Education and Income

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A Background Study for World Development Report, 1980

The five papers in this volume provide a comprehensive survey of the state of knowledge about the effects of education on income.

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Editor's Preface

The World Development Report, 1980 outlines three distinct grounds for the claims of education on scarce resources. The first is its direct enrichment of the lives of those who obtain it. The second is its contribution to improvements in nutritional levels and child health and to lower fertility. The third is its contribution to growth in incomes and, in some but not all circumstances, to greater equality of income. This third class of benefits includes those most comparable with the benefits of other investments and those most stressed in the literature on economic development.

These five papers provide a comprehensive survey of the state of knowledge about the effects of education on incomes. The papers by Bowman, Berry, and Fields were specially commissioned as Background Papers for the World Development Report, 1980. That is to say, their principal objective was to review research into certain key issues in a way that could be drawn on by the authors of the Report with more extensive coverage of the topics covered. Although the authors were in touch with one another, these three papers should be seen as being independently conceived and bearing on different aspects of the relations between education and income. From the point of view of the Report it was more important to ensure that issues did not disappear between the cracks than to avoid duplication. In consequence there are substantial overlaps, but not so extensive as to burden the reader. In any case, many readers will choose to read a particular paper rather than the whole volume straight through, so that unbalancing the structure of each paper to eliminate duplication would probably irritate more readers than it helped.

It will be obvious to readers of the Bowman, Berry, and Fields papers how useful and durable has been the compilation of rates of return to education in Psacharopoulos, with its establishment of a clear pattern of relative rates. 1/ But the very durability of that book, which reported on empirical research done mostly in the 1960s, began to nag at the authors of the Report. We became worried not only that there might have been a substantial change in the pattern of rates, but also that we might be losing an opportunity to detect time trends in countries where rates of return have been calculated in different years. We therefore asked Dr. Psacharopoulos if he could bring his earlier findings up to date.

The paper by Lockheed, Jamison, and Lau was originally written with a quite different purpose - the first step in developing a program of research into the role of education in rural development. A slightly earlier version will appear in a forthcoming issue of Economic Development and Cultural Change. That version will be the second chapter of a book by Dean T. Jamison and Lawrence J. Lau: Farmer Education and Farm Efficiency, to be published by John Hopkins University Press in 1981.

1/ George Psacharopoulos, Returns to Education: An International Comparison (Amsterdam: Elsevier Scientific Publishing, 1973).

A Readers' Guide

The papers themselves survey and summarize key issues; in the World Development Report, 1980, we attempt a balanced synthesis; to provide yet another full summary or synthesis in this preface would be redundant and possibly distracting. Instead, let me simply provide a brief guide to the contents of this volume.

Any reader unfamiliar with recent work in the economics of education should start with Bowman's "Overview". Her paper begins by discussing the qualities that people need to carry forward the process of development and the ways in which education can enhance these qualities. This introduces some of the major issues in the economics of education, to which other papers return. Of special importance is the question of what we are seeing when we observe that people with more education earn larger incomes - evidence of the extent to which education actually has contributed to an individual's productivity, or merely of its capacity to sort people out according to their potential future productivity? Or worse, evidence of a social pathology that rations scarce opportunities for the best-rewarded occupations by insisting on ever-rising educational credentials? We can scarcely assess the effects of education on income without taking a position on this issue, and four of the five papers address it to some degree. It receives its most thorough discussion in Berry's paper.

The Bowman paper then turns to the different approaches analysts have taken to assessing the contribution of education to income growth and associated policy questions. First are the attempts to derive conclusions from relative economic performance among countries. Then there are attempts to use international comparisons to identify manpower requirements for planning purposes - an area of fierce controversy in the 1960s. Although the debates are now less shrill and less frequent, and economists and manpower planners have tended to go their separate ways, there is still no general consensus on how an educational planner should determine the number of places to be provided at specialized educational institutions. Even among the authors of the papers here, there is some disagreement on the extent to which the weaknesses of rate of return calculations limit their usefulness in policy analysis.

Bowman's paper then considers attempts to identify the sources of growth in particular countries, including the consequences of increasing the stock of educated and skilled manpower. As Bowman points out, these approaches generally provide little insight into the processes of development. What is needed is more understanding of the nature of the interactions between educational advance, learning-by-doing, and new investment. The paper reviews some of the formal models of such interactions and then discusses the consequences of recognizing the critical importance of learning and training at work. For example, the much lower labor mobility in Japanese industry encourages firms to invest in the training of employees, and this may explain some of the remarkable growth of Japanese productivity. This may carry implications for policies to diffuse knowledge and skills widely among the population of a developing country, and for the role of donor agencies in this process.

As already mentioned, the core of the paper by Psacharopoulos is an updated set of calculations of both private and social rates of return to different levels of education in developing countries. The broad picture of differential rates has not tended to change, and although there is some sign that rates have fallen in the wake of educational expansion, this has not been to a large degree. The early part of the Psacharopoulos paper is an introduction to the estimation procedures used in the calculations. In the later part of the paper, Psacharopoulos defends the usefulness of the social rate of return as a guide to educational policy against many of the objections that have been levelled against it.

Lockheed, Jamison, and Lau review studies of the effect of a farmer's educational level and exposure to extension services on his productivity. In general, it is very much easier to estimate production functions relating physical inputs to physical outputs in agriculture than in other sectors - there are a relatively small number of inputs and reasonably homogeneous outputs. One of the inputs can be the farmer's level of education. Another can be some measure of his exposure to extension services. Such analysis may still have us unsure whether the effects on output are because of education or some measure of ability that is highly correlated with education, but we are at least spared the need to consider how labor markets are operating and whether relative earnings reflect relative marginal products of labor. As the paper shows, most of the studies show positive and usually statistically significant effects of education on output, especially in modernizing agricultural environments.

Although it had been hoped that Berry's paper might be able to provide an urban equivalent to that of Lockheed, Jamison, and Lau, there has simply been too little comparable work on productivity in urban occupations. The basis for Berry's analysis therefore has had to be an analysis of the effects of education in the labor market - on earnings, labor force participation, and employment. The evidence that earnings differentials associated with education might be attributed to effects other than its impact on productivity (that is, to "screening" or "credentialism") is considered at some length. On balance, the case for abandoning the human capital model is unpersuasive. There is something to be said on both sides, however, and the issue is far from settled. The paper than looks briefly at two external effects of education - its impact on fertility and on technological change. Finally, it discusses priorities for the alleviation of urban poverty and, in particular, the importance of continuing to expand the coverage of primary education among the poor and to raise its quality.

Rather similar notes are sounded by Fields. In looking at who is benefitting from education in developing countries, his paper first discusses the nature of income benefits from education and the degree to which these are invalidated by unemployment. It then considers alternative methodologies for examining whether returns from education differ for different socioeconomic and other groups. Much of the research on this topic has fallen into certain statistical traps - described in detail - which weaken, if not destroy, its findings. The paper then discusses differential participation in the educational system. It is clear that this is a very important cause of income inequality and its perpetuation from generation to generation. In this respect

Fields' paper considers, although not extensively, studies by sociologists and radical economists that lie outside the neoclassical mainstream into which most of the work reviewed here falls. The paper turns from private rates of return to a more general discussion of social rates and their limitations and thence to studies that have considered the relation between the distribution of educational opportunities and the distribution of income. Finally, Fields reviews studies that have looked at the distributional effect of mechanisms for financing education and at the allocation of both the direct and indirect costs of education.

Where do we go from here?

The evidence that individuals with higher levels of education enjoy higher incomes is well established. Despite unemployment among the educated - especially secondary school leavers - and despite some apparent tendency for returns to fall over time, if the source of the higher incomes of educated people is in fact education, then the returns to education remain high. It is important, however, that the straightforward calculation of returns and earnings functions continue. There may be little academic glamor left in such analyses, but without some sense of how these rates are changing over time we are left with little idea of what is happening at the margin. As the appendix to Fields' paper points out, the conventional calculation of rates of return looks at how education affects average earnings differentials; marginal returns may be very different. In addition, educational expenditures have a very long time lag before they yield their output - a decision in year t to build a secondary school may mean new classes in t+3 and new school leavers in t+7. By that time the return to education may be rather different. Since the ability to forecast the demand for skilled manpower is still very limited, planners need to keep their eyes on the barometers of labor market pressures and in this regard repeated analyses of rates of return can be helpful. Another barometric reading may be derived from tracer studies of school leavers; if there is evidence that their period of search for jobs is greatly increasing and/or they are accepting more poorly paid employment, this may be an indication of falling returns.

The "human capital" assumption - that additional education leads to higher incomes by raising productivity - is still subject to challenge. Pure "credentialism" - the view that education is merely an entrance ticket to a select club of relatively well paid people - does not seem to be supported by the evidence from informal and agricultural sectors as summarized in the papers by Berry and by Lockheed, Jamison, and Lau. Nevertheless, particularly in urban areas, research on the interaction between education and the labor market has been limited; the number of countries for which information exists and on which good research has taken place is very small. Evidence from Malaysia, Colombia, and Kenya is cited over and over again in these papers; and it is clear that the net needs to be cast over a much wider set of urban areas.

It is more difficult to determine how much of the apparent effect of education on incomes is the effect of ability, or other unobserved variables, on productivity and a high correlation between these variables and education, and how much it is the result of education per se. Furthermore, the mechanisms through which education has its economic effects - how much is due to cognitive skills, such as literacy or numeracy, and how much to such traits as modernity of attitude, adaptability, willingness to accept work discipline, and so on - are not clear. The early part of Bowman's paper is highly relevant to these questions - our ignorance does not reflect an absence of discussion but a lack of hard evidence. The World Bank is carrying on research into such questions in rural areas in Nepal and Thailand by attempting to measure ability, attitudes, agricultural knowledge and academic achievement, as well as by collecting data on home backgrounds, and relating them to farm productivity and profitability. A great deal more work along these lines is needed.

With such information we may get a firmer grip on which parts of education are best carried on in formal institutions, which appropriately tackled in nonformal settings, and which best left to on-the-job training. In turn, this information can guide much-needed research into identifying the critical elements of educational quality. Of course, something is known about this, as evidenced by the discussion in the World Development Report, 1980 and the recent World Bank Educational Sector Policy Paper, but much remains to be done.

It is probable that the major advances in the economics of education will come from careful empirical work at a micro level. This will largely require data collected in special-purpose investigations, though censuses and administrative data from ministries of education and regular household surveys of Statistical Offices may also be valuable. Compared with previous generations of researchers, we now have the advantage of the means of analyzing very large data sets, as well as of improved econometric techniques. Gradually we shall be able to compare and contrast the results of micro-level studies in different settings (in the maner of Lockheed, Jamison, and Lau) and to arrive at much sounder generalizations.

But with any micro work there is always a danger of seeing trees rather than the forest. We need to step back from time to time and survey the horizon. Micro-level studies are most easily able to explore differences among individuals in one country at one point of time. They tempt us also into developing hypotheses about things we know we can readily measure rather than things we think are necessarily the most important. But when, for example, we come to try to understand the reasons for the remarkable relative successes of East Asia in both economic development and educational progress, we need more than local cross-sectional analyses. I personally doubt, however, whether we will be much helped by further statistical analyses of relative performance at an aggregate level among nations, though this is by no means a universal view - or indeed, even shared by all the authors of the World Development Report, 1980. Growth accounting has also probably too many limitations to be very illuminating of the processes that cause the development experience of one nation to diverge from that of another. We are therefore likely always to need the broad discussions of the kind illustrated in both the early and later sections of Bowman's paper, which focus on economic issues but go beyond conventional economic variables in the discussion of them. Such considerations not only provide empirical micro-level research with a sense of perspective -- they offer a challenge to formulate hypotheses that are at once both testable and capable of capturing the richness and variety of the development process.

No doubt one could make similar remarks about the role of agriculture or of transport in development. But they seem especially appropriate for education. Education is not simply a creator of human capital, even though it is one of the most important investments necessary to bring about an increase in incomes. It is also a major way in which one generation transmits to the next its values, its culture, its attitude to work and to risk, and its commitment, or otherwise, to economic success and the alleviation of poverty. In trying to understand the significance of such things, the econometrician will not soon replace the economic historian.

I should like to thank the authors and, on their behalf, all other Bank staff and consultants participating in the work that led to the publication of these papers. James McEuen undertook the final editing of the manuscripts. Rhoda Blade-Charest, Banjonglak Duangrat, and Jaunianne Fawkes did most of the typing and coordinated other aspects of production.

Timothy King

PART I

EDUCATION AND ECONOMIC GROWTH: AN OVERVIEW

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AN OVERVIEW

Herbert Simon often has stated that the greatest resource we have is in men's heads. Simon Kusnets has laid before us the evidence of labor's dramatically increased share in the production of the GNP with progression from powerty to affluence. T. W. Schultz has led us into increasingly dynamic perceptions of how education may affect productivity in a context of change. All three of these Nobel laureates, different as their views may be in other respects, have turned a spotlight on the human factor as the generator and implementor of a new knowledge that can be the foundation of growth and the explanation of high marginal productivities of both physical and human capital, even as both these forms of capital have increased.

This overview is organized in seven sections as follows. Section I makes a few observations about the meanings of "development" and of "education." Section II, on "development man and innovative change" emphasizes disequilibrium as a central characteristic of growth processes, a theme that recurs in later sections and is given special attention again in the final section of the overview. However, Section II includes brief discussions of education and the human factor in agriculture and in small enterprises. Section III takes up a series of questions and issues that have been addressed primarily in a microeconomic perspective; it looks at different segments of education and at debates about the associations between measures commonly used and their societal counterparts. Section IV considers what may be gleaned from cross-national comparisons that relate primarily to literacy and levels of educational attainment. However, the use of cross-national comparisons in "manpower economics," and what in the main has been learned from such comparisons, are discussed in Section V. That section includes also "manpower-economics" aspects of other models. Section VI examines treatments of education in aggregative growth models, production functions, and national growth accounting and makes some assessments of these models and their findings. The final section comes back to an emphasis on disequilibria as a part of development, associated asymmetries in forms of human resource development, and the role of a reserve stock of capabilities for innovative change and economic growth. It seems clear to me, as we look at histories of development since World War II, that the most important insights for Third World development and human resources must come not from the conventional models of growth (valuable as Denison's work, in particular, has been), but from the analysis of structures and resource allocation in the contexts of history and of the repeated generation of disequilibria as a part of the process of growth. The formation and the use of human resources are twin aspects of this perspective; they are interdependent, and they are at the heart of sustained growth.

I. MEANINGS OF DEVELOPMENT AND EDUCATION

Economic growth probably has been the most universally accepted and the least understood criterion of public policy -- especially of policies concerning education in less developed countries. Evidence relating to the place of education in growth is of many sorts but often is untidy; the implications of this evidence for educational policy are largely indirect. Only slightly less difficult is the related but inverse question: how does growth affect demans for education? Furthermore, "growth" is not an unambiguous or a unidimensional concept. Every major decision relating to growth is in some degree a decision concerning the shape of growth and the kind of society in which people will live in the future. It is a decision also about the paths to be followed, the processes of change or development. Moreover, the formation of human resources for development is not a matter merely of what goes on in schools; we must lool at education in a broader perspective. A few words on these questions should help orient us to the analyses that follow.

A. Of Economic Growth or Development

Most aggregative growth models start out to explain changes in the total output of a national economy, but our real concern, presumably, is in output per capita. (I set aside militaristic goals to which sheer scale may be highly relevant.) However, no one probing problems of economic growth will long be satisfied with a per capita income measure when considering countries in which there may be a high mean income derived mainly from a valuable natural resource (the most obvious example is, of course, petroleum) and in which productivity throughout the society is low. This is not just a matter of the distribution of income; an oil-rich country may distribute the oil incomes quite evenly among the population, but this does not mean that economic development is taking hold. What, then, do we mean when we speak of economic growth or development? Do we mean the attainment of higher levels in the satisfaction of basic needs? Important as that may be (leaving aside the problem of specifying what are "basic needs" without regard to resource constraints), it seems that this brings us logically right back to my abstract example of an oil-rich state in which oil incomes are evenly shared but no real development occurs. When we speak of either growth or development, but especially of the latter, we have some further connotations in mind. There must be widespread participation not only in consumption, but in the creation of the products and services that make up that consumption. Unless such participation is realized, there is nothing to sustain continued economic progress, or to prevent regression into poverty.

It is not my contention that growth and equalization of the distribution of income are the same thing. Indeed, there is plenty of reason to expect (as has generally been the fact) that a society that is poor throughout will first fo through a stage of disequalization as a few of the population pull ahead of the general mass. Inequalities will ultimately diminish again, even in capitalist states -- as Kuznets has demonstrated. 1/ What I want to

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1/ He has developed this theme in many places. Perhaps the most detailed statistical elaboration is in the series of essays on development and income distribution published in Economic Development and Cultural Changes (Kuznets 1963).

stress is that, whatever the distribution of income, development cannot be healthy or sustained unless there is progressively wider participation in more productive economic activities. But this will not happen unless there is also widening participation in the rewards.

Some years ago C. A. Anderson and I were invited to give a joint paper under the title "Inter-disciplinary Aspects of a Theory of Regional Development" 1/ From my point of view this assignment was a refreshing challenge; the title given to us forced me to think afresh, almost without regard to conventional economic treatments, about what we had been rather glibly calling either "growth" or "development," and I was participating in this effort with a colleague who contributed other perspectives and, thereby, further challenges. We arrived at a definition that I still find useful (Bowman and Anderson 1965, p. 21): Development is the enlargement, diffusion, and realization of opportunities. In the present context I would use that definition a little more narrowly than in the application we made initially. Without further elaboration, perhaps the adjective "economic" can simply be inserted in front of "opportunities." Economic opportunities must then be seen as increasing, these opportunities must be diffused progressively more widely among the population, and the opportunities must not merely be potentials. They must be made real, and this must be visible, whether or not it can be subsumed under conventional measures.

