes, and so on.<sup>1</sup> In terms of data quality, the rank order would be 1983/84, 1974/75, 1957/58, and 1962/63.

Measurement of income and its growth immediately raises a number of difficulties. First, we have the problem of what to include in the definition of income. Second, we have to consider the relevant period for income measurement when there are severe fluctuations. Third, we need a price index for comparison across years. Fourth, we have to consider the question of the income unit—individual, family, household, and so on. Fifth, potential measurement inaccuracies associated with panel data must be recognized. We will comment briefly on these issues. Our notion of income is intended to measure the returns to land, labor, and other household assets, but we have not, largely for data reasons, been in a position to capture this perfectly. For example, because moneylending income was not collected in the two earlier surveys and even in later surveys proved difficult to verify, it is not included in our measure. As a rule, we have used only simple measures that do not go beyond the data availability for early years. Nevertheless, we do think that they remain useful and do not involve omissions that undermine our argument. We have subtracted current input costs from gross revenue, including payments for labor hired but not family labor, as far as we are able. We note that 1957/58 seems to have been an average year for agriculture; 1962/63 bad; 1974/75 rather good, with yields perhaps 15 percent or so higher than average at that time; and 1983/84 a bad year, with yields 30–35 percent or so below the average at that time. With more than 80 percent of income coming from agriculture for the years of the first three surveys (although



Table 29-1. *Broad Indicators of Economic Change in Palanpur*

Indicator	1957/58	1962/63	1974/75	1983/84
Population	528	585	757	960
Village real income (rupees)	85,166	94,712	208,024	186,432
Real income per capita (rupees)	161.3	161.9	274.8	194.2
Price index <sup>a</sup>	1.07	0.92	3.78	5.28
Index of agricultural daily wages, real (1962 = 100)	123	100	123	158
Agricultural daily wages (kilograms of wheat per day)	2.5	2.25	3.1	5.0
Index of real wages for regular outside jobs (1962 = 100)	—	100	122	193
Wheat yields, actual kilograms per bigha <sup>b</sup>	40	40	114	97
Wheat yields, normal kilograms per bigha <sup>c</sup>	40-50	50	100	150-160

a. The price index is taken from the consumer price index (CPI) for agricultural laborers in Uttar Pradesh. See Lal (1976) for the 1957/58 index. This is taken as the interpolation of 1956/57 and 1958/59. For 1962/63, the index at 92 was estimated by S. S. Tyagi, Jr., and communicated to us. For 1974/75, see the *Bulletin of Food Statistics* (1976) estimating the average between July 1974 and June 1975. The 1983/84 estimate is obtained from the mean CPI for agricultural laborers between November 1983 and October 1984 in the *Bulletin of Food Statistics* (1985).

b. 6.4 bighas = 1 acre.

c. "Normal" yields correspond to the perceived normal yield for Palanpur in the respective year.

only 57 percent in the last one), this consideration is obviously of great importance for assessing the level of incomes.

An aggregate picture of change in the village is presented in table 29-1. The growth in the village population over the twenty-six-year period has averaged 3 percent per annum, a rate similar to that for India as a whole. Daily wages for hired agricultural labor appear to have risen over the quarter of a century at a rate similar to real income per capita. Real wages for regular outside jobs have risen faster than real income per capita. Average wheat yields have approximately tripled.

Bearing agricultural fluctuations in mind, the "normal" income per capita (that is, averaging fairly crudely over fluctuations) for both the years 1974/75 and 1983/84 would appear to be around Rs240-250 (at 1960/61 prices). Comparing with 1957/58 we see a growth in income per capita of around 50 percent over twenty-six years, or around 1.9 percent per annum—again not far away from all-India figures. In 1974/75 the income per capita was close to the average for India. Generally then, we have a village that in terms of income as well as the growth of population and income is not far away from the average for India. We do not, of course, suggest that it is representative of India's half-a-million or so villages; the concept of a repre-

sentative village is not a particularly useful one. However, it is not peculiar in any important respect (such as some dominant trade or activity) and thus provides a useful setting in which to try out economic theories. One would hope that these would provide some help in understanding the economic changes taking place in Palanpur and, in particular, their impact on the distribution of income.

As a background to our discussion of the distributions of income and land in Palanpur, and as an additional link to the themes of this book, we provide a brief description of some important markets in Palanpur. The operation of these markets can be subtle and difficult to characterize, and such a brief discussion must therefore be cursory.

The market for land in Palanpur centers on rental transactions as opposed to sales. The principal contractual arrangement is sharecropping, with a 50-50 split of the harvest between landlord and tenant, but with the tenant incurring most production costs (such as seed, labor, use of bullocks, and so on). In recent years, with the expansion of fertilizer use and mechanized irrigation, some of these additional variable costs are shared between landlord and tenant. Sales of land occur infrequently and usually as a consequence of distress. See Bliss and Stern (1982) and Drèze and Sharma (1990) for further details on sharecropping in Palanpur.

The labor market within Palanpur operates largely in terms of casual agricultural labor. Contracts are usually agreed on the night before employment and the terms of employment, such as the wage rate, are uniform over the village and over time. Few women are employed as wage laborers, and those that are invariably come from the lower castes. Regular employment opportunities outside the village have increased substantially over the survey period, while traditional labor services and occupations are becoming less important. More detailed discussion of the labor market in Palanpur can be found in Drèze and Mukherjee (1987).

The credit market in Palanpur is expanding. The formal sector, largely local agricultural banks but also the credit union/seed store in the village, provides cash and in-kind loans at moderate rates of interest (generally below 18 percent in 1983/84). The banks generally lend for agricultural assets, particularly pumpsets. Some credit is available at high rates of interest (and occasionally with explicit gold or silver collateral requirements) from moneylenders in Palanpur and in nearby towns, while interest-free credit from friends and relatives is also of some importance. The purposes for which money is borrowed are numerous, and include consumption, gambling, and ceremonial events (which will be funded by credit from less formal sources), as well as the purchase of agricultural inputs. There is evidence that the cost of, and access to, credit varies considerably among households in the village. In addition, households similarly positioned in terms of income and assets avail themselves of credit to different degrees, even when they face

similar costs for the credit. Interlinkages among the labor, land, and credit markets are rare in the sense of simultaneous contracts (other than through sharecropping), and there is no record of credit contracts between Palanpur farmers and merchants in nearby towns. Further discussion of the credit market in Palanpur can be found in Drèze, Lanjouw, and Sharma (1990) and Lanjouw (1992).

The railway line running through Palanpur provides the major means of transportation to the outside world. It has had a marked influence on the operation of the labor market, because it provides access to outside jobs. There are no roads passable by bus or car through the village—the nearest is about eight kilometers away. The railway line plays a role similar to a road for other villages, and many villages in the area (on or off the railway line) are within two hours' travel of a major town such as Moradabad or Chandausi.

There is an active market for the services of most (nonanimal) assets used for productive purposes in Palanpur. In earlier years, most irrigation was conducted with the use of a Persian wheel powered by bullocks or buffaloes. By 1983/84, water was mainly drawn from tubewells by diesel pumpsets. Throughout the survey period, irrigation was organized and provided privately. Similarly, the introduction of new techniques and seed varieties was largely the result of private initiative. Although an extension worker has been appointed for Palanpur, there is little evidence of effective assistance and advice being provided. In chapter 28, Feder and Slade remark that, despite considerable efforts by the Indian government to increase the level of technical knowledge among farmers in India, a survey conducted in western Uttar Pradesh in 1982/83 found that extension work there was still poorly established.

## **Inequality of Income and Land**

Inequality in the distribution of income, as measured in the four surveys during 1957–84, did not follow a monotonic path. In table 29-2 we see that between 1957/58 and 1962/63, inequality as represented by a range of summary measures increased. The Gini coefficient for individually distributed per capita income (see below for a discussion on the choice of this unit) rose from 0.336 to 0.390, generally taken to be a substantial increase. Looking at the Lorenz curves in figure 29-1, we see that the curve representing 1962/63 lies outside that of all other years, implying that a whole range of inequality measures would present the 1962/63 distribution as being the most unequally distributed (Atkinson 1970). Between 1962/63 and 1974/75, inequality as represented by the Gini coefficient fell dramatically from 0.390 to 0.253, and between 1974/75 and 1983/84 it rose again to 0.307. Most of

Table 29-2. *Inequality of Individual Incomes*

	1957/58	1962/63	1974/75	1983/84
Gini coefficient	0.336	0.390	0.253	0.307
Coefficient of variation	0.649	0.871	0.504	0.545
Atkinson measure <sup>a</sup>				
$\epsilon = 1$	0.178	0.251	0.105	n.a.
$\epsilon = 2$	0.338	0.485	0.206	0.319
$\epsilon = 5$	0.647	0.821	0.483	0.739
Number of observations	528	585	757	960
Number of households	100	106	111	143

Note: Individual income is household income divided by household size.

a. The Atkinson measure with  $\epsilon = 1$  cannot be computed for 1983/84 because one household recorded a negative income in that year.

the summary measures of inequality present the 1983/84 distribution as more equal than the 1957/58 distribution. However, in 1983/84 the Atkinson index with an inequality aversion parameter of 5 is greater than the corresponding index for 1957/58. This means that as the index becomes extremely sensitive to inequality among the poor, income in 1983/84 is seen as less equally distributed than 1957/58. This is also reflected in the Lorenz curves in figure 29-1, where the 1983/84 curve lies below the 1957/58 curve at the lower end of the income scale, implying that the poor in 1983/84 received a lower share of total income than the poor in 1957/58. However, beyond the bottom 30 percent, income in 1983/84 appears to be more equally distributed than 1957/58, and beyond the bottom 80 percent, it crosses the 1974/75 Lorenz curve.

Notice that we have presented figures on the distribution of income in terms of "individually distributed income per capita." This is calculated by dividing household income by the number of individuals and then attributing to each individual in the household this per capita income. Inequality in household income itself is not a particularly useful concept when households vary in size. Experiments with dividing household income by "equivalent members" to correct for the lower "requirements" of children made little difference to the analysis presented here. We have not made any additional attempts to examine the extent of within-household inequality, although this clearly merits further research.

The relationship between average incomes and the degree of inequality for the four survey years is explored in figures 29-2 and 29-3. In figure 29-2 we present density functions for income in the four years, which allow us to see the relative position of the distributions along the income scale as well as to gain an impression of their dispersion. Following Shorrocks (1983), we present generalized Lorenz curves for the four distributions in figure 29-3. Generalized Lorenz curves are constructed by simply scaling the Lorenz

Figure 29-1. Lorenz Curves for the Four Survey Years

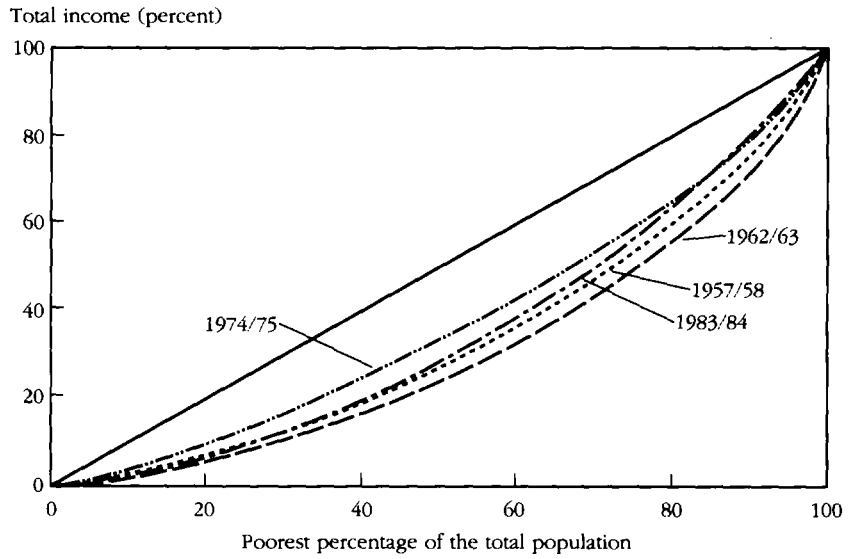


Figure 29-2. Probability Density Functions

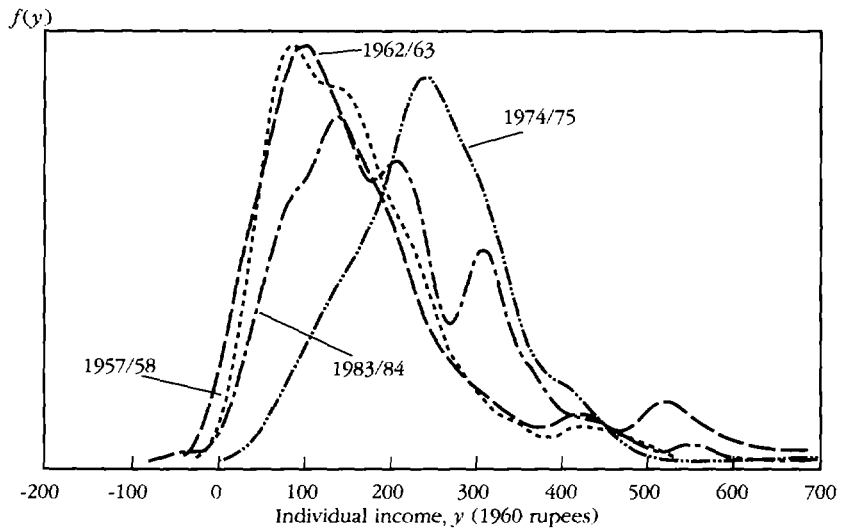
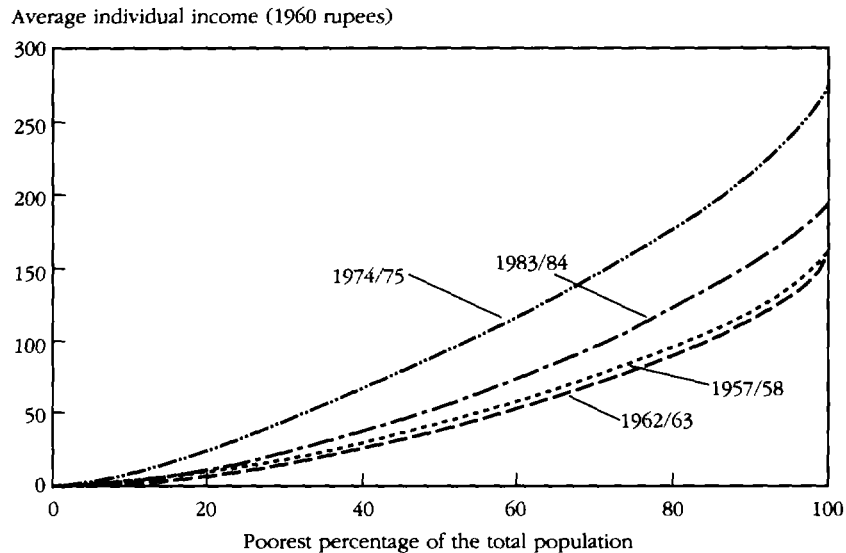