Unfortunately, an overview of the literature on education and economic growth gives room for only limited attention to key elements in this definition of development. There are three reasons: (1) most of what economists have written about growth conceals these aspects of development under averages; (2) productivity in the home is not included in measures of national income and its growth; (3) even the attempts to inject a consideration of basic needs into growth analysis, or the attempts to weight benefit-cost assessments of projects to take income-distribution effects into account, miss what I am trying to say here. They miss because they pay so little attention to development as a process or to opportunities and incentives. These are serious omissions if we are to understand growth and the rule of human resources in economic development.

B. Of Education and Learning

Lawrence Cremen (1976) has thought long and caregully about what education is, bringing to bear on his analysis an extensive knowledge of the history of education, which is much more than a history of schools and what happens in them. Pressure of time in the writing of this paper is such that I have not been able to chek his wording exactly, but, as I understand him, Cremen defines as "education" all deliberate learning activities. This is a very broad definition, but it does not include all the processes of acculturation through participation -- in the home, at play, or at work -- in which that learning is incidental (at least in the perspective of the learner). In other workds, to avoid a definition so broad that it would include all learning, Cremen specifies an act of choice. I suspect that he would exclude from his definition the recalcitrant youth who sits in a classroom resisting all learning opportunities; there must be at least a modicum of readiness to learn -- not merely incarceration. Yet Cremin responded in the affirmative when I asked him (at a seminar in 1976) whether under his definition he would include as an "educational" choice a person's taking a job that had a large learning component, albeit at lower initial pay, in contrast to a "dead-end" job. Cremin's definition is wholly satisfactory for present purposes. But notice that it does not fit very well with most of the measures of education embodied in the labor force; those measures are extremely crude approximations to education as a learning activity.

This brings us to two major kinds of problems. One of these is the nature and extent of learning at work -- how much of that learning is deliberately undertaken simply by choice of job or employer and how much of it is more formal (even if "nonformal," in the latest lingo). Between informal learning at work and the formal school system are many educational programs whose contributions to development deserve more attention but which I have not attempted to discuss here. Important examples are SENAR in Colombia and various related programs that have developed in other countries. From my limited knowledge about SENAR and SENAT in Brazil, for example, I would guess that such programs, <u>when well designed</u>, could provide important leverage for the "enlargement, diffusion, and realization of opportunities." Research on these experiences has been going on, but I am not well acquainted with its progress; in my judgment such investifations should be of high priority for the Bank.

The other problem is, of course, the question of how much education goes on in schools and what contributes to greater or lesser learning. This is an <u>economic</u>, not "merely an educational," problem. In saying this I do not refer to the economic assessment of costs and benefits (or even of cost effectiveness). It is an "economic" problem in a larger growth perspective. It is not years spent in school that contribute to a person's productive potential; rather, it is what he learns in those years. Furthermore, the learning is not merely cognitive, of the sort measured by achievement tests; it is of many other kinds as well.

C. <u>Explaining and Describing versus Prescribing</u>

This paper is an overview of education and economic growth. That is not at all the same thing as an investigation into the benefits and costs of alternative investments in education (their substitutive and complementary aspects) or of investments in education as against alternatives. In other words, I am not directing this paper toward policy decisions; although I will make a few incidental policy-oriented observations, I do not prescribe actions or policies.

An assessment of contributions of education to economic growth does not in itself specify whether education to one level or another, in one form or another, is a sound investment, even in narrowly economic terms. It may be that a particular kind or level of education has made a major contribution to growth, but that the cost has been so high as to make the <u>net</u> contribution negative. Yet there may also be neglect of educational investments that seem to contribute only small gains to production, that cost little, and that provide large net benefits in the aggregate.

An assessment of the contribution of education to growth is thus just one side of a benefit-cost assessment. It is, however, an important component of such assessments. Moreover, in seeking to go beyond mere description or accounting to explanation and consideration of processes, I probe a little way into questions that are too often disregarded in attempts at formal benefit-cost analyses -- which usually lack the dynamic and longer-term perspective that a concern with growth or development requires. Furthermore, we may learn something useful even from the inadequacies and the seeming contradictions of growth economics in its treatment of the human factor.

II. DEVELOPMENT MAN AND INNOVATIVE CHANGE

The central theme of this section is the association among sources of innovative change and the formation of human resources capable of coping with change and of carrying the process forward. The discussion is divided into four parts: the qualities of men and women that will undergird and foster development; associations between research and development and human resources in industrial advance (limited to a few remarks on the insights provided by Ingvar Svennilson, 1964); some observations about the human factor in agricultural progress (treated much more fuly in Lockheed, Jamison, and Lau in this volume); and a few remarks about education and progress in small-scale enterprises.

A. Men and Women for Development

> The development and transmission of know-how, or practical ingenuity, and of intellectual skills are at the heart of economic development. These qualities are especially important for men who adapt to and participate in the implementation of technological and organizational change -- in contrast to those who carry on routine practices. Arrangements for the shaping of men to participate in change include schooling but go beyond it; they include diverse sorts of learning at work and the diffusion of know-how by migration.

These observations are from a paer (Anderson and Bowman 1976) first presented at the 1968 meetings of the International Economic History Association and are cited because they sum up, in a few words, diverse aspects of the involvement of human beings in economic development and of people's preparation for this participation. Furthermore, these views stress what is so often missed in more formal attempts to identify contributions of education to growth -- the continuous generation of successive disequilibria and adjustments to them. It is essential that we keep in mind that development is a dynamic and innovative process, that learning takes many forms, and that learning is a lifelong process.

Following up on these generalizations, I had occasion more recently to delineate what I called the attributes of "development man" and of "development woman," 1/ on which I draw here. Whatever the particulars of individual

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1/ See Bowman (1975). The analysis for women was elaborated in an unpublished lecture (1976).

capabilities, the essence of development men or women is a readiness and ability to adapt to change and to grasp or to create new opportunities. It may be helpful to distinguish further several kinds of capabilities within the wide range of development attributes.

1. The simplest of these is adaptability: the development of speed and efficiency in the acquisition of new skills or in the adoption of a new practice when what needs to be done is explained and demonstrated in unambiguous terms. This first modest but basic capability has received slow but increasing recognition in the modern literature on manpower planning as practitioners have come to confront problems of skill obsolescence and to take a somewhat more human view -- recognizing that in one way or another we are educating people, not producing skill packages to be employed and deployed in unchanged ways over an ensuing forty to fifty years. The formal pursuit of "recurrent education" is no substitute for initial learning to learn.

2. Development man also has a more active attribute: ingenuity in the creation of new opportunities or new ways of doing things in response to new opportunities. What is important in most developing countries today is not the giants of innovative entrepreneurship but the ordinary people whose ingenuity is challenged by new opportunities and who seek to overcome obstacles. This ingenuity may be in finding or creating ways to acquire skills when the more formal, generally visible channels are restricted and their gates crowded. Ingenuity may be exercised by a humble craftsman; it may consist in finding ways to overcome barriers to trade (including barriers imposed by governments); or it may entail a highly sophisticated redesign of production processes, marketing arrangements, or internal information systems for the control and monitoring of production in a large, complex enterprise. Clearly, the education or training needed for performance at these various levels of complexity can range from a preindustrial apprenticeship to the highest levels of schooling in accountancy and enterprise economics.

3. Just as category 1 shades over into 2, so do both of these (but especially 2, shade over into the third: efficiency in acquiring information and in its interpreation for allocative decisions. This is important whether the decision maker's domain is agriculture, nonfarm enterprise, or a household; whether in private, collective, or governmental agencies. This is the core of what T. W. Schultz has in mind when he speaks of the "ability to deal with disequilibria." 1/

Although everything said thus far could apply to women as well as to men, there are some important differences associated with the roles a society defines by sex and the degrees of sharing and flexibility in assignments of reponsibilities. Education (formal and informal) of women for

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1/ Schultz has used this phrase frequently, and the basic idea has characterized much of his work for fifteen years, appearing initially in his Transforming Traditional Agriculture (1964). The most systematic formal statement appears in his 1975 article on "The Value of the Ability to Deal with Disequilibria," Journal of Economic Literature, vol. 13, no. 3 (September 1975) pp. 827-46.

participation in development is meaningful only insofar as conditions permit women to apply capabilities and talents to facilitate change. This is true of men also, in that other supportive conditions must be present, but there are more constraints on women's options in most societies. For the general population of a developing country, acquisition of literacy may be even more important for women than for men. This is not just a question of equity or equilization of opportunity; it is a matter of the enlistment of half of the adult population in the process of development. Literacy among women may be especially important for two reasons. First, and most fundamental, is the fact that women rarely are full participants with men in the informal communication networks or "information fields" that could integrate them into the flow of ongoing societal change. Literacy, accompanied by at least some minimum of newspapers and other reading materials, is an indispensable window onto the surrounding, changing society. Second, without the support of this access to horizons beyond the household and without the local channels of informal communication among women, there is a tendency to a progressive drift of decision-making responsibilities away from women even within agriculture (and trade, where that has been a significant women's activity). In developing his theme of "ability to deal with disequilibria," Schultz stressed its applications to women as well as to men, and in the household as in other activities. Summing up his analysis, he observed that "...it is the wide array of effects of the education of females that the investors in education in the developing countries can ill afford to overlook" (Schultz 1974, p. 53). Among those diverse effects are improved nutrition and the "marked advantage that children derive from being reared in homes where mothers have this schooling."

B. Svennilson on Education, Research, and Industrial Progress

Ingvar Svennilson displayed an early alertness to the link between the roles of education and research and their joint, central place in economic growth. Although his orientation was primarily to the Organization for Economic Cooperation and Development (OECD) countries, his analysis has a wider application to processes of industrial development.

Svennilson's approach reflected in part his association with the creative contributions of the ex-ante, ex-post economics developed by the Stockholm economists in the early 1930s (which was, in turn, a creative flowering of Wicksell's economics among his disciples). Svennilson (1964) started with a theory of how "technical progress" enters into a growth process, distinguishing between (1) "F-type technical progress" (or regress) with changes in the efficiency with which inherited physical capital is deployed (and depreciated) and (2) "N-type technical progress," which takes place with new equipment. He argues that "...the N-trend is probably, on the whole, stronger than the F-trend. Most of the positive elements in the F-trend, such as increasing skill of the labor force and innovations of methods of operation, may be applied as new equipment and form part of the N-trend. On the other hand, the N-trend is not affected by the negative element in the F-trend (physical deterioration of equipment) and the N-trend alone is increased by innovations that are 'embodied' in new types of capital equipment." Building on this theoretical base, Svennilson saw education and research and development (R and D) as jointly underlying the growth process. Because his contribution to this sort of thinking is little known, I quote from him here at further length:

> Research that increases our knowledge makes education more effective, and education, if properly designed, increases the capacity for research and for absorbing the results of research in production. To distinguish the effects of education and research on "technical progress" may, therefore, be a problem that is difficult to solve. If a distinction can be made between the effects of education and research, it may, however, tend in the following direction.
>
> Education that is extended to the whole labour-force will -- again depending on how it is designed -- tend to improve the efficiency with which existing capital equipment is used and speed up the "learning process" that is included in the F-type of technical progress. Especially important is the education of "leaders" who may improve the "organization" of operations within the framework of existing plants....
>
> It seems, however, evident that most of the results of R and D can be incorporated in production only by investment in new capital equipment....To a large extent, an increasing supply of old or new types of education can...be effectively utilized only in combination with new equipment and with adequate technological characteristics. The efficiency with which this new equipment initially is used will depend on the complementarity effects of educated manpower. The experience and new knowledge gained in the "learning process" in old plants will also, at least partly, be transferred to new plants, providing a feedback effect on the initial efficiency of their operations. We cannot, therefore, reserve the N-type of technical progress as an exclusive domain for R and D. Education has, directly or indirectly, an effect on the technical progress connected with the accumulation of capital.

Svennilson's anlaysis must be understood in its European context, which included his opposition in the early 1960s to the opening of gymnasia and facilities of higher education in Sweden at that time, on the grounds that an increased flow of young people through these institutions would undermine the markets for their services. (As we know, the decisions in Sweden went the other way.) Nevertheless, his model--with its emphasis on the interdependence in growth among human resources (education), innovation, and investment in new physical capital -- fits the Japanese case well. What it misses is the extent to which Japanese schooling and skills supported adaptations of Western technologies to Japanese conditions by making major changes in those technologies and in product design. It ignores also the sources of agricultural progress in Japan and the effects of that progress on Japan's economic development generally. Kuznets, by contrast, has always emphasized the importance of abilities and incentives to innovate in applying ideas from the developed world to conditions in less developed nations; only then is a self-sustaining development dynamic for the Third World realized.

C. Agricultural Progress, the Human Factor, and Economic Growth

Complementing the sort of thinking exemplified by Svennilson and Kuznets are the insights with respect to development in the work of the two new nobel laureates, Arthur Lewis and T. W. Schultz. Both have been close to the experience of the developing countries, and both have stressed the importance of agricultural progress in those lands. Different as this emphasis may be from Svennilson's orientation to industry, there is a convergence nevertheless in the dynamic emphasis and the linkage of education and research in the analysis of development.

Starting from observations and an analytical model of a stagnant traditional agriculture, Schultz focused on farmers as decision makers and on the importance of agriculture for development. He respected the shrewdness of the peasant, but he sought clues to agricultural progress in two main directions: (1) effects of government policies on prices and availabilities of inputs and on prices of outputs, and (2) developmental research for agriculture, the transmission of its findings, and the ability of farmers to interpret and apply the results. It is in this last respect that mass education comes to play a crucial role. A number of investigations of the effects of education to one level or another on productivity in agriculture have followed, usually in analytical frameworks that have sought to identify the degree of complementarity of schooling with research and how schooling and extension services interact in the encouragement of agricultural progress. Since an overview of these studies by Lockheed, Jamison, and Lau is included in this volume, I will not go into this important subject in any detail here. Several observations, however, would seem to be in order.

First, the theoretical foundations of this work are rooted in analyses of decision making and the ability to allocate resources efficiently in situations in which opportunities are changing; it is what D. P. Chaudhri first called (in an unpublished manuscript, circa 1968) the "allocative effect" of education of farmers -- as distinct from the "worker effect" -- that is at the heart of the matter. Whether the analysis is based on observations for geographic units or for individuals, it is important to ask whether the populations studied had decision-making roles in agriculture.

Second, it is important in such research that precisely those variables that would be altered by the improvement in resource allocation not be entered as control variables. There are dilemmas in this problem, but, if we are to understand what is going on, the problem cannot be ignored.

Third, results may vary according to whether, at the time of a survey, there were available new processes and the seeds, fertilizer, and so on to carry the new knowledge into practice. Bruce Harker's study of Japanese farmers (1971) revealed this clearly in that the less educated farmers were just adoptng new varieties of rice adopted earlier by those with more education; the latter were moving into other ventures or adopting newer innovations. So far as I am aware, studies in developing countries have not provided quite that type of information.

Fourth, to the extent that farmers quickly imitate the successes of their neighbors, data on individuals will give misleading results unless they incorporate information about the timing and nature of changes farmers are making (or have made) in their practices. There are problems of another kind in using data for an aggregate of farmers in each geographic district, but such aggregates reflect the effects of the "informal extension service" that emerges when a sufficient number of farmers in an area are alert to new opportunities, are capable of interpreting new information, and thereby act as visible models to their neighbors.

Finally, because most measures of extension services are extremely poor, it is not surprising that the complementarity or substitutability between education of farmers and extension services has varied among studies or been ambiguous within them. There is a further consideration: who is contacted by extension agents in a given setting, and with whom do the agents most readily communicate? Equally important, do effects differ substantially according to whether the environment is one in which we can observe mainly the differences between illiterate farmers and those with, say, four or five years of schooling? Or is the comparison (as in Japan) between farmers with six to eight or nine years of schooling and those with secondary education (general or agricultural)?

D. Education and the Small Entrepreneur

With a few exceptions, the small entrepreneur's importance in economic development has been ignored until quite recently. Yet it is the growth of small into middle-size enterprises and the entrepreneurial energies of those who pursue these ventures that hold the promise for wide participation in sustained growth. This is not the place in which to discuss the reasons for this neglect in thinking except for one thing: it is much more difficult to pursue research on entrepreneurial education and to develop an extension service to encourage small enterprise than to do the same for agriculture. I discussed some of the issues relating to education for the furtherance of enterprise in the rural-nonfarm economy in my paper on "Rural People and Rural Economic Development" for the International Institute for Education Planning (IIEP) (October 1975); I will not repeat its arguments here. A large part of what I said then about the rural, nonfarm sector applies to small and middle-scale enterprises in urban areas as well.

One study that deserves more careful attention and is not generally available is T. K. Koh's study (1977) of the education, the formation of entrepreneurial competence, and the behavior of small entrepreneurs in Japan. That study is grounded in a solid analytical framework that incorporates analysis of determinants of selection of individuals into entrepreneurship and into types of entrepreneurial activity that are relatively demanding of adaptive skills and of the ability to make complex decisions in the face of uncertainties. Eudcation is seen to play a significant part in this selection (self-selection) process. The main emphasis of Koh's work, however, is on the relations among education, the communication network and information sources (formal and informal) of entrepreneurs, and innovative entrepreneurial behavior. "Innovation" is defined in Koh's work in reference to changes the entrepreneurs have made in one or another aspect of their businesses. Koh found distinctive patterns in the kinds of information sought in their sources according to both level of schooling and the type of secondary curricula that had been pursued. Schultz's theme of the "ability to deal with disequilibria" and the contribution of schooling to that ability was supported in detail that goes well beyond anything else I have seen.

Koh distinguished three broad types of "dimensions" of innovation (p. 204): "(1) The 'technical' innovations subsumed all changes in products or services or in equipment, handling procedures, and production techniques generally; (2) under 'marketing' were included changes in customer relations, sales promotion, and ways of marketing; and (3) the 'organizational' dimension covered changes in structure of the firm, new internal control systems, substantial changes in personnel policies, or schemes for training." About half of the entrepreneurs reported making at least one innovation; these were designated "innovators." Almost all the innovators reported more than one change in a given dimension, whereas a small proportion made changes in more than one of the three broad categories. The proportions reporting changes of types 1, 2, and 3 were, respectively, 30, 4, and 22 percent. The better-educated heads of firms were the more innovative. However, given that virtually all Japanese entrepreneurs, even the smallest, had completed eight or nine years of schooling, the incidence of type 1 (technical) innovations seemed not to depend much on differences in schooling of the head of the firm -- which means also that, in the Japanese setting, it did not depend on having received technical training in school. Organizational innovations and (to a lesser extent) those in marketing tended to be made by better-educated entrepreneurs. Koh sums up: "the three dimensions of innovation exemplify three levels of sophistication in entrepreneurial response to a dynamic situation, the amount of managerial skills varying with the level."

Koh's findings are consistent with other studies of entrepreneurial development, even though they are also affected, of course, by the distinctively favorable environment and general human-resource base in Japan. Richard and Doris Taub (1974) have laid out clearly the problems for entrepreneurship of limited education and the difficulties encountered in efforts to help small entrepreneurs who lacked the schooling needed to acquire and interpret information. Further insights emerge in the pages of Kilby's Entrepreneurship and Economic Development (1971). There undoubtedly are other sources of importance for understanding this set of problems, but I have not searched such literature systematically.

In reading the results of more aggregative studies, and also of the various "rate-of-return" investigations of education, it is important that we continuously remind ourselves of the systematic bias, in much of this work, against the inclusion of returns to education in nonwage activities. Most of the rate-of-return studies are based on data of wage and salaried persons only. No one knows how much of a contribution to growth may derive from a better-educated population of independent entrepreneurs.

III. WHAT SCHOOLING DOES: SOME MICRO PERSPECTIVES AND THEIR SOCIETAL COUNTERPARTS

Most studies of growth have been highly aggregative in the domain of macroeconomics. The growth-oriented work in agricultural economics is probably the most important exception. Nevertheless, estimates of rates of return to investments in schooling frequently have been cited as evidence for the contributions of schooling to growth, and essentially such figures (more accurately, earning ratios by education) have been incorporated in both national-income and aggregate production-function assessments of the sources of growth in national incomes. Yet rate-of-return analysis in education had its roots in the microanalysis of investment decisions -- decisions of individuals (or families) to invest in education. Debates then arise about what schooling in fact does, about how far it accounts for differences in earnings and in what way, and about discrepancies between private and social costs and returns. What is concealed? What is distorted in observations about individuals, their schooling and their behavior, even if earnings are set aside? There is a miscellany of topics that calls for some attention here. Before addressing them, a few remarks of a more general nature are in order.

A. Human Resources and the Socioeconomic Environment

Unfortunately, some of the more important generalizations that can be justified have become linked recently to political-ideological debates with which they have little intrinsic connection. With that warning, I suggest four perhaps obvious, but certainly nontrivial, postulates.

(1) Motivations and perceptions of opportunities are important factors in learning, in addition to their significance with respect to school continuation rates, choices among types of schooling, and the extent and nature of out-of-school learning (even during the school years). Children are not just passive raw material being processed in educational factories, even when rote learning seems to be the order of the day. Perceptions of opportunities and associated motivations are usually more rational than the pronouncements of many so-called experts might suggest. Svennilson (1964) was careful in the passages quoted earlier to introduce caveats at each reference to what schoolng or education might do (depending on its "design"), but he was also shrewd enough, for example, to avoid becoming specific about curricula.

(2) Development of innovative behavior is a function of entire systems of opportunity and career patterns and of participation in enterprising endeavor. This goes beyond the usual conception of input-output relations to other dimensions of complementarity and to negative as well as positive inputs into human development. Schools that demonstrate innovative behavior are rare indeed, but perhaps that is not what is most important for the development of innovative performance later on.

(3) Once a foundation in basic skills is assured, what education can and will contribute to economic development in the developing countries may depend as much on economic as on strictly educational policies -- at least if

the latter is defined narrowly, to refer only to schools. To say this is not to downgrade the importance of secondary and higher education; rather, it is to emphasize on the one hand that people respond to opportunities in their educational, as in other, decisions and, on the other hand, that the effective utilization of human resources requires policies that complement those in education. Too often we think of adapting education to the economy; too rarely of how the economy can better use (and in the process further develop) the available human resources.

(4) The most fundamental contribution of schooling to the economy is unquestionably in the inculcation of basic general skills and the acquisition of at least a modicum of mastery in their independent application. In no other sphere is the comparative advantage of school relative to other agencies or avenues for learning so unquestionable and the situation of other agencies for most people so difficult.

B. Literacy

I come first, then, to literacy and its wide spread among a population as a foundation for economic progress that extends to the populaton at large. Both cross-national comparisons (discussed further in Section IV) and historical studies underline the importance of literacy. Case studies of communities, families, and individuals -- including the use they make of literacy (and the conditions under which, unused, literacy lapses) -- support the statistical evidence and strengthen it. Literacy enters into development not simply by employment in activities that obviously require the ability to read and write. I take the liberty to reproduce here some excerpts from three paragraphs in which C. A. Anderson and I (1976) addressed questions to historians, challenging them to pursue some of these matters further. The same questions could be posed in slightly modified form to those interested in developing countries at the present time.

> Not uncommonly, a historian will remark that "there was a demand for people to keep accounts and toconduct commercial correspondence." But would this demand have added up to even a third of the work force? How many literate men, if any, came to be needed as manufacture grew in importance? Perhaps the needed initial increase in the proportion of literate men (among nonpeasant workers) was not large in those countries first to industrialize. The increment may be larger, however, for countries now striving to build on new technology for economic growth. Does the size of this incremental demand for literacy reflect the comparative weight of "collectivized" direction over the economy? The important element may indeed be more organizational than technological. But the organizational transformations are of several kinds. While reorganization of production, transportation, and trade both foster and presuppose literacy, the total number employed as scribes and bookkeepers may tell us more about political bureaucratization than about innovative progress in the organization of economic life.

A second set of hypotheses arises when we focus more upon diffusion of reading ability than on ability to write and to cipher. Where ability to read is widespread, diversification of channels and media for communication ensues. As economic transactions ramify and accompanying organizations become more extended, the volume of depersonalized transmission of information expands. Literacy facilitates the storage of information in many forms accessible to ever larger proportions of a population. Practical handbooks were prominent among the early products of printing. Less often noticed by economic historians, pamphlets and books about strange and different places (often imaginary) found ready sale. The wearing away of provincialism through reading about life in exotic circumstances surely strengthened orientations toward the nonlocal aspects of economic affairs that constitute a vital part of any commercial revolution. For some countries one must emphasize religious motives for becoming literate; a map of vernacular versions of the Bible resembles a map of early modern centers of trade.

Almost every effect of literacy includes an element of change in men's perceptions of the alternatives in action that are open to them. Literacy contributes awareness of nonconventional and nontraditional possibilities -- of ways to do things -- including other kinds of jobs or careers than kin or neighbors have followed. Even old lines of work become changed because literacy (and other components of the three R's) brings accessibility to the store of how-to-do-it handbooks. In tracing out any of these effects from education one need not try to determine whether literacy was "required" for the job. Even meager schooling can affect the kinds of job a man seeks....Literacy fosters, but is not essential to, adaptability to changes introduced by employers or by innovative competitors. Undeniably, these change-fostering traits are displayed only weakly by most literate men, just as most university graduates do only a modest amount of hard reading in leisure hours. But elementary (and, in due course, secondary) schooling enlarges the number of individuals who can play at least a corporal's role in economic development.

As Adrian Wood has pointed out (and as T. W. Schultz and others have emphasized in other connections), the way we measure growth causes an understatement of the contribution of education to material well-being because it neglects the ways in which education increases productivity in the home -- or for that matter in all nonmarket production. This bias affects assessments of contributions of education at all levels, but here we are talking about literacy. In Wood's words (remarking on an earlier draft of this paper), "if people have a sufficient command of literacy and can read pamphlets telling them how to build better cooking stoves, or thatch their huts better, or heat water with less fuel, they are unquestionably better off in a material sense."

sense." They are also better off nutritionally and in health status when literacy fosters the transmission and understanding of sanitary practices and improved diet (or treatment of given foods). This latter effect has been documented by international studies, some of which are noted in Section IV.

C. The Education Mix and Rates of Return

Estimates of rates of return to investment in primary, secondary, and higher education are frequently cited to indicate the contributions of education to economic growth. George Psacharopoulos (1973) has collated available estimates (and has brought them as closely as possible into conformity with one another) for thirty-two countries at diverse levels of economic development. He shows estimates of private and of social returns separately; the latter include public subsidies in the estimates of costs, whereas the private rates do not. His findings on these rates are reproduced in Table 1, along wiht a column on per capita income in 1968 and one on agriculture as a percentage of gross domestic product (GDP) in that year. What interpretation can we give to these estimates for analysis of growth? Several points must be emphasized.

(1) First of all, observations of differences in earnings by level of schooling are always indicators of returns at the margin, given the state of the economy, the educational composition of the labor force, and the substitution elasticities among skill levels as measured by schooling. This means that the estimates of differentials in earnings are conservative indicators of what the schooling component of human capital has contributed to gross national product (GNP), but that they are not conservative estimates for the same country in the future <u>unless</u> -- and this is important -- there is good reason to expect rising demands for better-qualified people.

(2) Questions may be and have been raised, however, as to how far observed differences in earnings between persons with different levels of educational attainment should be attributed to education and how far to other factors. Most frequently cited as presumptively causing upward biases in the estimates are "ability" and parental socioeconomic status. Recent studies for the United States have given mixed results, reducing estimated rates of return for college graduates who were students a generation ago by anywhere from 5 to 35 percent, but most evidence points to a figure around 10 percent -- much lower than the 40 percent downward adjustment Denison made in the 1960s and that has been followed by many of those on whose work Psacharopoulos drew. For less developed countries, information is scanty -- although some years ago Martin Carnoy (1967) demonstrated that for Mexico a downward adjustment on account of family background would be inappropriate. It is unlikely that such adjustments would be needed or appropriate for most of Africa, but it is likely that substantial adjustments might be needed in some developing countries (Colombia, for example). In any case, more serious, especially for interpretation of rates of return to primary schooling, is the confounding of income data for rural and urban residents.

RATES OF RETURN TO EDUCATION, PER CAPITA INCOME IN 1968,
AND SHARE OF AGRICULTURE IN GROSS DOMESTIC PRODUCT (GDP) IN SELECTED COUNTRIES

				Rates of Return by educational sector and level					
				Social			Private		
Country	Per capita income (US Dollars)	Agri-culture's share in GDP (%)	Year	Pri-mary	Secon-dary	Higher	Pri-mary	Secon-dary	Higher
Sweden	2,500	6.0	1967	...	10.5	9.2	...	...	10.3
Hawaii	2,495	NR	1959	24.1	4.4	9.2	100.0	5.1	11.0
U.S.A.	2,361	4.0	1959	17.8	14.0	9.7	155.1	19.5	13.6
New Zealand	1,931	NR	1966	...	19.4	13.2	...	20.5	14.7
Norway	1,831	8.2	1966	...	7.2	7.5	...	7.4	7.7
Blegium	1,777	5.5	1967	...	...	9.3	...	...	17.0
Canada	1,774	6.1	1961	...	11.7	14.0	...	16.3	19.7
Great Britain	1,660	3.3	1966	...	3.6	8.2	...	6.2	12.0
Denmark	1,651	12.3	1964	...	...	7.8	...	...	10.0
Netherlands	1,490	8.3	1965	...	5.2	5.5	...	8.5	10.4
W. Germany	1,420	5.0	1964	...	...	...	...	...	4.6
Venezuela	776	7.2	1957	82.0	17.0	23.0	...	18.0	27.0
Puerto Rico	761	12.4	1959	17.1	21.7	16.5	100.0	23.4	27.9
Israel	704	13.5	1958	16.5	6.9	6.6	27.0	6.9	8.0
Greece	478	25.6	1964	...	3.0	8.0	...	5.0	14.0
Japan	464	14.3	1961	...	5.0	6.0	...	6.0	9.0
Mexico	374	18.0	1963	25.0	17.0	23.0	32.0	23.0	29.0
Chile	365	12.6	1959	24.0	16.9	12.2	...	...	...
Colombia	320	30.5	1966	40.0	24.0	8.0	50.0	32.0	15.5
Malaysia	280	28.3	1967	9.3	12.3	10.7	...	...	...
Brazil	261	27.0	1962	10.7	17.2	14.5	11.3	21.4	38.1
+Philippines	250	32.4	1966	7.0	21.0	11.0	7.5	28.0	12.5
Ghana	233	33.7	1967	18.0	13.0	16.5	24.5	17.0	37.0
Thailand	150	NR	1970	30.5	13.0	11.0	56.0	14.5	14.0
S. Korea	146	NR	1967	12.0	9.0	5.0	...	...	...
N. Rhodesia	144	NR	1960	12.4	...	...	...	...	...
Kenya	111	34.6	1968	21.7	19.2	8.8	32.7	30.0	27.4
Uganda	84	59.4	1965	66.0	28.6	12.0	...	...	...
Nigeria	75	55.6	1966	23.0	12.8	17.0	30.0	14.0	34.0
India	73	51.3	1960	20.2	16.8	12.7	24.7	19.2	14.3
Turkey			1968	...	...	8.5	...	24.0	26.0
Singapore			1966	6.6	17.6	14.6	...	20.0	25.4

Note: NR, not recorded; ..., no data.

Source: Psacharopoulos (1973), pp. 62, 85, 189.

The other principal arguments concerning bias in attributing observed differentials in earnings to schooling cluster around one version or another of the "screening hypothesis," which I discuss separately in Section III.E, below.

(3) A societal interpretation of rates of return to education assumes that wages are a reasonable approximation to the value of the marginal product for the average individual (not for each individual) in each education category. Whether this is a stronger assumption than the assumptions of national income accounting depends on whether there is systematic bias in the wage payments to graduates of different levels of education. This may be the case especially where, as in some developing countries, a large majority of college gaduates are employed in the bureaucracy. I see no systematic distortion on that account in Psacharopoulos' material.

(4) Rates of return are systematically lower than rental-to-cost ratios because of the limited span of working life, but the appropriate measure for growth accounting is an undiscounted value of education's contribution in each year as it becomes a present year.

(5) Furthermore, we must distinguish between analysis of what education contributes to growth and the benefit-cost balance of educational investments. What Psacharopoulos' rate-of-return data tell us, accepting them at face value, is the real interest rate up to which investment in the specified increment of education would be worthwhile. If rates of return in alternative investments (educational or otherwise) fall short of the social rate in his table, a favorable educational investment is signaled.

Associations between social rates of return to secondary (or to higher) education and per capita income are easily seen by running one's eye down Table 1, which I have organized in rank order by 1968 per capita income. It should come as no surprise that high rates of return tend to characterize the poor countries. Rates of return to education can be closely approximated (high direct outlays aside) by wage ratios controlling for age. The high social, as well as private, rates of return to secondary education in most of the developing countries tend to dampen those to higher education, since earnings of secondary school graduates are the base from which returns to higher education are measured.

Overall, it is my judgment that, despite imperfections, these figures should be taken seriously in any assessment of the importance of secondary education for the countries involved. They tell us nothing, however, about the kinds of secondary education that may most deserve support.

D. Assessing the Roles of Vocational Schools in Growth

Virtually all schools are vocational in that virtually all contribute to the productive potentials of their students, whether at work or in the home. The general academic schools are as "vocational" in this sense as trade or technical schools or those offering commerce curricula. What differentiates vocational schools, in the usual usage of that term, is their focus on preparation for a more delimited set of occupations. Also, the term "vocational" usually refers to schools at middle or intermediate levels; such schools often do not prepare youth to enter careers that are open ended. But to pose a dichotomy between "vocational" and general schools is far too gross an oversimplification for any practical purpose. Vocational schools are extremely diverse in the kinds of skills they teach. Indeed, a first obvious and crucial distinction is that between the commerce courses and instruction in manual and technical skills, with multiple distinctions among the latter. Vocational schools are extremely diverse in the levels they address. They differ in the extent to which curricula include general components (such as skills in language and mathematics) that have a wide applicability along with skills specialized to particular occupations. They differ in the duration of courses and in the quality of instruction at any given level (including the amount of misinformation imparted). They differ substantially in costs of instruction per student. There can be no valid generalizations about the net contributions of vocational education to economic growth. There can, however, be generalizations about criteria in the public provision of opportunities to acquire vocational skills.