Figure 29-3. *Generalized Lorenz Curves for the Four Survey Years*

curves for different distributions by their mean. Shorrocks shows that if a generalized curve for a particular distribution lies everywhere above that of another, then one can say that welfare in the former distribution, as represented by a wide class of social welfare functions, is unambiguously higher. It can be seen that although average income in 1983/84 is greater than in 1957/58 and 1962/63, the generalized Lorenz curve does not lie everywhere above that for 1957/58, and hence we cannot rank 1983/84 higher than 1957/58 in terms of welfare. However, the curve for 1974/75 clearly lies above that for all three other years.

It is our objective in this chapter to arrive at some understanding of the causes of changes in inequality in Palanpur over the four survey years. Our analysis will focus on the different components of income, principally those derived from cultivation and from jobs outside agriculture. There is also agricultural labor income, which is treated separately and may be negative for households that hire in labor. The main source for income outside agriculture is regular jobs outside the village, but some small nonagricultural income is earned inside the village and some jobs outside the village are casual.

The surveys are essentially snapshots of the village in their respective years, and we must therefore consider the possibility that inequality may to some extent simply reflect variations in harvests due to fluctuations in climate or other stochastic factors that can affect households in different ways.

Indeed, as we noted, the harvests in 1957/58 and 1974/75 were generally regarded as being average or above, while those in 1962/63 and 1983/84 were less successful. One idea investigated was that these fluctuations might explain a considerable portion of the rise in inequality between the last two survey years. In the last year, outside job income had become particularly important. A poor harvest might increase inequality by widening the gap in income between those whose income derives mostly from agriculture and those with outside jobs. In table 29-3 we see that the proportion of total per capita income from agricultural activities was around 80 percent in the first three years, and 56 percent in 1983/84. We tried to obtain a more accurate measure of permanent income by scaling agricultural revenue up in 1962/63 and 1983/84 and down in 1974/75 using factors derived from, inter alia, table 29-1. Because inputs in cultivation are generally applied some time before the harvest and with the expectation that this will correspond perhaps to the preceding or some "average" of past harvests, it seems reasonable to scale agricultural revenue while leaving costs unchanged. This approach of course assumes that good or bad harvests do not have any marked effect on output prices, and that the reason for the bad or good harvest does not appear until late in the season (often, but not always, true). These adjustments have little effect on measured differences in inequality across the years. We can see why and begin to understand the reasons for the differences in inequality by looking more carefully at the components of income.

In table 29-3 we present the Gini coefficients of the four survey years, decomposed by income components. Following Shorrocks (1982), the contribution of components to total income inequality, as measured by the Gini coefficient, can be obtained from the product of a "pseudo-Gini" coefficient for each component and a weight given by the proportion of the mean of the component to the mean of total income. The pseudo-Gini simply consists of the Gini for the distribution of the income component when individuals are ranked in terms of their total (rather than component) income. If income inequality is decomposed in this way, one can readily see why scaling agricultural income by some factor does not result in a significant change in inequality.

Suppose we consider changes in the income components that multiply each component by a scalar factor and together are sufficiently small not to change the overall income ranking. Then  $G_k^*$ , the pseudo-Gini for component  $k$ , is unchanged. Suppose the mean of component  $k$  changes from  $\mu_k$  to  $\mu'_k$  and the mean of the overall income from  $\mu$  to  $\mu'$ . Then

$$(29-1) \quad G = \left[ \frac{\mu_1}{\mu} \right] G_1^* + \dots + \left[ \frac{\mu_k}{\mu} \right] G_k^* + \dots + \left[ \frac{\mu_n}{\mu} \right] G_n^*$$

$$(29-2) \quad G' = \left[ \frac{\mu'_1}{\mu'} \right] G_1^* + \dots + \left[ \frac{\mu'_k}{\mu'} \right] G_k^* + \dots + \left[ \frac{\mu'_n}{\mu'} \right] G_n^*$$

Table 29-3. Decomposition of Gini Coefficients by Components of Income

	1957/58	1962/63	1974/75	1983/84
<i>Total income</i>				
Gini coefficient	0.336	0.390	0.253	0.307
<i>Agricultural income</i>				
(1) $\mu_k/\mu$	0.790	0.800	0.830	0.560
(2) $G_k^*$	0.390	0.394	0.321	0.293
(3) $[\mu_k/\mu] G_k^*$	0.308	0.315	0.265	0.164
Percentage contribution to total inequality	92	81	105	53
Gini coefficient	0.463	0.509	0.372	0.487
$G_k^*/G_k$ (rank correlation ratio)	0.842	0.774	0.863	0.602
<i>Outside income</i>				
(1) $\mu_k/\mu$	0.081	0.123	0.151	0.340
(2) $G_k^*$	0.350	0.410	0.065	0.446
(3) $[\mu_k/\mu] G_k^*$	0.028	0.050	0.010	0.152
Percentage contribution to total inequality	8	13	4	49
Gini coefficient	0.897	0.872	0.739	0.691
$G_k^*/G_k$ (rank correlation ratio)	0.390	0.470	0.088	0.645
<i>Other income sources</i>				
(1) $\mu_k/\mu$	0.134	0.073	0.021	0.097
(2) $G_k^*$	0.012	0.318	-1.052	-0.095
(3) $[\mu_k/\mu] G_k^*$	0.002	0.023	-0.022	-0.009
Percentage contribution to total inequality	1	6	-9	-3
Gini coefficient	0.962	2.000	2.328	0.889
$G_k^*/G_k$ (rank correlation ratio)	0.013	0.159	-0.452	-0.107