The first steps in setting out such criteria must be to ask two broad questions: (1) how do we determine which skills are needed to further economic development, and (2) what are the most effective ways to develop those skills? Of these closely related questions, it is the first that has been posed by manpower planners (discussed in Section V), although manpower planners have not generally appreciated its relationship to question 2. The second question is closely related to the discussion of on-the-job learning and training (see Section VIII). I forgo formalization of the analysis in favor of a few summary observations.

(1) There are good economic reasons why the teaching of basic language and mathematical skills has been universally a function of agencies set up for instruction -- what we call "schools" (I assume we are talking about situations in which literacy has been extended beyond a tiny fraction of the population). By contrast, specialized skills have historically been more often acquired through formal or informal apprenticeship.

(2) There is also a sound economic logic -- from a societal, not merely a private, point of view -- to the fact that commerce schools spring up quickly where private provision is permitted and demand for their services exceeds places provided for these services in the public institutions. This is a comparatively low-cost education, with relevance across most industries and types of employers; moreover, it is a broad avenue into the "modern sectors" of the economy.

(3) Attempts to prevent transfers from technical-vocational schools into higher levels of education of other kinds are almost always misguided. Where many individuals try to make such moves, these moves signal one of two things: (a) the subsidies to the technical schools are wasteful, since many students are simply using those schools as second-best (but publicly expensive) ways of moving up the educational ladder, or (b) individuals are choosing to add further general skills that can enrich their capabilities in the deployment of their technical proficiencies. The first situation was stressed by Foster

in his "Vocational School Fallacy." It may be associated also with dysfunctional controls in the labor markets. An approximation to the second situation was documented by Puryear (1974) for Colombian youth who pursued further education after completing a period of technical-manual training in SENA. There unquestionably are many other examples.

(4) The complementarity of learning in general and in trade schools, as in school and at work, should not be underestimated. By the same token, neither is it automatically a sign of malallocation of educational resources when the students who take short courses in a trade school turn out to have attended general secondary schools, whereas the planners had intended the trade schools to serve primary school graduates. These secondary school youth in short-course trade schools may serve the economy well as small-scale entrepreneurs, and their total learning is likely to cost much less than that provided in full technical-secondary education.

None of these observations says anything directly about high-quality, full-term technical schools at the secondary level. That omission is deliberate, since I would approach such decisions on a case-by-case basis with a cold eye for their costs and some concern about how education is serving the small-enterprise sectors of the economy.

E. Learning or Certification?

During "teach-ins" accompanying the 1968 sit-in of students at the University of Chicago, one group of graduate students, in their recommendations for university reform, suggested three kinds of Ph.Ds: one in theory, one in research, and one in "activities." The distinction between the doctorate in theory and the one in research was shocking, of course, but the inclusion of the doctorate in "activities" surely is "certificitis" carried to a point of madness. It is as though the world were the university, and no man could learn, or at least no one could get a "decent" job, except under the seal of that institution. It is a sad commentary on the lack of independence of these students that this recommendation to stretch university credentialling was made in the midst of protestations that there should be no grades and few, if any, degree requirements.

In fact, we are fortunate in the United States in the relative looseness of the educational system and the minimal emphasis, compared with most other countries, on certification and examinations. It is arguable, at least, that we have gone too far in this direction, especially in the lower and secondary schools. At the other extreme -- as Ronald Dore (1976), among others, has said -- are the serious cases of the "diploma disease," most intense perhaps in Sri Lanka and in Japan. But why do I bring this topic up in an essay on economic growth? The reason is its close association with arguments about "screening" on the one hand, but the topic's quite different association with economic growth processes on the other.

The "screening hypothesis" has been propounded primarily as an attack on theories of human capital applied to societal, as distinct from individual, evaluations of the benefits and costs of education. The most extreme assumption, presented in an abstract model by Kenneth Arrow (1973) was that education (meaning schools) contributed literally nothing to capabilities for productive activity: what it did was to sort people out according to traits that ensured their high productivity even without the schooling (or the increment of schooling) under review. By this line of reasoning, differentials in earnings associated with schooling said nothing about any contribution of the schooling to the social product even though the schooling might still be a good investment from the point of view of the individual. In a complex economy, the school might make some positive net contribution to the national product through its services in providing information that favored better allocation of human resources. But, if this extreme assumption held, then neither rate-of-return analysis nor any of the aggregate indicators of educaton's contribution to growth were justified for societal assessments, since all these make use of observed wage rates as rental values (with or without adjustments, such as Denison made, for "ability"). Most of those who have argued the "screening" case have not gone to the extreme of Arrow's abstract exercise, nor would Arrow defend it as a realistic depiction of what happens over the college years to which he applied it.

In dealing with this subject on another occasion (Bowman 1976), I found it useful to set out the following possibilities.

(1) Education affects earnings wholly through what it does to increase abilities or aptitudes as we measure them.

(2) Education affects earnings entirely through the ways in which it changes people, but our measures of the changes are grossly inadequate. There are two further variants: (a) education increases productive potential for everyone, but we just are not measuring this successfully; (b) schools have perverse, distorting effects on the more disadvantaged individuals, depressing their ambitions and self-images -- other individuals (and those who remain longest) are oriented in attitudes and in personality to success (this theme was first elaborated by Gintis, 1971).

(3) Education acts in large part as a screening device. Here we have three main variants: (a) labor markets are open and there is effective wage competition, but information is costly (the 1973 Arrow model); (b) as in (a), employers are rational but there is little wage competition -- instead there is queuing for jobs, and one's rank in the queue is determined by schooling; (c) human resources are allocated in the interests of a managerial elite (sometimes "capitalists"), and schooling is used to sort people out for entry into segmented labor markets.

Case 1 can be valid for the United States at least (and presumably elsewhere as well) only if we measure the aptitudes by an ultimate dependent variable -- say, earnings. We have evidence from longitudinal studies of individuals that knowing an individual's schooling predicts his earnings better than knowing his measured ability or cognitive knowledge alone. Case 2, variant (a), gives essentially the same result, but this time with an explicit assumption that schooling is operating on earnings through effects on people that have not been identified or measured. If we accept case 2, variant (b), we must assume that schooling to lower levels actually depresses the earnings of students who do not continue, thereby exaggerating differentials between the productivities of those who continue to higher levels of education and those who drop out early and distorting (in favor of schooling) assessments of schooling's contribution ot the national product. To me this is not a plausible assumption.

Case 3, variant, (a) has already been discussed. It does not distort the wage measures of productivity, but it implies that we are attributing to schooling more than the schooling has in fact contributed to that productivity. Case 3, variant (b) -- best represented by Thurow (1972, 1975), turns out to be much the same in its implications as variant (a), providing the sorting entails a selection process associated with ability to perform. Such an implication is built into Thurow's version of it when he argues that the queuing selects for ability to learn quickly and efficiently on the job. Yet Case 3, variant (b), implies rigidity in the economic structure that, inhibits efficient resource allocation through wage adjustments. Case 3, variant (c), is ambiguous in its implications for growth measurement because it has no economic rationale other than the exercise of power and exploitation.

Before taking a position regarding the relative learning and screening roles of schools, or the situations in which there may be some perverse effects, it may be well to look once more at the "certificitis" (my 1970 label) or the "diploma disease" (Dore's 1976 label) syndromes. No one can argue very persuasively that Japan's emphasis on examinations had led us to overestimate the contributions of education to growth in that country. Whatever the strains and the waste that may have been associated with "the examination hell," the schools of Japan have been eminently successful, by all available measures, in transmitting skills of a high order -- including problem-solving skills -- and those skills are being utilized, whether in the labor market or in the home (with the preparation of each oncoming generation). What does happen is a sorting out by cliques in the higher institutions, with effects upon the careers of those involved. Level of education does not act as a screen or establish queues, but this process does occur as between institutions at a given level. Overall, that sort of screening does not distort aggregative measures of the contributions of education to growth. Neither, I am prepared to assert, do we get such distortions for the United States, or for that matter for India. The problem for the analysis of economic growth brings us back to the importance of looking at particular cases if we are to understand them, even though in doing so we need a broader background to give us perspective.

F. The Educated Unemployed

What can we say about the incidence of unemployment, its relation to schooling, and the implications for assessing the role of schooling in economic growth? Here the distortion in aggregative estimates of contributions to growth may be much less than sometimes is supposed -- although there may be significant distortion in social benefit-cost accounting if it is taken over without adjustments from the private benefit-cost estimates. This matter has been discussed many times by others (most notably, perhaps, by Blaugh, Layard, and Woodhall 1969). In aggregative models the better-educated people who are delaying commitments to jobs while searching for better opportunities (having greater incentives to do so and family support while waiting) are not counted in the labor force; in that respect they are in the same situation as those still attending school. This reduces both the number of workers and the count of incremental earnings that would be associated with their employment (and will be so associated later on). The same argument applies with respect to rural migrants to the cities who wait in queues to get jobs in the modern sector. The economy loses their forgone production in the countryside while they wait for urban jobs. Actually, we are likely to get an undercount of their product, since most of what they do in the informal sector of the urban economy may be missed. On a long-term, lifetime basis we come out with the right estimates of inputs into the economy in both cases -- that of the migrants and that of those with higher education. What we do not do, with or without unemployment, is to subtract -- from our count of what education contributes -- the forgone earnings while attending schools (or while waiting for a job). Once again, what education contributes to growth is not the same thing as assessment of net benefits over costs; it is not, in other words, a sufficient basis for decisions.

IV. CROSS-NATIONAL COMPARISONS

Cross-national comparisons have been used in a number of different ways to gain insights into the associations between education and national economic performance. I consider three such comparisons here: (1) simple and multiple correlations among measures of educational attainment in the aggregate and per capita incomes, with or without controls for other variables; (2) attempts to specify the extent to which human factors might explain gaps in per capita income between the United States and other countries (at a time when the highest per capita income was in the United States); (3) attempts to incorporate basic needs or socioeconomic indicators (health and literacy, for instance) in the examination of relations between the fulfillment of such needs and economic progress. Discussion of the use of international comparisons in attempts to identify manpower requirements for attainment of higher levels of per capita income is deferred to Section V.

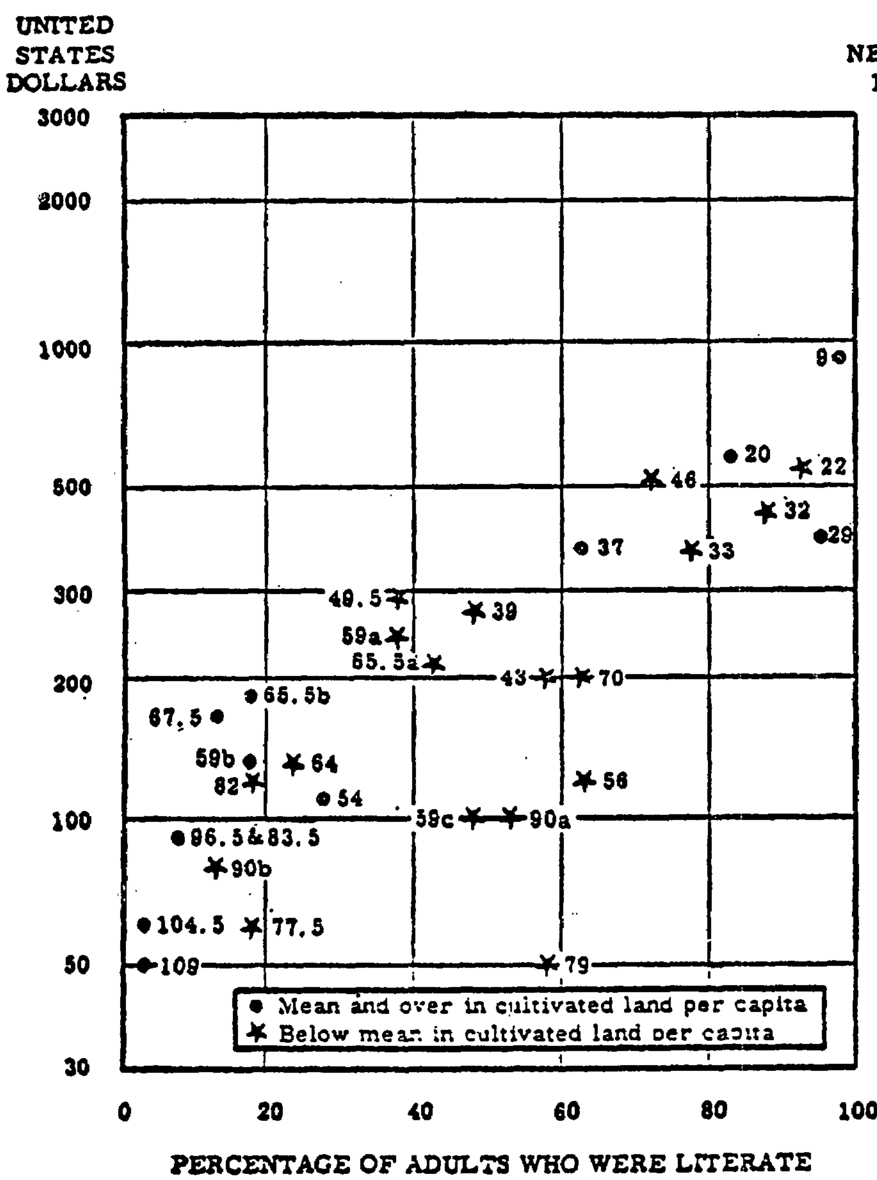
A. Cross-national Comparisons and Educational Lead and Lag

The first cross-national comparison of educational attainments with per capita income that went beyond simple cross-tabulations with literacy was, to the best of my knowledge, a 1961 essay that was published in 1963 (Bowman and Anderson 1963). That study examined countries in each of three world regions separately, with and without controls for energy potential and proportions of the population engaged in agriculture. The relations within world regions were of quite different patterns, but two conclusions stood out clearly. First, a threshold effect of something like 40 percent adult literacy was a necessary but not sufficient condition for attainment in 1950 of per capita incomes above US$200; with the exception of Puerto Rico (with its special commonwealth relationship with the United States), it was only when literacy rates exceeded 80 percent that per capita incomes surpassed US$500 without benefit of income from rich petroleum fields. This pattern showed up most clearly in a chart referring only to countries in the middle third of our measure of energy potential. I include here the three charts (Figures 1-3) we initially constructed to illustrate this point; the individual countries are identified by number, with information also given on their rank in daily newspaper circulation per thousand people. Notice that in the chart for the

Figure 1

GROSS NATIONAL PRODUCT PER CAPITA, 1955 (IN UNITED STATES DOLLARS) AND PERCENTAGE OF ADULTS WHO WERE LITERATE, 1950*

LOWEST THIRD OF COUNTRIES IN ENERGY POTENTIAL



RANK IN DAILY NEWSPAPER CIRCULATION PER 1000 POPULATION (N=112)

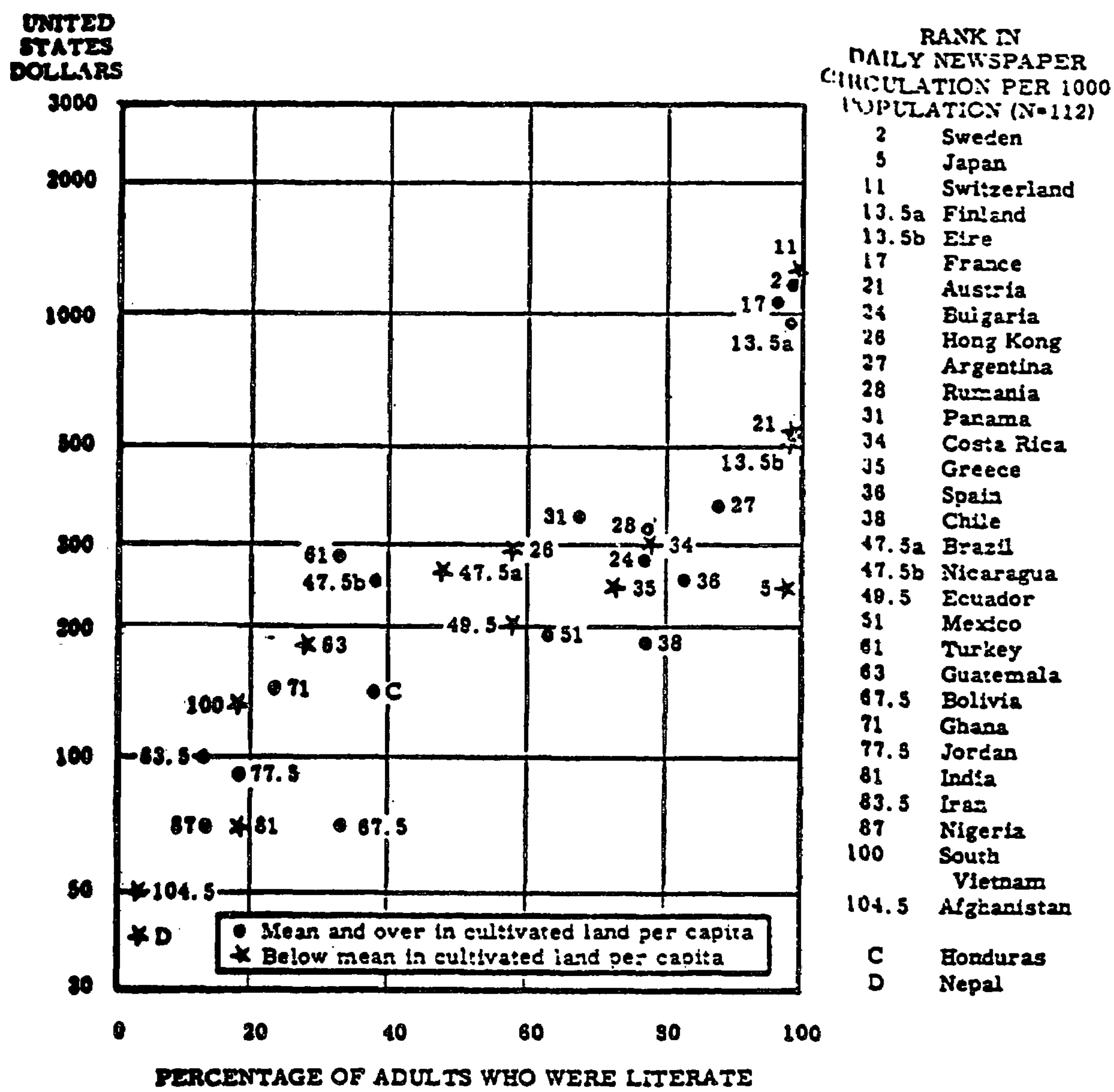
9	Denmark
20	Uruguay
22	Israel
29	Hungary
32	Italy
33	Cuba
37	Cyprus
39	Lebanon
43	Portugal
46	Puerto Rico
49.5	Malaya
54	Syria
56	Ceylon
59a	El Salvador
59b	Tunisia
59c	Taiwan
64	Egypt
65.5a	Dominican Republic
65.5b	Algeria
67.5	Morocco
70	Phillipines
77.5	Pakistan
79	Burma
82	Indonesia
83.5	Libya
90a	Thailand
90b	Haiti
96.5	Sudan
104.5	French West Africa
109	Ethiopia