Note: Gini coefficient  $G = \Sigma[\mu_k/\mu]G_k^*$ , where  $\mu_k/\mu$  is the share of component  $k$  in total income. Given that  $G = \{2/[n^2\mu]\}\Sigma_i\{r_i - [n+1]/2\}Y_i$ , for  $n$  households indexed by  $i$ , where  $r_i$  is the income ranking of total incomes, then the *pseudo-Gini*,  $G_k^*$ , is obtained in the same way except with  $Y_{k,i}$ , the  $k$ th component of income, replacing total income  $Y_i$ . The percentage contribution of inequality in component  $k$  to total inequality is  $[\mu_k/\mu]G_k^*/G$ . It can be readily shown that  $G_k^*/G_k$  is equal to  $\text{cov}(Y_{k,r_k})/\text{cov}(Y_{k,y_k})$ , the rank correlation ratio, where  $r_k$  is the income ranking of the  $k$ th component.

and

$$(29-3) \quad G - G' = \left[ \frac{\mu_1}{\mu} - \frac{\mu'_1}{\mu'} \right] G_1^* + \dots + \left[ \frac{\mu_k}{\mu} - \frac{\mu'_k}{\mu'} \right] G_k^* \\ + \dots + \left[ \frac{\mu_n}{\mu} - \frac{\mu'_n}{\mu'} \right] G_n^*.$$

In 1974/75, for example (see table 29-3), we have very different pseudo-Ginis for agricultural income and outside income, yet an increase of five percentage points in the share of outside job income and a corresponding reduction



Table 29-4. *Gini Coefficients for Original and Scaled Incomes*

	1957/58 <sup>a</sup>	1962/63 <sup>b</sup>	1974/75 <sup>a</sup>	1983/84 <sup>b</sup>
Original income	0.336 ( $\mu = 161.3$ )	0.390 ( $\mu = 161.9$ )	0.253 ( $\mu = 274.8$ )	0.307 ( $\mu = 194.2$ )
Scaled incomes	0.336 ( $\mu = 135.4$ )	0.387 ( $\mu = 191.1$ )	0.242 ( $\mu = 234.8$ )	0.304 ( $\mu = 202.8$ )

Note: This numerical experiment simulates the effect on inequality of scaling cultivation incomes corresponding to a good or bad year caused by exogenous factors such as drought or more than average rainfall.

a. In 1957/58 and 1974/75, agricultural revenue was scaled down by 20 percent and outside job incomes scaled up by 20 percent.

b. In 1962/63 and 1983/84, revenue from cultivation was scaled up by 20 percent and outside job incomes scaled down by 20 percent.

in the share of agricultural income (a large adjustment) would reduce the Gini (if the above assumptions apply) by  $0.05 (0.321 - 0.065) = 0.013$ , small relative to the difference between the Ginis for 1974/75 and 1983/84. An example of a fairly radical change in the components (without an approximation) is provided in table 29-4, and it is seen that the changes in the Ginis are very small. We conclude that the changes in inequality must be understood mainly in terms of the inequality within the components together with the shares of those components in the total, rather than in terms of inequality across components.

From table 29-3 we see that for the first three surveys, inequality is largely explained by inequality in agricultural income, whereas in 1983/84 only around half is attributable to agricultural income, with the other half coming from outside jobs. This led us to look more closely at the causes of inequality in these two components.

In table 29-5 we present mean per capita incomes for the different castes in Palanpur. Following Shorrocks (1980), Cowell (1980), and Bourguignon (1979), we decompose inequality between castes, using the Theil index, to assess the extent to which total income inequality is due to between-caste or within-caste differences. We see in table 29-6 that the bulk of inequality in all four survey years can be attributed to the within-caste component. Nonetheless, roughly 25 percent of inequality as represented by this particular summary statistic is the result of between-caste differences in all four years. There appears to have been little change in this respect over the whole survey period.

The determinants of household income, as summarized using simple regressions, are set out in table 29-7. The important influences appear to be land, the number of adult males, family size, and outside jobs. Interestingly, education does not appear to play a major role, although it is possible that

Table 29-5. Caste and Per Capita Real Income in Palanpur

Caste	1957/58		1962/63		1974/75		1983/84			
	Income (rupees) <sup>a</sup>	Number of households	Income (rupees) <sup>a</sup>	Number of households	Income (rupees) <sup>a</sup>	Number of households	Income (rupees) <sup>a</sup>	Number of households	Number of individuals	Total land owned (bighas) <sup>b</sup>
Thakur	186.34	17	174.27	19	354.76	25	199.83	30	217	758
Murao	253.94	21	222.62	25	364.91	27	230.82	27	217	1,053
Dhimar	114.93	10	96.72	9	202.38	8	180.56	13	74	65
Gadaria	187.88	9	209.31	9	242.10	10	202.08	12	83	195
Dhobi	235.51	2	730.98	1	154.47	3	159.35	4	27	21
Teli	107.56	8	104.33	9	203.59	12	147.12	16	92	101
Passi	174.57	11	281.58	16	275.15	8	217.67	14	79	141
Jatab	149.39	16	110.70	13	195.04	14	84.64	19	118	217
Others	128.73	6	101.84	5	255.79	4	183.89	8	53	17

Note: Castes are listed from highest in social ranking to lowest, following the classification of Bliss and Stern (1982).

a. Per capita real income is in 1960/61 rupees; see note "a" in table 29-1.

b. 6.4 bighas = 1 acre; 2.5 acres = 1 hectare.

Table 29-6. *Inequality within and between Castes*

Year	Theil index	Component within caste	Component between castes
1957/58	0.1858	0.1438 (77%)	0.0419 (23%)
1962/63	0.2742	0.2201 (80%)	0.0541 (20%)
1974/75	0.1106	0.0825 (75%)	0.0281 (25%)
1983/84	0.1510	0.1126 (75%)	0.0384 (25%)

our measure, years of schooling attained by the most educated household member, does not proxy education well. A large part of the variation is explained by the regressions in table 29-7, although, as in some other respects, the 1962/63 results are less satisfactory. The influence of land is particularly strong in 1974/75, and of outside jobs in 1983/84. The influence of the caste variables, allowance having been made for other attributes, is not strong, although the coefficients for Muraos are generally positive whereas those for the Thakurs are negative. The Thakurs and Muraos are the two richest castes and own the most land (respectively, 29.4 percent and 41.3 percent in 1983/84). Muraos are traditionally a cultivating caste, and Thakurs traditionally a warrior caste. The Muraos appear to be particularly hardworking and attached to agriculture. A number of Thakurs have lost land, partly as a result of drinking and gambling.