*Data Source: Norton Ginsburg and Brian Berry, Atlas of Economic Development, 1961

Figure 2

GROSS NATIONAL PRODUCT PER CAPITA, 1955 (IN UNITED STATES DOLLARS) AND PERCENTAGE OF ADULTS WHO WERE LITERATE, 1950*

MIDDLE THIRD OF COUNTRIES IN ENERGY POTENTIAL

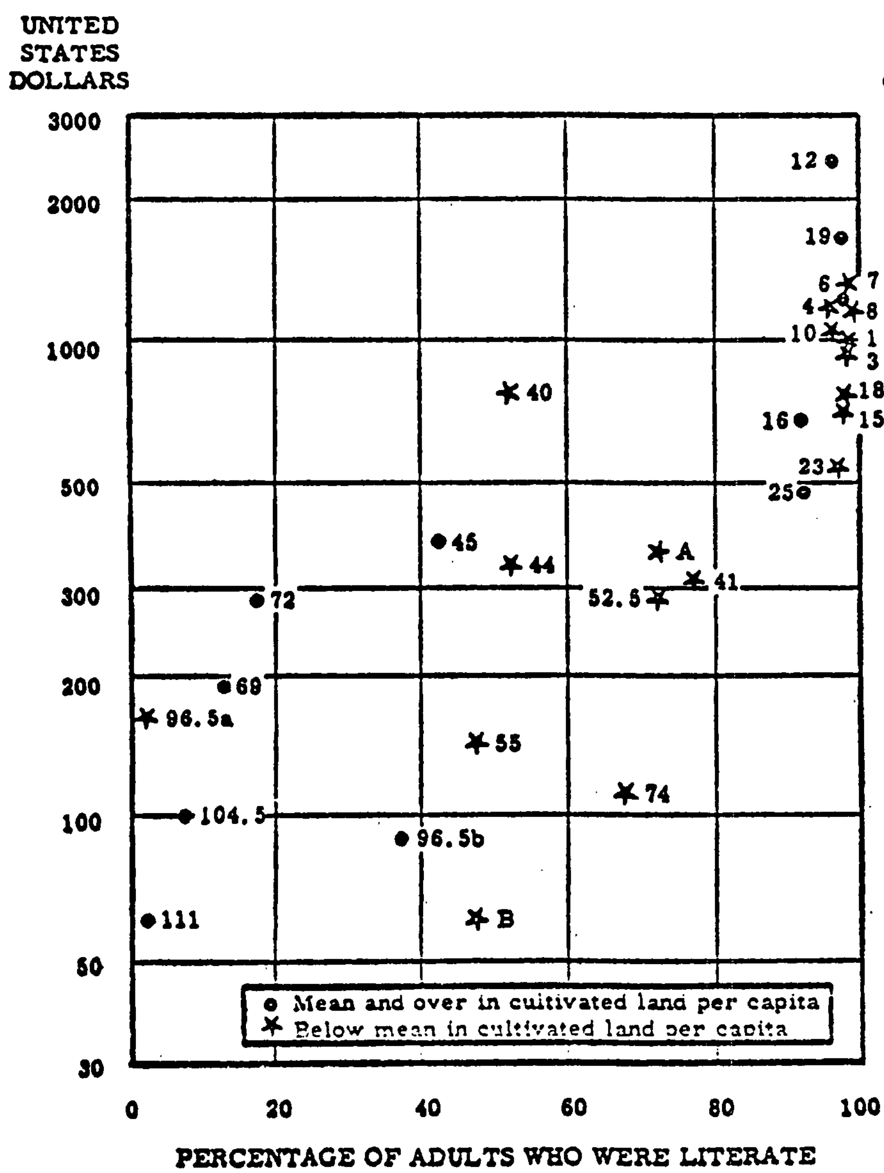


*Data Source: Norton Ginsburg and Brian Berry, Atlas of Economic Development, 1961

Figure 3

GROSS NATIONAL PRODUCT PER CAPITA, 1955 (IN UNITED STATES DOLLARS) AND PERCENTAGE OF ADULTS WHO WERE LITERATE, 1950*

TOP THIRD OF COUNTRIES IN ENERGY POTENTIAL



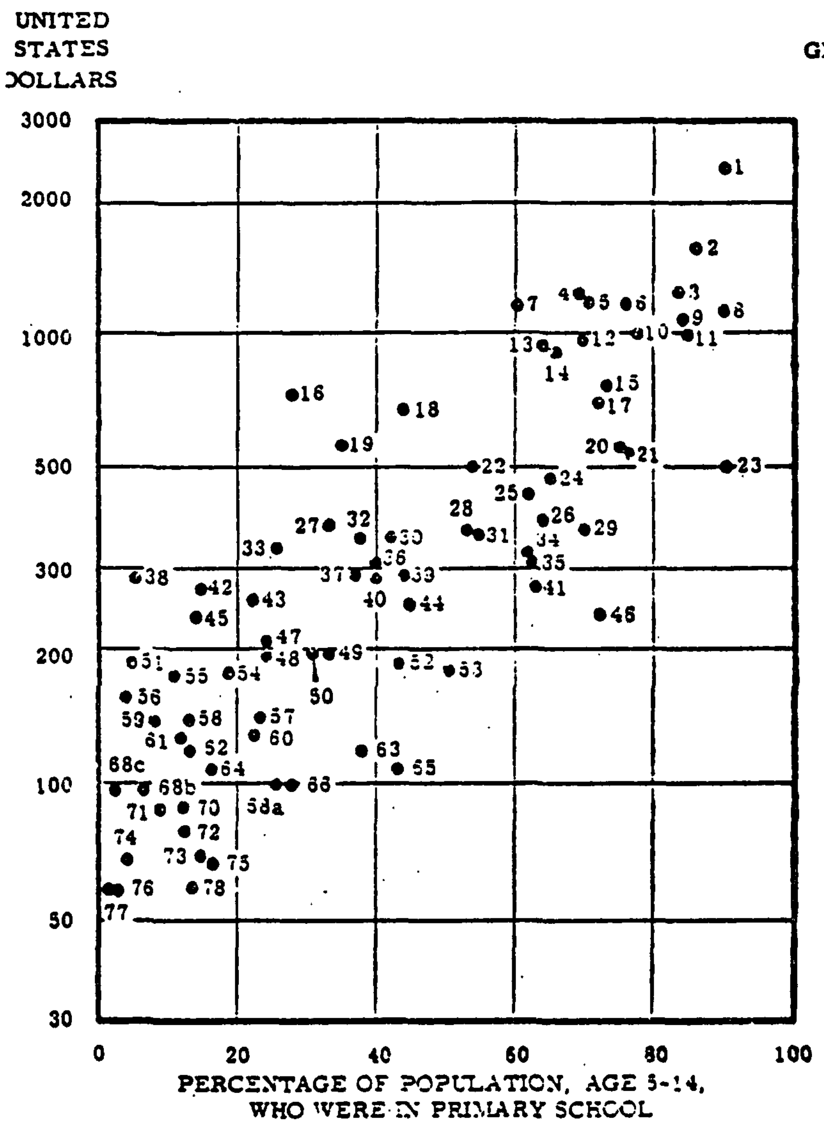
RANK IN DAILY NEWSPAPER CIRCULATION PER 1000 POPULATION (N=112)

1	United Kingdom
3	Norway
4	Luxembourg
6	Australia
7	New Zealand
8	Iceland
10	Belgium
12	United States
15	Netherlands
16	Soviet Union.
18	West Germany
19	Canada
23	Czechoslovakia
25	Poland
40	Venezuela
41	British Guiana
44	Columbia
45	South Africa
52.5	Yugoslavia
55	Peru
69	Iraq
72	British North Borneo
74	Paraguay
96.5a	Saudi Arabia
96.5b	Belgian Congo
104.5	Liberia
111	French Equatorial Africa
A	Surinam
B	China

*Source: Norton Ginsburg and Brian Berry, Atlas of Economic Development, 1961

Figure 4

GROSS NATIONAL PRODUCT PER CAPITA, 1955*(IN UNITED STATES DOLLARS) AND PERCENTAGE OF POPULATION, AGE 5-14, WHO WERE IN PRIMARY SCHOOL, 1950**



RANK IN GROSS NATIONAL PRODUCT PER CAPITA, 1955

1	United States
2	Canada
3	New Zealand
4	Switzerland
5	Australia
6	Luxembourg
7	Sweden
8	Iceland
9	France
10	Belgium
11	United Kingdom
12	Norway
13	Finland
14	Denmark
15	West Germany
16	Venezuela
17	Netherlands
18	Soviet Union
19	Uruguay
20	Israel
21	Austria
22	Puerto Rico
23	Eire
24	Poland
25	Italy
26	Hungary
27	South Africa
28	Argentina
29	Cyprus
30	Cuba
31	Surinam
32	Panama
33	Columbia
34	Rumania
35	British Guiana
36	Costa Rica
37	Malaya
38	British North Borneo
39	Yugoslavia
40	Hong Kong
41	Bulgaria
42	Turkey
43	Brazil
44	Spain
45	El Salvador
46	Japan
47	Dominican Republic
48	Ecuador
49	Portugal
50	Philippines
51	Iraq
52	Mexico
53	Chile
54	Guatemala
55	Algeria
56	Morocco
57	Peru
58	Honduras
59	Ghana
60	Egypt
61	Tunisia
62	Indonesia
63	Ceylon
64	Syria
65	Paraguay
66	Taiwan
68a	Thailand
68b	Iran
68c	Sudan
70	Belgian Congo
71	Jordan
72	Haiti
73	India
74	Nigeria
75	Bolivia
76	French West Africa
77	French Equatorial Africa
78	China

*Source: Norton Ginsburg and Brian Berry, Atlas of Economic Development, 1961

**Source: UNESCO, World Survey of Education, Volume II, Primary Education, 1958 top third of countries in energy potential, only Venezuela among those with literacy rates below 80 percent had attained per capita income above US$500; that income level was reached in the early 1950s by no country with under 80 percent literacy among those ranking in the middle third in energy potential; and that, of the group ranking in the lowest third in energy, this income was barely reached by Puerto Rico and Uruguay, with literacy rates between 75 and 85 percent (Denmark and Israel surpassd US$500, but they had literacy rates above 90 percent. For all countries with literacy rates under 90 percent, the coefficient of determination between literacy rates and per capita incomes in the early 1950s was 0.43. The threshold level of 40 percent literacy, which we observed in examining these data for the early 1950s from several angles, gains further support from historical studies. Thus, Anderson's search throught historical records (1965) revealed that 40 percent rates of adult literacy were matched or exceeded in the preindustrial West, in the first years of the Meiji era in Japan, and in urban Russia of the late nineteenth century.

Second, although primary enrollments in the 1930s had substantial explanatory power for income twenty years later, in 1955 (see Figure 4) the reverse association -- effects of income in the 1930s on primary enrollment rates in the early 1950s -- was the stronger. It is this comparison that is addressed to the "identification problem": on the one hand, how much does an observed association between levels of income and of educational attainment indicate effects of education on economic performance and growth? How much, on the other hand, are we seeing effects of higher income on the ability and readiness to support schooling? This question, as we pursue it, turns quickly into one of shifting leads and lags in the spread of education and economic advance. Our findings, along with findings from much more sophisticated treatments using simultaneous equation techniques, can be properly interpreted only when we take into accont the historical context. The early 1950s were a period of worldwide emphasis on education, both as an instrumental variable in policy oriented to growth and as a symbol of national prestige. This was the beginning of the "educational explosion," in which schooling must inevitably reflect abilities to support it currently; schooling then leads further economic developments. Going further back in history, there have been diverse patterns of lead and lag in relations between the development of education and gains in income. In England, for example, economic change moved ahead for a while, and limited education was a drag on development which, however, brought responses in education that enabled growth to continue. In Japan, by contrast, education has led development from the late Tokogawa and Meiji eras to the present, providing a reserve stock of qualified human resources that has supported subsequent, rapid technological advance and economic growth. It is probably fruitless to try to sort out causality in these processes -- and not just because this is a "chicken-and-egg" process, for it is much more complex than that. There is considerable room for variation in such relations, which are affected by other powerful forces operating both within nations and globally. Which is the "best" or "optimal" route cannot be simply answered, even if the issues of equity and "human rights" that have been receiving increasing attention of late are set aside.

Although these caveats have been underscored in relation to the nature of the "identification problem," it may be worthwhile to digress briefly and discuss a study by Tolley and Olson (May-June 1971) on the interdependencies of public school expenditures and per capita incomes among the states of the United States. These authors were particularly interested in assessing the magnitude of "single equation bias" in estimates of elasticities of educational expenditures with respect to incomes, and vice versa. In other words, they were concerned with sorting out the reciprocal effects of two variables when the two are mutually supportive -- higher income leading to higher educational expenditure and so, in turn, to higher income, and so on. Building on human-investment theory, they began by setting up behavioral equations to estimate relationships of presumed causation in each direction separately, going on from these structural equations to a reduced-form simultaneous system. They found the responsiveness of educational expenditures to income to be substantially greater for income from private, nonhuman wealth than for income from human wealth, with only small single-equation bias. Looking in the other direction, they found that the number of years of schooling in the adult population was a strong predictor of per capita income, the elasticity in this case being clearly higher (at 0.852) in the simultaneous equation estimate than in the single equation estimate (0.649). Elasticity of income with respect to current educational expenditures, on the other hand, was close to zero (0.066) in the simultaneous equation estimates and a low 0.259 in the single equation. This finding should not surprise us, given that the current expenditures are for the education of children who are not yet members of the labor force. The important finding in the Tolley-Olsen study is that adult educational attainments had an even stronger effect on current incomes when the estimates were corrected for possible bias than in the initial, simpler equations.

All too often, some misleading methodological assumptions have been made in attempts to use cross-country comparisons to assess effects of education on per capita income. Some of these have been incorporated in the more mechanical of the models of manpower requirements, though this occurs less often now than ten or fifteen years ago. Most glaring of the common errors is the use of current school enrollment variables to "explain" a nation's current income; yet just such procedures continue to appear and to reappear. Even if the fallacy of using a single variable to explain variations in per capita income across countries is set aside, it should be obvious that we must get the time sequence in the right order. If data regarding the educational composition of the adult population are not available, the appropriate rates of child enrollment are those applicable when today's adults were of school age.

Although Harbison and Myers (1964) were guilty of using present enrollments to explain present income, their attempts to use international comparisons of several educational indicators with per capita incomes in a search for guides in manpower planning are worth citing for two reasons. First, a comparison of some of their findings with analogous correlations in Bowman and Anderson (1963) indicates a very rapid change over less than a decade of the "educational explosion," and some of their evidence (which does not coincide with their conclusions) concerning technical education may be of interest. Using adjusted data on enrollment rates around 1960 (which should have been cleaner than ours) they found a squared correlation of 0.45 between per capita income and primary enrollment rates, and a squared coefficient of 0.66 between per capita income and secondary enrollment rates. Our finding for comparable comparisons, but with 1955 incomes and enrollment rates in the early 1950s, were 0.69 and 0.48, respectively. How much of the seeming reversal in these correlations reflects unreliabilities in the measures, how much of it is a real change, would be difficult to say. The direction of the shift, however, is what would be predicted if we consider the rapid spread of secondary schooling among the industrially advanced nations at that time. It is worth noting in this respect that, instead of a coefficient of determination of 0.48 between secondary enrollments and per capita incomes when all countries were included, we found a coefficient of only 0.28 when countries with 90 percent literacy or more were excluded from the regression. Also, for the subsample that excluded the countries with literacy rates above 90 percent, a multiple regression that included secondary school enrollment rates along with literacy (again, for the early 1950s) added nothing to the coefficient of determintion of 0.43 in the simple correlation between literacy and per capita income. In brief, despite resource constraints there was substantial diversity in levels of secondary enrollments and in the pace of their expansion among countries within any given range of per capita income. This tells us nothing about how productive those educational investments may be, but it does point to the fact, again, that generalizations about what levels of education may call for expansion in the Third World cannot be justified. More recent data, easily obtained from UNESCO publications, tells essentially the same story.