One of the problems encountered when looking at the individual survey years and attempting to describe trends by following particular households through the whole period is that in each survey year the whole composition of the village can be different. First, households in the village may split over time. In the earlier years this usually occurred when brothers set up independent households following the death of their father, and it was generally associated with the division of the household's land among them. Later, it became increasingly common for members of the household to separate from their parents while the parents were still economically active. This then involved being a landless household until the family land was divided, with perhaps the son getting the usufruct of some of his father's land. Second, between 1957/58 and 1983/84 a number of households entered the village while others left. Sometimes a particular household was away for one of the survey years and could not be questioned. Thus it is not always possible to trace each household in one year to its antecedents in all other survey years. In order to examine the development of a given population, a subset of the village households in each year, consisting of those that could be traced through all four survey years, was examined. This subset can be thought of as representing the "closed village." Any newcomer or departing household was ignored, but splitting households were retained. Inequality of income

Table 29-7. *Income Regressions*

	1957/58 (100 observations)		1962/63 (106 observations)		1974/75 (111 observations)		1983/84 (143 observations)	
Constant	-15.4	(-0.14)	6.8	(0.05)	-1,909.7	(-2.74)	-3,216.6	(-5.60)
$\beta_1$	10.1	(5.75)	13.7	(4.85)	86.7	(5.01)	23.9	(1.13)
$\beta_2$	123.4	(2.31)	65.6	(1.58)	564.8	(1.78)	1,756.3	(6.27)
$\beta_3$	57.2	(2.25)	15.2	(0.34)	610.8	(4.51)	881.6	(7.04)
$\beta_4$	52.7	(0.91)	37.7	(0.54)	622.1	(2.58)	-173.9	(0.44)
$\beta_5$	101.7	(1.32)	-8.8	(-0.10)	264.3	(0.64)	-945.6	(-2.62)
$\beta_6$	44.8	(1.92)	47.8	(1.72)	411.4	(2.6)	203.4	(1.79)
$\beta_7$	-26.3	(-1.09)	30.7	(1.32)	518.7	(1.19)	119.3	(1.72)
$\beta_8$	-95.3	(-0.66)	-145.2	(-0.81)	1,276.8	(1.67)	-385.1	(-0.47)
$\beta_9$	224.8	(1.81)	22.5	(0.14)	709.9	(0.89)	1,593.2	(1.71)
$\beta_{10}$	617.6	(4.11)	521.9	(2.81)	1,310.9	(2.22)	3,042.1	(6.03)
R <sup>2</sup>	0.683		0.498		0.720		0.800	

Note: Current nominal income =  $\beta_1$ Land +  $\beta_2$ Adm +  $\beta_3$ Fam +  $\beta_4$ Bullocks +  $\beta_5$ He-Buffalo +  $\beta_6$ Animals +  $\beta_7$ Educ +  $\beta_8$ dThakur +  $\beta_9$ dMurao +  $\beta_{10}$ Jobs + stochastic term. "Land" is land owned in bighas; "Adm" is number of adult males; "Fam" is number of family members; "Bullocks" is number of bullocks; "He-buffalo" is number of he-buffalo; "Animals" is number of other animals; "Educ" is years of schooling of most-educated household member; "dThakur" is dummy for Thakurs; "dMurao" is dummy for Muraos; "Jobs" is number of outside jobs.

Numbers in parentheses are *t*-statistics.

within this group appears to mirror the experience of the population as a whole, although in all years inequality is a little lower. In particular, changes between the years seem to be of roughly the same magnitude. It is useful to use this subset of the population when looking at issues that are amenable to panel data analysis.

The distribution of land is represented in figure 29-4 for the whole population in each year. As before, we attribute an equal proportion of a household's land to each member. Except at the very top end, the Lorenz curve for 1983/84 can be seen to lie outside that for the other years. However, if we take the "closed village" population and merge the households that split over the twenty-six-year period, so that we are effectively considering the distribution of land between "dynasties," we see that much of the difference in the distribution of land between the survey years is eliminated (see figure 29-5). It is clear therefore that the main determinant of the changes in the distribution of land over time has been the phenomenon of household splits. The market for land in Palanpur is not very active, and land sales played a minor role in the changing distribution of land.

In table 29-8 we contrast the distribution of landownership and land operated (or operational holding), focusing now on a household basis since the point of interest is the difference between land owned and land