The other feature of the Harbison and Myers study of importance here is the authors' emphasis on the expansion of technical education, especially at the university level, as a strategy for growth. They may be right, but their conclusion wars curiously with their evidence. Western societies have provided little technical education in their universities until recently. Furthermore, the proportion of university students enrolled in scientific and technical studies was not related, in the Harbison and Myers data, to per capita income (or to their "composite index" of level of development). In fact, that proportion was <u>negatively</u> related to the proportion of the labor force employed as engineers and scientists, and negatively related also to the proportion of the national income spent on education. Yet the percentage of national income spent on eduction was positively correlated with proportions employed in science and engineering. There are many ways in which people acquire engineering skills in association with economic development, and it is clear that Harbison and Myers had not identified what really was going on. Policy conclusions with respect to the content of secondary or higher education are not readily inferred from cross-country comparisons by economic level. Harbison was more aware of this problem than his misuses of statistics might suggest, for he was emphasizing the importance of on-the-job learning long before "nonformal education" became an international slogan.

B. <u>Explaining Gaps between Per Capita Income in the United States and Elsewhere</u>

In 1968 Anne Krueger estimated the degree to which educational attainment, age structure, and rural-urban distribution of the population accounted for per capita income differences among countries. She focused attention especially on developing countries, for which it was reasonable to assume, in an approximation, that nonhuman resources per capita were lower than in the United States around 1960. The analysis assumed that all countries were subject to uniform, underlying aggregate production functions with constant returns to scale, expressed for her purpose as uniforn <u>per capita</u> functions with marginal products of all factors positive and diminishing. Under these assumptions, use of the U.S. marginal product of any factor times the difference in that factor per capita between the United States and another country provides a lower-bound estimate of the difference in per capita income attributable to that factor. (To aggregate for human-capital stocks, she assumed perfect sustitutability among skills valued at 1959 U.S. earnings ratios). I have reproduced some of her results in Table 2, but with two modifications: column (4) attributes half of the term for age-education-sector interaction to education, and column (5) expresses the effect of education as a proportion of the per capita income gap between the United States and each other country. These figures are less dramatic than those usually cited for "human capital" from Krueger's article because I have not included in them the values attributed to differences in age structures or to rural-urban distributions, the minor interaction adjustment between columns (3) and (4) notwithstanding. Nevertheless, the results on education are impressive, accounting in most cases for between 25 and 40 percent of the per capita income gap. The largest values in column (5) are for the countries with the lowest per capita incomes, but the relation is not monotonic. The striking deviance for Japan reflects a situation that is picked up in longitudinal studies as well; Japan was more than ready for the explosion into high-level production with postwar accumulation of investments in modern plant and equipment.

Fallon and Layard (1975) have approached the analysis of inter-country differences in per capita incomes from a very different perspective. They set out to test the proposition that returns to education had been sustained over the postwar decades primarily because demands for services of well-educated persons had risen along with supplies, and that this reflected complementarity in production between skill and physical capital. They tested the complementarity hypothesis by applying a two-level CES (constant elasticity of substitution) production function to data from twenty-three countries. Instead of the comparatively detailed education categories used by Krueger, Fallon and Layard distinguished only two: primary schooling or less ("raw labor") and education beyond that level. The wage data were based on the sources used in Psacharopoulos (1973): the employment data from the 1961 censuses. The sample included Japan, the United States, seven other "richer countries" and thirteen Third World "poorer countries." Their analysis predicted that the relative share of physical capital would fall with economic progress and that the share of human capital and earnings would rise -- as has indeed often been observed and was documented by Kuznets many years ago. Fallon and Layard predicted also that the value of human capital would rise faster than physical capital. Following Krueger, they summarized effects of differences in factor endowments per capita on levels of income, comparing each country with the United States. Their measures cannot be compared directly with Krueger's, however, even for the few countries that were in both samples. In summarizing, they emphasize that their model attributes a greater part of the gaps between per capita income in the United States and in most developing countries to differences in physical capital and in the "efficiency" parameter than to education above the primary level, although the latter is also a major factor. This finding is in fact quite close to Krueger's results, though one would not think so in reading Fallon and Layard. In addition to using a different (more complex) production function, they differed from Krueger in counting primary education with "raw labor" (especially misleading if the roles of education in the less developed lands are to be assessed), in disregarding age structure, and in omitting any rural-urban distinction. Krueger included all of these under her rubric "human capital," which is the

Table 2:

EDUCATION AND GAPS IN PER CAPITA INCOMES BETWEEN
THE UNITED STATES AND OTHER COUNTRIES AS MEASURED BY ANNE KRUEGER

Country	Per capita GDP as percentage of U.S. value (1)	Per capita attainable income with present human resources (2) a/	Percentage by which attainable income is reduced by gap in education (3) b/	(4) c/	Percentage of gap explained by education (5) d/
U.S.A.	100.0	...	...	...	...
Canada	72.6	100.5	8.1	7.9	28.8
Israel	38.3	83.8	13.6	13.9	22.5
Japan	14.4	93.2	3.7	4.3	5.0
Puerto Rico	23.2	59.8	12.6	16.5	21.5
Jamaica	16.2	56.7	16.0	21.1	25.2
Panama	15.0	51.5	16.0	21.5	25.3
Mexico	14.2	45.6	22.9	29.5	34.4
Greece	12.5	71.2	28.6	29.8	34.1
Portugal	11.6	67.1	29.9	31.3	35.4
El Salvador	7.5	45.5	24.1	30.5	33.0
Honduras	7.5	36.6	23.9	33.3	36.0
Peru	7.3	51.0	18.3	23.3	25.1
Iran	7.2	39.8	33.2	40.0	43.1
Jordan	6.9	38.7	23.3	31.3	33.6
Malaysia	7.9	44.2	25.0	31.5	34.2
Indonesia	3.1	37.3	32.2	38.8	40.0
S. Korea	4.7	44.3	24.8	30.8	32.3
Taiwan	3.9	48.5	21.6	27.2	28.3
Thailand	3.6	46.5	21.4	27.6	28.6
India	3.0	34.1	32.6	39.3	40.5
Ghana	7.7	38.0	30.3	37.4	40.5

..., no data.

Source: Krueger (1968).

a/ Per capita income attainable with present human resources if the contry has U.S. per capita nonhuman resources. Human resources as defined by Krueger included age structure, education, and rural-urban sectoral composition.
b/ Controlling for age and sector.
c/ Incuding half of the age-education-sector interaction. (Controlling for age and education, sector had a very small effect.)
d/ Column (4) divided by [100 - column (1)].

one (instead of education) to which Fallon and Layard referred in contrasting their results with hers. Instead of being true minimal estimates, Krueger's credits to education may be generous, but the orders of magnitude are not seriously out of line with the Fallon-Layard findings. Education is important, but so are physical capital and organizational efficiency, and these sources of growth are interactive.

Several other scholars have looked at differences in incomes across countries and in factors that might explain those differences, but I have seen other cross-national studies that seem relevant for this paper. Denison 1/ compared levels of income per person employed incidentaly to his 1967 study of Why Growth Rates Differ, but this covered only the United States, seven countries of northwestern Europe, and Italy; no developing countries were included. Robinson (1971) undertook an ambitious cross-country analysis of growth rates in thirty-nine coutries, but he included only aggregated total investment, population growth (his surrogate for labor supply), the share of agriculture in national income, the proportion of the population living in cities, and net foreign balance on current account as a fraction of GDP. It should not be surprising that his coefficients on "labor" (measured by population change) and on his crude capital investment indicator were lower than the labor and capital shares in income. There is nothing in his study to distinguish qualities and kinds of labor, or even labor force participation, from population. However, he made two observations that deserve special notice on both theoretical and empirical grounds: (1) when factor markets are in disequilibrium, factor output elasticities are likely to be lower than factor shares, and (2) factor mobility is important for growth. These generalizations are relevant to the examination of roles of education in growth even though Robinson does not touch that problem.

1/ Denison (1967) presented a table in which he analyzed the components of differences in level of national income per employed person. For the countries of northwestern Europe in 1960, the total difference from the United States in income per employed person was 41 percentage points, of which an average of 3.9 points, or 9.3 percent of the gap, was attributable to differences in education. Among countries the ranges of these figures were narrow, from 35 to 42 percentage points on total income per employed person and from 6 to 11 percent of that gap attributable to education. For Italy, the total difference was 60 percentage points, of which 8.5 (14 percent) was attributed to education. It must be remembered that Denison made a large deduction (40 percent) on his education estimates for an ability correction that has been challenged by Griliches (1970) and others; if we eliminated that adjustment, the differences in education would account for 10 to 18 percent of the income gaps in 1960 between the United States and the countries of northwestern Europe, and for 23 percent of that between Italy and the United States. The biggest part of the 1960 gaps remained unexplained in the residual Denison labors lag in the application of knowledge, general efficiency, and errors and omissions; that figure ranged from a low of 19.1 percentage points for France to 29.3 for the United Kingdom -- 47 percent and 71 percent, respectively, of the 1960 differences between their income levels and those of the United States. A third of the difference between 1960 income levels in Italy and the United States was counted in this omnibus residual.

C. Education, "Basic Needs," and Economic Growth

"Basic needs" has become a slogan in the international agencies in the past few years, and it is associated with shifts of emphasis toward problems not just of poor countries, but also of the poor within these (and some less poor) nations. One of the endeavors that has emerged from this emphasis has been an attempt to estimate not only what factors may explain differences in attainment on a set of "basic need" variables, but also to what extent the provision of basic needs may be in competition with, or supportive of, general economic growth. That endeavor is analogous in some ways (but only in some ways) to the much older but continuing efforts to sort out associations and trade-offs between redistributive policies and policies focused on maximizing the rate of growth in national income per capita. There could be another way of looking at this question: how, in fact, do we perceive economic growth (or better, in this context, "economic development") as a goal? The movement to develop social indicators and the debates 1/ over how these indicators might be consolidated -- and whether they should be included in some new omnibus welfare measure of which GNP per capita would be only a part -- derives from just such concerns. From this point of view, literacy rates, for example, would constitute a component of national welfare, even though literacy appears in national income and wealth accounting only by the most indirect, circuitous, and partial routes (though factor inputs into primary schooling, which leave out entirely the inputs of the time spent in acquiring literacy). Although papers and books on basic needs have been proliferating both in the Bank and elsewhere (especially in the International Labour Organisation), no one to my knowledge has attempted to set up an overall "national welfare" index -- for fairly obvious pragmatic, as well as more profound, reasons. What we do have is three principal kinds of studies: (1) longituinal, national income-accounting studies, in which health indicators are introduced as quality adjustments on human capital inputs (which are included in the national accounting studies of growth discussed in Section VI); (2) attempts to identify factors that may explain the levels attained on various basic need indicators from cross-national data; and (3) attempts to incorporate basic need indicators with other variables in cross-national analyses on the determinants of per capita incomes. In the work by Norman Hicks at the Bank (1979a; 1979b) these last two are joined -- as they are also in another model, by David Wheeler (1980).

An overview of associations among each of several indicators of basic needs and the level and distribution of incomes was undertaken by Glen Sheehan and Mike Hopkins of the International Labour Organisation (1979), who gave their results both in scattergrams and in more formal discriminant analysis. Their main findings are easily summarized. First, the most important variable explaining the level of satisfaction of basic needs was per capita GNP; the authors stress (p. 98) that "while this result may seem obvious, it is worth emphasizing that material basic needs are ultimately satisfied out of national income, and whatever specific policies are adopted to ameliorate the problem, the satisfaction of material basic needs in the less developed countries will not be possible without a major increase in the production of goods and services." Neither the percentage of national income accruing to the poorest 40 percent of a population nor rapid economic growth per se were important determinants of

1/ In the International Association for Research on Income and Wealth and elsewhere.

average levels of basic needs performance (p. 100). They found (p. 101) only limited support for the hypothesis that education was a critical input to the satisfaciton of other basic needs, with the important exceptions of life expectancy and infant mortality, for which education was an important explanatory variable. Associations between improvements over the decade 1961-70 in the basic needs variables and growth in per capita income were essentially zero for each basic need, including life expectancy and infant mortality.

Hicks (1979) began with essentially these same questions, but he concentrated on a single basic need variable as his dependent variable -- life expectancy. It is unfortunate, if perhaps unavoidable, that the measure he used is life expectancy at birth rather than life expectancy for those who have survived the early years. A life expectancy figure of the latter kind would give a better index of health or morbidity among the population of working age and should therefore have more relevance for analysis of growth. In common with the International Labour Organisation study, which was underway at the same time, Hicks observed the strong explanatory power of literacy rates in the determination of life expectancy. Hicks and Streeten (1979) found that a better relationship between life expectancy and per capita GNP could be obtained using a semilog transformation, since improvements in life expectancy diminish as income rises. But what of growth as a dependent variable? Using the same set of international data, Hicks was highly successful (an $\bar{R}^2$ of .624) in his first equation, in which growth rate in per capita GNP between 1960 and 1973 was explained by LIEX (life expectancy at birth), GRIMP (growth rate of imports in constant prices from 1960 to 1973), and INVRT (average ratio of gross investment to GDP over the same period). In this equation I wonder, however, whether GRIMP (the most significant of the independent variables) was a cause or an effect of the growth in per capita income. When Hicks added literacy to the equation, the coefficient on LIEX was reduced somewhat and that for literacy actually became negative, though nonsignificant. To me, this suggests that a path model would have been appropriate; it would seem that literacy plays a strong part in the explanation of LIEX, through which it affects growth in per capita income. Hicks does comment on this in another way (1979a, p. 13):

> Thus, the development of a critical minimum level of basic human capital may be an important prerequisite for accelerating the growth of output. However, this type of formulation suffers, because it does not reveal to what extent growth was sacrificed during the period that basic needs were being improved. It might be expected that the redirection of resources from direct investment activities toward basic needs could act permanently to increase consumption, particularly government consumption, and thus lower the level of investment and growth in the future. Thus, the construction of more primary schools might divert resources from investment in industry as an initial effect, and the continued resources needed to operate these schools could result in lower government savings and, hence, capital formation in future years.

This view resolves into several questions Hicks has not raised. First, how far, in fact, are the investments in people properly viewed as "consumption" for purposes of growth analysis? Second, to what extent are the investments in schooling in fact drawn away from alternative investments that might bring more grapid growth? In particular, would the human resources that go into further formation of human resources be used otherwise primarily for investment or for production of consumer goods and services? And third, what are the rates of return on the educational investments? All of these are implicit in the spirit of Hick's analysis, although here -- as in some other Bank documents -- I have a little difficulty in accepting assumptions that government bureaucracies are efficient investors, whereas resources that are controlled by the private sector mean "consumption."

David Wheeler (1979; 1980) has advanced the analysis of issues relating to welfare of the poor and economic growth over a wide range of topics, including not only matters commonly raised in discussions of basic needs (a term he wisely avoids) but other matters as well.

The title of Wheeler's paper describes its main concern well -- "Human Development and Economic Growth in the Developing Countries: A Simultaneous Model." In fact, the paper contains several multistage models analyzing changes in eighty-eight developing countries in the 1970s, with a few equations for 1960-77. It includes an excellent discussion of determinants of changes in fertility. The "human resource" variables (population numbers aside) are: nutrition (calories), adult literacy rates, and -- in some equations -- life expectancy. Wheeler is cautious in his use of the life-expectancy variable as an independent variable, and where he has used it his results do not, as I interpret them, agree with Hicks' simpler analysis.

Literacy rates come into Wheeler's analysis in several distinctive ways, both as one of the change variables and as a base-year stock. He found literacy to be consistently labor augmenting (compare Saxonhouse 1977), to foster growth of manufactured exports, and to contribute significantly to the improvement of other welfare indicators. Increases in adult literacy had a significant positive effect in the equations set up to explain rates of increase in investments over the period 1960-77 but had little immediate effect between 1970 and 1977, which is not surprising. Literacy had strong effects on reductions in birth rates. Wheeler attempted to bring the many parts of his model together in a comprehensive simulation model designed to provide policy experiments (and which was accompanied by an admirable discussion of what simulations can and cannot do). He drew attention to the results on literacy (1980, pp. 91-92):

> Through time, the beneficial impact of some policy change on one part of the system transmits itself through the entire system, and not necessarily in a linear way. In extensive experiments with different schooling intensities over very long time periods, for example, it became clear that the final result of a continuation of low schooling rates is an apparent failure of the society to reach the point of self-sustaining increase in per capita income growth. Unless the primary-school enrollment ratio is over 80

> percent, the performance of the socioeconomic system seems fundamentally constrained in the long run. All relevant curves become parabolic, and in the very long run the society seems to begin falling backward. There is obviously some principle of complementarity at work here, although considerably more experimentation with the model would be necessary for a complete understanding of this particular characteristic. At any rate, the opposite seems to occur at schooling rates of over 80 percent. Rather than exhibiting parabolic behavior, thr system becomes exponential, with per capita income curving upward and population growth steadily downward.