Figure 29-4. *Lorenz Curves for Landholdings*

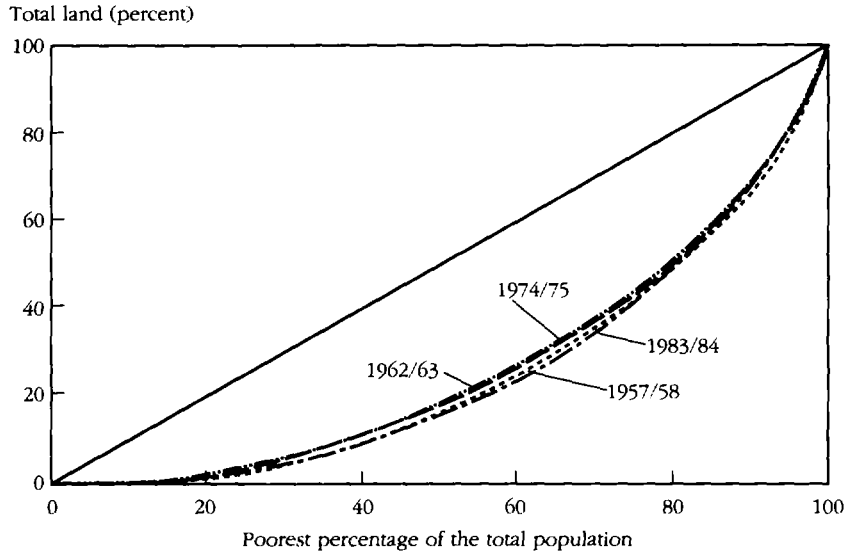


Figure 29-5. *Lorenz Curves for Landholdings ("Closed" Population)*

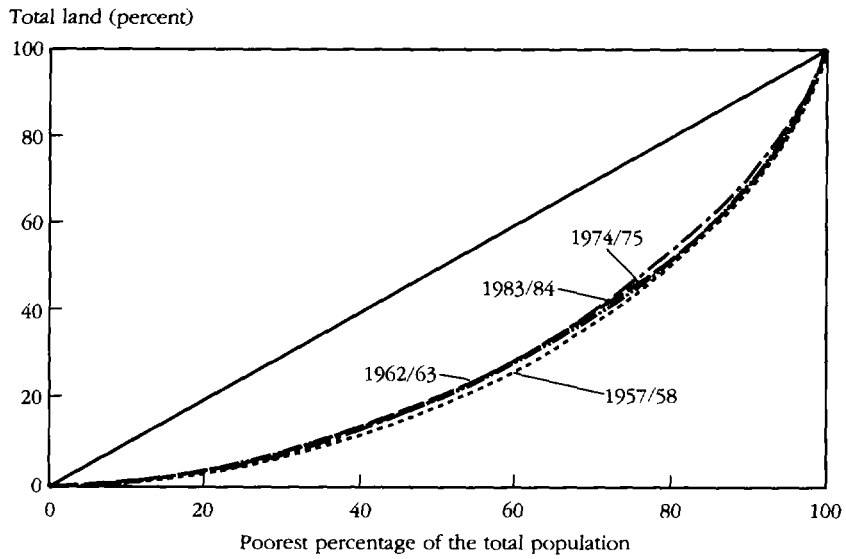


Table 29-8. *Distribution of Land Holdings by Size*

Landholding size (bighas) <sup>a</sup>	Number of ownership holdings				Number of operational holdings			
	1957	1962	1974	1983	1957	1962	1974	1983
> 100	4	3	0	0	6	3	0	2
75-100	4	4	3	6	5	4	1	3
50-75	6	6	12	5	8	9	8	4
40-50	6	7	4	4	6	6	4	8
30-40	12	14	5	11	8	14	16	22
20-30	21	24	31	24	16	27	35	18
15-20	4	4	10	12	5	9	8	9
10-15	11	14	15	12	9	5	6	9
5-10	17	14	9	23	9	8	9	9
2.5-5	0	0	8	12	0	1	4	7
0.1-2.5	1	1	4	7	1	0	2	6
0	14	15	10	27	27	20	18	46
Number of observations	100	106	111	143	100	106	111	143
Average holding size (bighas)	27	26	22	18	27	26	22	19
Gini coefficient	0.54	0.50	0.49	0.57	0.61	0.49	0.44	0.60

Note: Landholdings are presented for households, not individuals.  
a. 6.4 bighas = 1 acre; 2.5 acres = 1 hectare.

operated—that is, tenancy. Tenancy is almost exclusively sharecropping throughout this period. The total amounts of land leased in the four years were 209 bighas in 1957/58, 341 bighas in 1962/63, 538 bighas in 1974/75, and 736 bighas in 1983/84. This corresponds to an increase from about one-quarter of all land cultivated to roughly one-third. We have more confidence in this aspect of the data for the last two survey years, and we can assert that leasing has shown a significant increase across that period. For 1962/63 the Gini coefficients for the distribution of land owned and land operated were roughly equal, although this conceals considerable tenancy, as discussed in the next section. For 1957/58 and 1983/84 the Ginis for land operated are larger than for land owned, but this ranking is reversed for 1974/75. Hence, on balance, tenancy had an equalizing effect on operational holdings in 1974/75 but not in other years. The reversal by 1983/84 of the equalizing effect of tenancy is associated with some larger landowners leasing in land in 1983/84 where very few of them did in 1974/75, together with more smaller households leasing out land. As agriculture becomes a more intensive activity, it appears to involve greater commitment of time and energy.

## Agricultural Change

It has been suggested by some that the Green Revolution benefits large landowners more than small farmers for a number of reasons. First, large farmers may have greater access to the credit market and are therefore more able to acquire the seed varieties, fertilizers, and capital goods (largely for irrigation) that the more intensive cultivation practices require. Second, large farmers may be able to reap economies of scale from cultivating intensively on larger plots of land by utilizing their capital stock more efficiently. Third, large farmers may be quicker to adopt the new practices, because they need not devote their entire landholdings to the new techniques and the risks posed are thus less severe. One can try to trace further linkages between the distribution of income and agricultural change through the general equilibrium of the village. For example, Braverman and Stiglitz (1989) suggest that credit-market rationing for small farmers could lead to land sales, forcing these farmers to turn to sharecropping, and leading to a reduction of the initial productivity gains as well as a widening income distribution. In Palanpur things worked out differently with, between 1974/75 and 1983/84, few land sales but with the bigger and better farmers taking on more land under share tenancy.

In Palanpur the new farming practices and seeds were introduced in the period between 1962/63 and 1974/75. Average per capita income from agricultural activities in 1957/58 and 1962/63 was roughly constant, but between 1962/63 and 1974/75 it grew by 76 percent. Average real income from cultivation of the poorest 30 percent (in terms of total income) in 1974/75 was 79 percent greater than that of the poorest 30 percent in 1962/63. Average real income from cultivation of the richest 30 percent in 1974/75 was 47 percent higher. However, average real income from cultivation of the middle 40 percent was 102 percent higher in 1974/75 than in 1962/63. The effect of the new farming practices seems to have been spread over the distribution, with the largest rise among those around the median.

Although 1983/84 was a poor year for agriculture (see table 29-1), agricultural practices had intensified still further. In 1974/75, for example, Persian wheels made a large contribution to irrigation (there were twenty-two Persian wheels and nine diesel pumping sets), whereas in 1983/84 very few Persian wheels were in active use and there were twenty-two diesel pumping sets.

The impact of the Green Revolution on the distribution of agricultural income can be seen in table 29-3. The Gini for agricultural income fell from 0.509 to 0.372 between 1962/63 and 1974/75, suggesting an initially equalizing influence. However, between 1974/75 and 1983/84 this Gini coefficient

rose from 0.372 to 0.487, a considerable increase. Having suggested that agricultural change between 1962/63 and 1974/75 did not exacerbate agricultural income inequality, it is necessary to consider how this might have happened, and why some of the mechanisms suggested did not apply strongly to Palanpur. Agricultural change in Palanpur over the years between 1957/58 and 1974/75 took various forms. In 1957/58 less than half of the village land was irrigated. Most of it was single-cropped and cultivation consisted largely of sowing and harvesting. By 1974/75 double-cropping was commonplace. The use of Persian wheels and diesel pumping sets was widespread and almost all the village land was irrigated. An active market for the services of existing Persian wheels, tubewells, and pumpsets developed alongside the rise in their numbers. High-yielding varieties (HYVs) of wheat had been introduced and were widely used.

The expansion in irrigation as well as the increased adoption of HYVs in Palanpur was not the result of an integrated program of public investment and extension services. It appears that the new technologies made their way into the village on a gradual basis, with farmers acquiring new capital and seed varieties as and when they could afford them. When new practices had been successfully adopted by some farmers, they would be imitated by others. Although a government seed store had been established in Palanpur, providing new seed varieties and fertilizer on credit, it was widely accepted that these were often adulterated and of a lower quality than what was available on the market. Most seed loans taken out from the seed store were for consumption purposes. Pumpsets and Persian wheels were occasionally purchased with loans from banks in the nearby towns of Chandausi and Bilari, but this was by no means the rule, and frequently they were purchased from accumulated savings.

We may think of agricultural income as being determined by a combination of three factors. First, land cultivated; second, inputs per acre; and third, an "unexplained" contribution to output per acre that we may associate with skills, land quality, luck, and so on. The dispersion of land cultivated was discussed above, and we saw that in 1974/75 this was indeed lower than in other years. We also investigated the relationship between output and land cultivated. We can see from the two regressions in table 29-9 that for all four years, both output and expenditures for inputs were roughly proportional to the area cultivated.

The proportionality conclusion is confirmed when we look at the small covariance of the logarithm of output per bigha and the logarithm of land cultivated in table 29-10. Hence we may investigate the dispersion of output in terms of the dispersion of land cultivated and of output per acre. From the variances presented in table 29-10, we see that the logarithm of land cultivated is more important, but that the variance of the logarithm of output per acre also plays an important role, particularly in the last year. This latter



Table 29-9. *Effects of Farm Size on Output and Expenditures for Inputs*

	1957/58	1962/63	1974/75	1983/84
<i>Regression of log (output) on log (land cultivated)<sup>a</sup></i>				
Land cultivated	0.956 (21.95)	1.070 (11.54)	1.080 (27.0)	0.937 (13.50)
Intercept	3.220 (22.54)	2.73 (8.75)	5.06 (84.33)	5.207 (23.78)
R <sup>2</sup>	0.850	0.615	0.940	0.673
<i>Regression of log (expenditures for inputs) on log (land cultivated)<sup>b</sup></i>				
Land cultivated	0.961 (7.3)	1.051 (10.46)	1.15 (8.62)	0.902 (12.94)
Intercept	0.573 (1.20)	1.393 (4.15)	9.69 (3.84)	4.43 (20.26)
R <sup>2</sup>	0.498	0.567	0.519	0.652

Note: Numbers in parentheses are *t*-statistics.

a. Output is in 1960/61 rupees. Land cultivated is in bighas.

b. Expenditures for inputs in 1957/58, 1962/63, and 1983/84 included expenditures for irrigation, seeds, fertilizer, and fodder; in 1974/75 the only data available were for fertilizer. Land cultivated is in bighas.

variance was low for the two good years (1957/58 and 1974/75) and higher for the bad, being particularly low in 1974/75 and high in 1983/84. It is possible that in good years a more intensive agriculture leads to more equality in yields with errant practices being punished less, but that in bad years it leads to more inequality in yields as better farmers are more able to protect themselves.

Finally, we examined the relationship between the logarithm of output per bigha and the logarithm of expenditures for inputs per bigha to see how far the latter accounted for the variation in the former (table 29-11). We see that the  $R^2$ 's in the bad years are indeed higher than those in the good years, being as high as 0.42 in 1983/84 and essentially zero for 1957/58, prior to the Green Revolution. It should be emphasized that we have greater faith in the data for 1974/75 and 1983/84 with respect to the issues discussed here than in that for the earlier years. Finally, we should note that there is still a sizable variation in output per bigha after allowing for variation in input costs.

We conclude then that the most important determinant of agricultural

Table 29-10. *Variance/Covariance Matrices of Log (Output per Bigha) and Log (Land Cultivated)*

	<i>Log (output/bigha)</i>	<i>Log (land cultivated)</i>
<i>1957/58</i>		
Log (output/bigha)	0.1812	-0.0902
Log (land cultivated)	-0.0902	0.8147
<i>1962/63</i>		
Log (output/bigha)	0.3333	0.0367
Log (land cultivated)	0.0367	0.4610
<i>1974/75</i>		
Log (output/bigha)	0.0826	0.0638
Log (land cultivated)	0.0638	0.5297
<i>1983/84</i>		
Log (output/bigha)	0.4652	-0.0695
Log (land cultivated)	-0.0695	1.0998

output is, not surprisingly, land cultivated. But output per bigha is not related to farm size either before or after the Green Revolution, a result that is quite striking given the three arguments that we presented at the beginning of this section. Further, while variation in output per acre is strongly related to input per acre, particularly post-Green Revolution and in bad years, there is a great deal that is unexplained. This, we take it, corresponds (apart from the usual reasons of problems of modeling and data) to household effects (better and worse farmers) and "genuine" stochastic factors. This is a topic that we hope to pursue further. We note that the stochastic model with "multiplicative" uncertainty is not contradicted by our results (the proportionality of output and land cultivated appears to be there in all four

Table 29-11. *Output and Costs*

	<i>1957/58</i>	<i>1962/63</i>	<i>1974/75</i>	<i>1983/84</i>
Expenditures for inputs	0.069 (0.99)	0.585 (7.27)	0.143 (3.64)	0.663 (8.18)
Intercept	2.95 (47.71)	2.08 (15.46)	5.07 (56.91)	2.258 (6.60)
R <sup>2</sup>	0.00	0.385	0.153	0.428

*Note:* Log (output per bigha) is regressed on log (expenditures for inputs per bigha). Output is in 1960/61 rupees. Expenditures for inputs in 1957/58, 1962/63, and 1983/84 included expenditures for irrigation, seeds, fertilizer, and fodder; in 1974/75 the only data available were for fertilizer. Numbers in parentheses are *t*-statistics.

years), but that adverse outcomes seem to raise the dispersion as well as to lower the mean of the distributions.

## Outside Jobs

The rise in the importance of outside jobs (meaning jobs outside agriculture) in Palanpur can be seen both in the rise in the number and variety of occupations that villagers filled and in the increasing proportion of income from outside jobs to total income. In table 29-3 we saw that outside job income made up about 8 percent of total income in 1957/58, and that this proportion had reached 34 percent by 1983/84.

The number and types of regular jobs available in the four survey years are displayed in table 29-12. There were nine villagers employed outside the village in 1957/58. By 1983/84 this number had risen to fifty-four. The

Table 29-12. *Regular Jobs Outside Agriculture*

<i>Job</i>	<i>1957/58</i>	<i>1962/63</i>	<i>1974/75</i>	<i>1983/84</i>
<i>Regular job involving good education or skills</i>				
Teacher	0	0	3	2
Mechanic	1	1	0	0
Electrician	0	0	1	0
Insurance salesman	0	0	0	1
Tax collector	0	0	0	1
Cook	0	0	0	1
Skilled worker in bread factory	0	0	0	1
Clerk in factory	0	0	1	0
<i>Regular job involving limited training or skills</i>				
Chowkidar (watchman)	2	0	1	5
Permanent railway employee	3	5	6	10
Nonpermanent railway worker	1	0	3	6
Permanent servant	1	0	0	0
<i>Unskilled worker in:</i>				
Cloth mill or spinning factory	0	1	11	14
Cane center	0	0	2	0
Bread factory	0	0	0	7
Coal depot in Moradabad	0	0	0	1
Security guard or policeman	0	0	0	2
Brick seller in Moradabad	0	0	0	1
<i>Unspecified regular job</i>	<u>1</u>	<u>3</u>	<u>9</u>	<u>1</u>
<i>Total</i>	<u>9</u>	<u>10</u>	<u>37</u>	<u>54</u>

Note: This list does not include occupations that are seasonal, casual, semiregular, or carried out on the basis of traditional arrangements.

expansion of outside jobs occurred primarily after 1962/63, with increasing employment in occupations (such as the railways) that had already existed in 1957/58, and also with villagers finding new employment opportunities, such as in a bread factory or cloth mill.