The main effect of rising literacy in these simulations was on productivity. It will be remembered that we spoke of a literacy rate of 40 percent as a necessary condition historically for a nation to rise out of poverty but not as a sufficient condition for sustained growth. Simple as they are, the charts displayed earlier (Figures 1-4) are consistent with Wheeler's much more sophisticated and rigorous analysis in the contrast between countries with over 80 percent literacy and all others. Wheeler has arrived at this pattern without looking at the advanced countries at all; they were excluded from his empirical work. He found also (p. 95) that "an individual economy which is interested in export-led expansion must pay careful attention to its relative human-resource status if it is to grow successfully."

V. MANPOWER ECONOMICS AND CATEGORIES OF SKILL

Analyses of contributions of education to growth and studies focusing on manpower requirements have usually followed quite different paths, and at the extremes with diametrically opposed assumptions with respect to skill substitutions. In some instances, however, the paths have crossed or even merged. I begin here with the simplest of the manpower orientations, exemplified in some of the work of the (OECD) using cross-national comparisons; the principal value of that work for the immediate purposes of this paper is the empirical diversities displayed. I will then go on to take note of some applications of manpower combined with other types of analysis in shadow-pricing and optimizing models.

A. Manpower Economics in International Perspective

There has been remarkably little association between efforts to put manpower planning into actual practice in a country and the participation of the country's economists in the development and advocacy of manpower-planning techniques internationally. (Perhaps the Dutch are an exception; cautiously positive in word and action, they seem to have been the most consistent.) To take the extremes, it was the Russians who first attempted manpower planning on a large scale and who continue that practice. But Russians (such as Komarov) who have been involved in the forecasting of manpower requirements have also openly bemoaned the fact that it is so difficult to forecast needs for "productive" skills in contrast to needs for medical services, for example. Russia can claim in Strumilin the first real precursor of rate-of-return analysis in modern human-capital theory, even though the use of discount rates was not in order in the Soviet Union.

In the United States, broad-gauged manpower planning has never been considered, and that term is most often used to refer to plans that deal with problems of structural unemployment and the training for employability of persons at the lower end of the skill distribution. But the United States exported simple models for forecasting manpower requirements from an early date -- notably in the international sallies of Frederick Harbison and in Herbert Parne's manpower manual for the OECD.

The work of Harbison, who was the least "methodological" of all those who have been involved in manpower planning exchanges, has already been discussed. Harbison was well known internationally as a manpower-requirements economist over fifteen years ago -- first for his activities (with Lord Ashby) in Nigeria and later as he carried his message around the world. However, his methodology never was really conventional, and unlike most manpower planners, he laid stress on the importance of postschool learning and adaptability. In his international travels he came increasingly to decry the use in educational planning of the coefficients derived from international comparisons that at first he had recommended. But what, then, is manpower economics?

Manpower economics, as it has been applied to studies of human resources in economic growth, grew out of economic planning. Attempts to apply it have led both to problems and to some discoveries about the nature of economic development and the diversity of ways in which human resources might be formed and utilized in the growth process. From the start it was quantitative planning, and, to the extent that there was disaggregation in dealing with human resources, the categorization has been by the uses of those resources rather than by human-resource supplies. This orientation has several implications. First, it is not people centered, and what I have said about "development man and woman" finds no place in models of manpower requirements as they have conventionally been constructed. Second, initially manpower economics was a fixed-coefficient, input-output model, which assumed low elasticities of substitution among designated types of classes of manpower (defined by uses) but implicitly high or perfect elasticities within those categories. Third, at first no account was taken of effects of human-resource supplies on their allocation among activities; later this omission was partially corrected.

Initial attempts to apply such a model became in effect exercises in the testing of hypotheses about the nature of economic development in the areas or countries examined. Most interesting in this work, for my present purposes, are the country reports of the OECD's Mediterranean Regional Project (some of which were economically quite sophisticated, and each of which was in some respect a methodological experiment); a technical evaluation by Robinson Hollister (1966) of this OECD work (which brought the supply side more fully into the picture); and a more superficial, but important, OECD study covering fifty-three countries, which was published in 1970 under the title, Occupational and Educational Strucures of the Labor Force and Levels of Economic Development: Possibilities and Limitations of an International Comparison Approach (Fallade, Croner, and Emmerih, 1970). The conclusions considered in the light of the history of work on manpower planning in the OECD (and of manpower requirements forecasting in particular) are important even if not surprising. Of findings with respect to "occupational structures and economic development," the 1970 volume referred to above concluded (p. 100) that:

> The evidence strongly suggests significant differences in the utilization patterns of highly qualified personnel among countries. Quite clearly, at the level of aggregation of this study and with the kinds of data used, any interpretation has to be made with extreme care. The analysis will have to be pursued on a case study basis by taking, for example, the countries with different occupational values and which are at analogous levels of development...bringing in a host of explanatory variables in order to determine which are the most important factors behind these variations.

In drawing conclusions concerning the role of education, the principal "findings" can be seen as almost statistical truisms once one recognizes that, in the real world, broad categories of occupation and education are not tightly locked together. Thus we have the virtual tautology that the greater the past flows of graduates into the labor force, the larger the proportions of educated people among persons engaged in the various broad categories of occupational activities. There is, of course, association between levels of educational attainment in the labor force and GNP. Concerning the "identification" problem of interdependencies between educational supplies (education embodied in the labor force) and general development or technological indicators, the report (Jallade, Croner, and Emmerih, 1970) states (p. 248): "in practice manpower forecasts by levels of education should always be accompanied by forecasts of the educational system's supply of graduates."

This statement reflects what was already happening -- a shift of emphasis toward what came to be labeled as the problem of "social demand" for education and Markov-chain analyses of flows through the educational system. Also, and contrary to earlier tenets of manpower planning models, the 1970 OECD concluded (p. 248) that the results:

> ...strongly suggest that possibilities of partial substitution between different types of labor exist at given levels of economic and technological development. As has already been indicated several times in the course of the analysis, other reasons besides substitution possibilities may exist to explain our findings, but the least one can say is that they cast serious doubt on the complementarity hypothesis usually adopted in manpower forecasting.

At no place in this study (except among outside critics invited to participate in prepublication discussions) was there mention of analyses that would take account of relative wage rates. This is in striking contrast, for example, to studies conducted at the National Bureau of Economic Research twenty years ago, into the intraoccupation or intrasector versus intersector components of increases in productivity. Although the lack of empirical analysis using wage data might have been attributed to difficulties in obtaining such data, the lack of any discussion of this matter -- despite elaborate details concerning the composition and allocation of the labor force -- is not so easily dismissed. This neglect becomes understandable only when seen as a reflection of the initial orientation to the fixed-coefficient, manpower-planning models. Given that initial orientation and the extent to which it comes through again and again in the OECD's report, the conclusions are all the more commendable.

It does not follow from all of this that quantitative analyses of manpower needs have no place in making decisions about growth-oriented investments and their implementation. It is important that we should not confound aggregative perspectives with the micro decisions, whether private or public, that are at the cutting edge of growth and that sustain the economy. The fundamental mistakes of the more sweeping manpower-planning perspectives, in my judgment, were their high level of aggregation, their attempt to encompass virtually everything, their extreme position in disregarding and denying all monetary indicators, and their failure to consider in any way the implications of their view of human beings as skill packages put rigidly in place (even though most of us will be working for several decades in which, if plans are successful, there will be substantial technological change).

B. Manpower Projections and Education in Optimizing Models

Of greatest interest here are a study by Keesing and Manne (1973) and one by Psacharopoulos (1968). Before turning to them, a few words may be in order about the book by Adelman and Robinson on Korea (1978) -- simply because they are well known, and they use the term "education" in summary statements that might suggest pertinence to this overview. In fact, in their model education is a suppressed variable; their "human resource" experiments incorporate no education variable. They point this out explicitly (p. 139): "Our model does not provide specifically for demographic change or for the relationship between skill composition of the labor force and education." Those variables "are modeled by changing some of their parameters exogenously." I would characterize their analysis as in a "manpower style" in this respect because education is identified with occupational structure (implicit fixed coefficients), and there is no place in their modeling for any possible contribution of education to productivity within occupational categories -- nor do I find any comments on this matter. The effects of increased investment in education in rural areas are "modeled by increasing the migration elasticity in Stage II and the relative supply (number) of technicians and white-collar workers" (Adelman and Robinson 1978, p. 139). Urban education is measured by technicians and white-collar workers.

More interesting in the context of this paper is the study by Keesing and Manne (1973) of manpower projections, which is one of an integrated set of essays on multisectoral models applied to Mexico. Their chapter "describes the projection of human resources within the DINAMICO model," which includes input-output, capital investment, foreign trade constraints, and supply and demand constraints for five skill classes of manpower. As they describe it (p. 55), their analysis "is intended to yield macroeconomic projections together with efficiency prices for key factors of production. The model incorporates certain aspects of Mexico's potential in human resources: labor input coefficients, human capital formation through education, and skill substitution." The analysis starts out in what seems conventional manpower style, in which workers are classified by "skill class" identified initially with occupation and in which each skill class has its normal or appropriate educational equivalent. The analogy with conventional manpower models ceases at this point, however, for the authors go on to incorporate in their optimizing program the opportunity costs of students' forgone earnings and of the time of teachers and educational personnel. (Because of lack of available data, Keesing and Manne were unable to make allowances for on-the-job learning; that is, of course, a very general measurement problem, but many model builders seem to be more complacent about it.)

As an independent check on the educational norms used for skill classes, they "calculated the von Neumann prices -- assuming that the rate of return on human capital is a datum, and that the relative wages for different skills are to remain constant over the indefinite future." Skill substitution is treated as up- and downgrading in their five skill categories. With upgrading, they assumed diminished efficiency and, therefore, a demand for additional clerical and manual workers. Over the longer horizon, upgrading is eliminated -- with education to the standard qualifications taking its place. This (like the Adelman-Robinson endeavor) is essentially a planning model, not an assessment of the role (or roles) of education in economic growth. (This is not the place to reproduce their analysis, which is readily available.) Keesing and Manne's empirical conclusions are of interest, however. They found that it would be optimal for Mexico "to operate virtually every one of the human capital formation activities ... at a positive intensity. This means upgrading the skill mix by amounts exceeding the 1968-71 increment, and implies further increase in the capacity and output of middle and higher education" (p. 79).

In summarizing these findings, Keesing and Manne emphasized systematic biases: "Quite apart from errors in projecting requirements for skilled occupations, this model disregards the benefits of upgrading the training of the labor force <u>within</u> each skill class. As a result, the economically justified demand for education is probably underestimated." They concluded that results were broadly consistent with planned rates of expansion in middle and higher education and that, if that policy were followed, Mexico would not face serious quantitative shortages for major classes of skilled manpower. Neither should there be concern about a surplus with expansion of postprimary education at a 7 percent annual rate. They looked instead to gains from a continuing increase in the educational standards for each job category. While their results are sensible, it must be recognized that here -- as in all such models -- the conclusions are to a considerable extent built into the models themselves by assumptions regarding substitution elasticities and changes in demand for skills in the years ahead.

Some years ago, several separate analyses were undertaken, each by a different person or persons, in an attempt to derive recommendations for educational policies in Greece. Each study came out with a different set of recommendations, reflecting the different assumptions built into the analyses. Only one, to my knowledge, could be regarded as a component of a larger economic assessment, and it was not really in the same category with the "global" frameworks in the Adelman-Robinson work or to which the Keesing-Manne work was linked. I refer to Psacharopoulos' methodological experimentation with the analysis of skill requirements in Greece (1968). He first assessed planning models and methods that had emerged with respect to education and manpower planning, including treatments of education in dynamic programming models. In that assessment he concluded, among other things, that the most serious shortcoming of models with constrained maximization (whatever their foci) is that the more highly aggregated the level of analysis, the less reliable the results. Psacharopoulos attempted a partial reconciliation of the "technical" (manpower planning) and the "economic" (rate-of-return or benefit-cost) approaches. His analysis was based simultaneously on two investment guides: a profitability criterion and a technical constraint. He distinguished between actual and shadow rates of return, emphasizing the importance of that distinction for countries "like Greece" where institutional factors tend to distort the price system. The theoretical basis of his study was the necessary duality between a quantity solution and a price solution to every resource allocation problem. He focused not on the optimal solution, but on "the efficiency of alternative investments in skills and the alternative of investing in something else" (p. 25). His analysis had two main features: a shadow wage model and an interindustry, manpower-forecast model (to link the skill structure of the labor force to the
forecast model (to link the skill structure of the labor force to the
economy as a whole, using an extended input-output table). The shadow prices of skills were the Lagrangian multipliers of a constrained maximization problem in which the production function was of the Leontief input-output type, with zero elasticity of substitution, and the optimization technique was that of linear programming. To overcome the rigidity of a Leontief production function, he introduced alternative techniques -- thus introducing discrete substitution for a given level of production and allowing for a nonlinear expansion path.

Among Psacharopoulos' empirical findings for Greece, I find the following of special interest. First, using Greek input-output coefficients, Psacharopoulos found shadow prices that were incompatible with private rates of return to investments in skills, "suggesting that in Greece private decisions with respect to investment in human capital may be very inefficient when asessed in social terms..." (pp. 102-03). Second, although parametric linear programming on the availability of skills gave the expected negative slopes of the marginal product curves, the substitution experiments with respect to skill-input vectors -- derived using coefficients from other Mediteranean countries -- gave a wide range of shadow prices for labor skills.

Psacharopoulos' study was sophisticated in its sensitivity tests and estimates of shadow prices. It was evident also, however, that a fixed-coefficient model could yield shadow prices that were wildly divergent with plausible changes in the technical coefficients assumed. Psacharopoulos raised the question: "to what extent are these technologies transferrable across countries?" That question implicitly challenges all the prior attempts to derive manpower planning guidelines from international comparisons in a "fixed-coefficient" world. Keesing and Manne avoided this problem by their initial elasticity and factor price assumptions, whereas Psacharopoulos had attempted to attack head-on the problem of discrepancies between private and social returns. He concluded that further examination of skill-substitution elasticities must be a high research priority.

VI. HUMAN RESOURCES IN AGGREGATE PRODUCTION FUNCTIONS AND GROWTH ACCOUNTING

It is no accident that "the residual" came to be designated early in the 1960s by the definite article. During the 1950s, growth had been extraordinarily rapid, and, in reflecting on this experience, economists began to recognize what Tinbergen had shown almost twenty years before (1942): conventionally specified Cobb-Douglas aggregate production functions left a large part of observed growth in national income per capita unexplained. This fact was simultaneously rediscovered in the late 1950s in Norway, in Finland, and in the United States. The residual was given many designations: technical change, the human factor, organization, and the measure of our ignorance were the favorites. These labels tell us quite clearly where various economists were looking for the answer.

A. Embodied and Disembodied Advances in Knowledge: Theoretical Models

Reactions to the large residuals were almost as various as the economists who looked at them. In most of the econometric models, technical progress appears as an exogenous variable -- almost manna from heaven -- which may be seen to find its way into production processes by differently specified routes. There are three major types of production-function models in which technical or organizational progress is incorporated but left essentially unexplained. Where Y is national income, K is capital, L is labor, and A is "technical progress." these models may be stated in the simplest and most general form as follows:

(1) $Y = f(A(t)K, L)$;

(2) $Y = f(K, A(t)L)$;

(3.1) $Y = f(K, L, A)$; or alternatively,

(3.2) $Y = f(K, L, A(t))$.

In the formulations (3.1) and (3.2), "technical progress" (Solow, 1957) or "advancement in knowledge" (Denison 1967, 1969) are neutral with respect to capital and labor, but the difference between them is important.

In formultion (3.2), "technical progress" becomes a shift in the production function that is systematically associated with time. Solow (1957) first applied it to the period 1909-49. But in this form, time explained too much: during the first half of the period the production function shifted upward by 1 percent annually and in the second part of the period by 2 percent. Almost 90 percent of the increases in output per capita over this period was thereby "explained," but this was not a very useful guide to the understanding of growth. Solow took the direction of "embodying" the technical progress in physical capital with his vintage model (1960).

The vintage model may be represented by equation (1), which treats all technical progress as embodied in physical capital, leaving the marginal productivity of homogeneous labor unchanged. In this case, technical progress is taken to be purely capital-augmenting; machines of different vintages have different capital (and rental) values, and these can be added up to get a new valuation of aggregate capital inputs. The separate term A(t), though entered as an exogenous function of time, becomes absorbed into a respecified input of services K. That model goes beyond revaluations of the "quality" of physical capital in a national accounting approach to derive the quality of capital from t. This leaves all quality improvements in labor entirely out of the picture.

In the equation (2), technical progress is labor augmenting. This is the model required for Harrod-neutral technical progress if we are to have such progress without corresponding population growth. By increasing labor in terms of efficiency units, this model can allow for steady-state growth even when the rate of growth of numbers in the labor force is less than Harrod's "warranted" rate. Theoretically, it would have been possible to inject higher growth rates in labor inputs into the model by analogy with the physical-capital vintage model and without benefit of changes in physical capital. The introduction of education embodied in human capital is a step in that direction. Yet, mathematical growth theories that have incorporated technical progress that is labor augmenting have usually, in fact, traced this effect back to investments in physical capital, ignoring education In this sense they are still capital-vintage models. Wages rise not because of a change in the quality of labor but because the same homogeneous labor is made more effective. Alternatively, the technical change is "disembodied," perhaps in organizational progress, as in the "Horndall effect" observed in Sweden.

In formulation (3.1), A is a true residual, not a function of time, and it is independent of either K of L. This is the formulation that underlies most aggregative growth accounting and is exemplified by Denison, who sets "advances in knowledge" apart as the unexplained part of the initial "residual." Denison (1962, 1967, 1976) is dealing with data from the real world, however, and in detail; he keeps a large measure of freedom to add variables and incorporate them in his analysis. He describes himself as a "standardizer," not an aggregate production-function economist, although is analysis does incorporate an implicit production function.