In table 29-3 we can see that regular outside job income had a differing impact on the distribution of total income in the different years. In 1974/75, for example, the pseudo-Gini for outside job income was 0.065. This meant that income from outside jobs was very equally distributed when villagers were ranked in terms of total per capita incomes. In 1983/84, however, the pseudo-Gini was 0.444. With the proportion of per capita outside job income to total per capita income reaching 34 percent in 1983/84, the contribution of outside job income inequality to total income inequality reached 50 percent by that year.

Outside jobs, particularly the more remunerative ones, went to villagers positioned differently along the income distribution in the four survey years. In the two earlier years, as well as in 1983/84, those who held the well-paying outside jobs were also those who were well-off in total income terms. This was not the case in 1974/75, when sixteen out of the thirty-seven villagers with a regular outside job came from households in the bottom half of the income distribution, and only six out of the twenty richest households had any member with outside employment.

## Conclusions

Broadly speaking, we have seen that the technological changes of the 1960s and 1970s brought with them, at least initially, a reduction in the inequality of incomes. The common assertion that "the Green Revolution has been strongly biased in favor of rich farmers" through their cheaper or privileged credit, lower risk aversion, greater access to information and scarce capital equipment, and so on, cannot therefore be seen as a characterization of the most powerful influences at work on changes in the income distribution. In fact, in Palanpur technological change appears to have been scale-neutral with respect to size of agricultural holding.

Two factors have been important in shaping the distribution of agricultural incomes. First, irrigation reduces variability in yield across possible outcomes. This equalizing effect seems to have been particularly strong in a good year for agriculture (1974/75), when errant techniques may have been less heavily penalized. Second, the distribution of land cultivated in 1974/75 was more equal than in other years. This was for a combination of reasons. In the earlier two surveys the biggest holdings were generally owned by Thakur households. Four of these major landowning households split between 1962/63 and 1974/75 and divided the land among themselves. A few members of this traditionally warrior caste were prone to drinking and

gambling and lost land as a result over the years, usually selling to Muraos, traditionally a cultivating caste. By 1974/75 the Muraos owned more land than the Thakurs and were well represented among the largest landowning households. The biggest landowners in that year were not, however, leasing in land and, for this year only, tenancy acted to make the distribution of cultivated holdings more equal than landownership.

Between 1974/75 and 1983/84 some of the larger landholders responded energetically to the opportunities offered by specialized cultivation, and others with very small plots gave up agriculture. The equalizing effect of tenancy on the distribution of cultivated land thus faded in the later years and the more effective farmers took on more land. In 1983/84 ten of the fifteen largest cultivators were Muraos and only two were Thakurs. The increasing dispersion in land cultivated was compounded by the more productive taking more land and by the more adverse conditions that led to greater dispersion in yield per acre in 1983/84. The relationship between inequality of incomes and of land cultivated is influenced by the absence of a specific labor market in Palanpur, namely, a market for farm managers. In a world of complete and perfect markets, inequality would be determined by endowments (given prices and abstracting away from nonconvexities such as those involved in productivity-consumption links) and could be clearly traced back to them. In Palanpur, a market exists for agricultural labor, but not for farm management skills. Since these skills cannot be directly marketed, divergent abilities become manifested as the taking of more land under tenancy. Land cultivation thus reflects the distribution of these farming skills, particularly after 1974/75, when the further intensification of farming through technological change, as well as the increased range of alternative sources of income outside the village, led to a clearer realization among the less skilled farmers of their comparative disadvantage.

We should note that this comparative disadvantage in farming was not necessarily caused by lack of access to, or high cost of, credit. In Palanpur credit can be obtained from a number of sources, predominantly from the formal sector, but also from nearby town moneylenders and Palanpur moneylenders. We have mentioned that between 1974/75 and 1983/84, Thakurs figured highly among the landowners leasing out their land to other villagers. Because they have traditionally occupied the highest position in the village hierarchy and are still among the richer households in the village, it is difficult to imagine that the Thakurs were unable to obtain credit in order to purchase the necessary inputs required to make them effective farmers. However, we can also see in table 29-8 that between 1974/75 and 1983/84 there was a substantial increase in leasing out of land by small landholders. It may well be that for these landowners the decision to lease out land to the more effective farmers was prompted in part by the cost of, or a lack of access to, credit.

The most striking impact on inequality in the period 1974/75 to 1983/84

was not, however, from agriculture but from outside jobs. Where some lower castes had seized the opportunities for outside jobs in earlier years, in 1983/84 the higher castes were more prominently represented, and the outside jobs became a source of inequality as significant as agricultural income even though outside jobs represented only one-third of total income.

Movements in the inequality of landownership seem to be much smaller than those in income. On average less than 1 percent of the landownership turns over in any one year (whereas one-quarter to one-third of the land would be under tenancy). Inequality in landownership grew a little in those nine years, but this was almost entirely due to the early division of certain households, in the sense that a number of sons lived separately from their fathers before the land was divided and thus became landless households. This is an interesting social development and possibly associated with the growth of outside jobs, but it is not really an example of the dynamics of factor market imperfections. Other movements in landownership have been connected with distress sales brought about by dissipation, particularly drinking and gambling, and not by agricultural failure. Those who have bought the land tend to be those who have been successful in agriculture. As we have noted, such farmers are also taking more land under tenancy.

The picture that emerges then is one where inequality arises from endowments, sector or type of employment, risk-good fortune, and different types of behavior. These factors receive some reinforcement from imperfections in markets (for example, differential access to, or price for, credit and labor), but from our evidence it would be difficult to argue that the market imperfections, as opposed to the aspects just described, played the major role in determining inequality, and its changes, in Palanpur.

The big changes described in development stories—agricultural advancement, the decreasing relative role of agriculture, and population growth—are having major effects on the level and distribution of income in Palanpur. Their interaction and variation over time require careful analysis, and the simpler versions of the standard stories do not always apply.

Finally, we should note that this chapter has focused on identifying and understanding changes in Palanpur. The role for policy is another issue and one that we are examining elsewhere. We would argue, for example, that there is much that could be done to improve the position of the most disadvantaged in Palanpur.

## Notes

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1. The first two of the studies were organized by the Agricultural Economics Research Centre at the University of Delhi, and data from the first of them were analyzed in a report by that Centre (Ansari 1964). The 1974/75 study was conducted by Bliss and Stern and the results reported in Bliss and Stern (1982). Bliss, Drèze, and Stern were responsible for the 1983/84 survey. The senior research investigator for the last two surveys was S. S. Tyagi, Jr., the brother of S. S. Tyagi, Sr., who had conducted the first study, so there was some continuity across the long period. The first two studies were, however, conducted over briefer investigation periods. The 1983/84 study was particularly intensive with Jean Drèze, Naresh Sharma, and S. S. Tyagi, Jr., residing in the village throughout the agricultural year.

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