The concepts of both capital and labor lose their abstract elegance (if they ever had it!) in a heterogeneous world, and Denison's first task was to construct indexes of the untidy, actual components of "capital" and "labor." This goes beyond the growth models that introduced heterogeneous capital to incorporate differentiations within labor as well -- and so allows human capital to enter the implicit production function, instead of leaving it in the residual A. Whatever it may be, A remains totally disembodied, and deliberately so, in Denison's analysis. Denison adds a term or terms for improvements in resource allocation in a world that is always in some degree out of long-run equilibrium. However, he does not incorporate any theory about what processes may foster or inhibit improved allocation. Finally, he introduces economies of scale as a simple proportionality to the level of national income attained. Differentiating a Cobb-Douglas version of equation (3.1) with respect to time, and extending it to incorporate Denison's elaborations, would give us something like this:

$$\text{(3.1a)} \qquad \frac{dY}{Y} = u\left[\beta\frac{dL}{L} + (1-\beta)\frac{dK}{K} + \frac{dZ}{Z} + \frac{dA}{A}\right],$$

where u is a scale factor, L is a composite labor index, K is a composite capital index, is the share of labor, dZ/Z is the rate of improvement in resource allocation, and dA/A is the rate of advancement in knowledge. Transposing, we get the definitional specification of dA/A as the residual:

$$\text{(3.1b)} \qquad \frac{dA}{A} = \frac{1}{u}\cdot\frac{dY}{Y} - \left[\beta\frac{dL}{L} + (1-\beta)\frac{dK}{K} + \frac{dZ}{Z}\right]$$

Thus <u>dA/A</u> is just what could not be explained; if no estimate of dZ/Z is attempted, it can simply be added to <u>dA/A</u> in a somewhat larger residual. The econometric analysis of Jorgenson and Griliches (1969) resembles Denison's in that human and physical capital are treated symmetrically, but it differs from Denison's in the significant fact (among others) that the aim of these authors was to account for all increases in "total factor productivity" by fully embodying advances in knowledge as quality adjustments in the labor and capital inputs. Jorgenson and Griliches gained flexibility also by use of Divisia indexes for the pricing of inputs over time.

B. Growth Accounting and the Rental Values of Human Capital

One of the advantages in dealing with human capital as compared with physical capital in growth accounting is the fact that we can observe the values of inputs as they occur in the case of human resources. Physical capital may be traded infrequently if at all after it is first put to work; this greatly complicates estimation of annual contributions and adjustments for utilization of a physical capital stock. One of the developments of recent years has been to bring physical capital more nearly in line with the natural tratment of human capital in this respect.

The chief difficulty in human resource accounting is the problem of separating out the differentials that may be attributed to schooling -- those that reflect the association of the amount of schooling with other traits that account for part of the observed differentials. I have remarked earlier that there is good evidence to suggest that Denison's arbitrary correction factor on this account has been exaggerated. As we look across different societies, the distortions may vary substantially -- especially when they are bound up not only with "ability" but with institutional constraints on the opportunities for some categories of people relative to others and when such discrimination is linked (as it is likely to be) with the amount of schooling obtained. The problem in that case, and a difficult one, is then to separate out the depressive effects on growth of such constraints, the gains from their diminution or removal.

Where institutional rigidities do not seriously distort relationships for entire broad categories of persons, such problems for growth accounting can be handled in the manner that adjustments for "ability" are handled; we can compare results without an adjustment with what we find when we make a sizeable adjustment, as Denison has done. The case for making no adjustment in growth accounting (in contrast to rate-of-return analysis) is much stronger than commonly is supposed, however. As education spreads through a society, each generation of young people comes from a total population of more educated parents than in prior generations. We know also that parental education contributes to school performance: among the factors raising the quality of human resources over time are the contributions that come from the home environment. This means that there is little or no deterioration (and sometimes there actually is appreciation) in the "quality" of young people entering successively higher levels of education in later, as compared with earlier, periods. To make the essentially static-model adjustments for ability (even if these were not exaggerated adjustments) is then inappropriate for the measurement of the quality of the labor force. Schooling (among other things) has both direct effects and intergenerational effects on productivity.

Another question that has arisen in the treatment of education in national income accounting is that of adjustments for changes in the quality of the education. Ideally, we might like to know not just the years of schooling embodied in the labor force, but the quality of that schooling. Despite his use of rental-value measures (which should reflect educational quality) to construct an index of inputs of human resources adjusted for embodied education inputs, Denison is essentially a "capital-at-cost" or "capital-volume" economist. He follows this logic in statements about his treatment of education as well. To start with, he emphasized that his measurement of contributions of education to growth do not include effects of changes in the quality of any given amount of education. But that is not all; he does not want to address such changes. The education weights stand for resources that were put into the formation of human capital. For any given "amount" of education aggregated in terms of resources absorbed by education, increases in yield then become increases in output per unit of input, or productivity changes.

Following this mode of thought, Denison insists on a constant-cost valuation of physical capital: if new physical capital produced at the same resource cost has higher yields, by his line of argument this must be regarded not as an increase in capital input but rather in output per unit of input. In Denison's words (1969, p. 3), as modern new capital goods enter production,

> ...output would rise more than if replacement had been by new goods of an old type. The difference is the contribution of the development of better capital goods which can be supplied at the same cost as the old, a contribution which I wish to ascribe to advances in knowledge.

This is the capital-volume view of measurement of inputs, which would carry with it a analogous cost approach of aggregative measurement of capital stock (ideally, of human as well as nonhuman capital).

Jorgenson and Griliches agree with Denison in objecting to Solow's vintage model and his incorporation of an independent time function within his production function (whether or not interpreted in vintage-capital terms). However, they would like to weight the various kinds of both physical and human capital by marginal products rather than by cost.

The link between cost and value accounting for analysis of growth is indicated clearly enough if we consider the implications of the Jorgenson-Griliches position with respect to desirable extensions of national accounts for application to the stud of productivity change. First, they look for further disaggregation of the analysis of physical capital inputs, allowing rates of return to differ not only by legal form of organization but also by industry and type of asset; this brings physical capital accounting closer to human capital accounting in Schultz's style (or Delison's) in that rental values of different sorts of human resources take account of different relationships between investment costs and returns. Their second suggestion is indeed to incorporate the education sector into a total economy-wide accounting framework. Third is the development of measures of research and other tangible capital, to be incorporated in the productivity accounts. Their aim is to specify inputs in such a way as to account fully for total output.

Whereas Denison estimated sources of growth between two calendar dates and by national accounting methods, Jorgenson and Griliches incorporated data for each year from 1945 to 1965 in an econometric time series analysis. They used a chain-linked Divisia index procedure in specifying the labor-quality (as other) inputs. This procedure allowed for adjustments in weights when relative wages associated with one level of education versus another rose or fell. Thus, no particular assumption with respect to "elasticity of demand" for educated people (or weighting by factor shares) is imposed on their model. The Jorgenson and Griliches procedure does assume, in common with all national-income accounting, that relative wage rates are good approximations to productivity ratios. Also, they treat labor-quality units as additive. Among the final results of the Jorgenson-Griliches study were an estimated annual growth rate for 1945-65 of 3.59 percentage points, just over a tenth of which they attributed to improvements in the quality of the labor force compared with Denison's estimate (even after a "correction" for ability) of 15 percent for the period 1950-62.

T. W. Schultz never became involved in national income or growth accounting. His emphasis was, rather, on a more direct look into some of the processes of change and on finding and identifying new sources of income streams, whether to individual decision makers or -- his ultimate emphasis -- for the development of the economy in the future. The question of what might be the most promising policy was never far from his thinking. It is not surprising, then, that even when he strove to interest economists in the importance of human resources (and research) for growth, and when he presented measurements of estimated contributions of education to growth in the United States, he started from an investment perspective. What had been the investments in schooling, and what were the returns on those investments? This is a much more laborious way of arriving at the rental values used by Denison and others in their human-resource accounting. It is an important perspective (which was picked up by Harberger and Selowsky in a joint growth study published in 1966; but the discounting process involved in estimating internal rates of return is not appropriate for an analysis of the determinants of national income as the once-future years become present. Empirically, the two approaches may converge in results because of a complex of interactions and adjustments for the age-sex composition of the labor force. It could be argued, however, that the internal rate of return is the best procedure (assuming satisfactory cost figures to which to apply it) if what is wanted is the best estimate of the contributions of schooling alone, purified of any contributions of experiences and postschool investments in human resources. The internal rate of return gives the best estimate of Mincer's "take-over" point (Mincer 1974) -- independently of how far people choose, and economic institutions provide for, the continued improvement of the labor force in the postschool years.

There is another important contrast between the Schultz and Denison approaches in conceptualization and in associated empirical treatment of education. Denison and those who have followed his procedures omit in their accounting for education the yields attributable to that part of the investment in new members of the labor force that was required to maintain the mean levels of schooling of the base year. This point is discussed in Bowman (1966) and has been emphasized in several writings by Selowsky (1969; 1971). Schultz's treatment is logically symmetrical with the treatment of physical capital in this respect. Denison, by contrast, credits this educational "maintenance" component simply to increase in numbers employed. The downward bias in estimates of relative contributions of education can be substantial.

Following the early work of Schultz and Denison, there have been a number of studies by other economists, with several variants in the handling of education. Most have been close imitators of Denison, using the rental values of education embodied in the labor force as the starting point for construction of indexes of quality of labor distinguished from its quantity (i.e., from mere counts of employed persons). Within that framework, there are differnces in detail, but generally of minor importance. The approaches of C. G. Langoni, G. Psacharopoulos, and Marcelo Selowsky are outlined below.

One of the most interesting departures within an essentially Denisonian mode (but with Divisia indexes) is that of C. G. Langoni (1970). For both labor and capital, he distinguished quantity and quality by industry or sector. Thus, he split up $\Delta \underline{Y_L}$, the contribution of labor to national income, into three parts:

- The contribution of increase in numbers was mean wage times change in numbers ($w \cdot \Delta L$)

  where

  $$\bar{w} = \sum_i \sum_j \left[\frac{(\bar{w}_{ij}) \quad (L_{ij})}{L} \right]$$

- The gain from improved sectoral distribution net of what would have been gained if the sectoral distribution had been unchanged. Designating w_j as the weighted average wage of labor in the j^jth sector and $L_{\cdot j}$ as the total labor force of the j-th sector, the gain from improved sectoral distribution of labor is then

  $$\sum_j \left[(\bar{w}_{\cdot j})(\Delta L_{\cdot j}) \right] - \sum_j \left[(\bar{w}_{\cdot j} \frac{L_{\cdot j}}{L})(\Delta L) \right] .$$

- Change in real output because of changes in quality composition of the labor force (education), but keeping the distribution of the labor force the same, is

  $$\sum_i \left[(\bar{w}_{i.}) \; \Delta L_i) \right] - \sum_i \left[(\bar{w}_{i.} \frac{L_{i.}}{L}.)(\Delta L \right] ,$$

  where w_i is the weighted average wage of the i-th quality of labor and L_i is the total labor force of the i-th quality.

This formulation omits the interaction terms, which fall into Langoni's residual. Denison's formulation also left out interaction terms between quantity (employment) and education, but he divided the inteaction between its two components.

Psacharopoulos (1969 and 1972) modified this procedure in his analysis of the contribution of education to growth in Hawaii. Instead of using average., he built his estimate up by a simple aggregation that gave him the marginal contributions for each level of education. The aggreagate contribution of education to growth is defined as $\Sigma\, g_h S_h$, where g_h is the average annual rate of growth of labor with educational level h, and S_h is the share of that type of labor in the national income

$$(S_h = \frac{L_h f_h}{Y}$$

where f_h is the marginal product of persons with education h, measured by their wage). Taking the lowest level of schooling (or illiteracy) as the base of "raw" or "brute" labor, he builds up the contributions of those with education i by estimating

$$g_i \frac{L_i f_i}{Y} - g_i \frac{L_i f_0}{Y}$$

This procedure avoids some of the problems that arise with the index-number procedure and its associated interaction terms. Equally or more important, it incorporates the "maintenance" component in the measures of increases in human-capital inputs.

But, like all accounting models based on differential rental values (wage differences) of the human capital embodied in persons with various levels of schooling (the basis for Denison's, Langoni's, and most other national accounting models), Psacharopoulos' treatment uses factor shares as weights (and hence as measures of the elasticity of outputs). In his model, the share of labor of a given kind becomes the weight on that share. Results can be quite sensitive to constant-share assumptions when comparisons are made to cover extended periods of time over which factor shares may be shifting. Indeed, we know that shares of labor as a whole rise very substantially over the long term with economic development, even though there is also something less than infinite elasticities of demand (constant marginal products). Changes in factor shares are of course related to both the rates of increase in human and physical capital and elasticities of substitution or degree of complementarity between physical capital (with technical change) and better or lesser educated contingents of the labor force. I referred earlier to the article by Fallon and Layard (1975) on this question.

Most of the explorations into elasticities of substitution as related to labor and education have concentrated, however, entirely on substitution among different sorts of labor inputs. Several of the chapters in Studies in Development Planning (Chenery 1971) deal with this question -- see in particular the chapters by Bowles, by Dougherty, and by Selowsky. The first two of these chapters were attempts to identify substitution elasticities using CES functions . Selowsky, however, tested the sensitivity of estimates of contributions of education to growth in Chile and in Mexico under different intralabor substitution elasticities. His model is interesting in its handling of factor shares and elasticities, as is his use of it to estimate "full-employment marginal products" of the various categories of labor. The book with Selowsky's chapter is readily available, so I shall not reproduce his analysis here -- except to specify the structure of his production function.

Selowsky started with a standard Cobb-Douglas function in which

$$Y = A K^{\alpha} L^{1-\alpha},$$

the relative share of capital being α and that of all labor $(1 - \alpha)$. He then breaks labor, however, into components using a CES function of the form

$$L = [\sum_i \sum_j a_{ij} C_{ij}^{\theta}]^{\frac{1}{\theta}}$$

where a_{ij} is the distribution of the ij-th category of labor and $\theta = \frac{\sigma L-1}{\sigma L}$ is the constant elasticity of substitution among labor groups. The aggregate production function can then be written

$$Y = AK^{\alpha} [\sum_i \sum_j a_{ij} C^{\theta}_{ij}]^{\frac{1-\alpha}{\theta}}$$

from which Selowsky leads us to

$$\frac{dY}{dC_{ij}} = (1 - \alpha)\, a_{ij} \left(\frac{Y}{C_{ij}}\right)\left(\frac{C_{ij}}{L}\right)^{\theta}$$

Selowsky goes on to evaluate rates of return at the wage that would have been determined under full employment at various assumed elasticities of substitution among labor categories. The lower the elasticity of substitution, the higher will have been the cumulative contribution of education to growth in the national product of any given final wage structure. Selowsky illustrates this with his estimates for Chile and Mexico. Without developing a comparable formalized specification, Langoni illustrated the effect for Brazil; using the 1969 wage structure, he estimated an annual percentage-point contribution of education to Brazilian growth of 0.8 percent, whereas with the 1960 structure his estimate was 1.4 percent. A cumulative analysis would have fallen between these limits. Looking back, estimates using end-of-period wage relationships will tend to underestimate the cumulative contributions of education to past growth; but, as these become base-period wage relationships looking to the future, the opposite bias is indicated, provided -- and this proviso is crucially important -- that demand for educated labor does not rise fast enough to compensate for what in a less dynamic situation would bring declining marginal products. Once again, capital-education complementarities or substitution and the associated nature of technological change (including effects of education on technologies) becomes of central importance. Saxonhouse (1977) addressed just such problems (see Section IV.D below).

C. Some Empirical Results from Growth Accounting

Aggregative assessments of the contributions of education to the national product and to economic growth are really a description of the combined effect of prevailing differentials in earnings associated with differences in schooling (and whether, with appropriate pricing, there have been substantial changes in skill-wage ratios over the period) and of changes in the educational composition of the labor force. On the basis of the former alone, one would have expected a higher estimated contribution of schooling to income growth over the years 1950-62 (see Table 3) in Europe than in the United States, since schooling had a greater relative effect on earnings in Europe. However, mass education in the United States (which began early enough to extend its effects by 1960 over a large proportion of the labor force even at middle age and above) explained enough to sweep education into a front position among factors accounting for the growth that occured over the prior three decades. In other words, in national-income-accounting analyses of this sort the estimates of what education explains are predetermined by the estimates of measured inputs of embodied schooling at any given constant pattern of differentials in earnings; what is not predictable is the changes in the earnings pattern.

Table 3 brings together the results of a number of studies -- from Denison, from Correa, and from others -- some of which were assembled by Nadiri (1972) in an excellent synthesis and commentary. As I have set these studies out in Table 3 they are ranked by the estimated rate of growth in national income. (Countries with incomplete data on the educational estimates have been omitted.) Two estimates are given in most cases under education; the first column is without "ability" adjustments, the second column with those adjustments as made by the authors. It becomes important in looking at a table such as this to draw on the perspectives that Denison is bringing currently to his analysis of why growth rates slowed (and why more in one country than another), for some of his insights on that problem are also relevant to the placement of the various countries in the growth rate

Table 3

EDUCATION IN GROWTH ACCOUNTING, 1950-62 (EXCEPT AS OTHERWISE SPECIFIED

Country	Rate of growth of income	Annual percentage point contributions								Percentage of growth attributed to education	
		Total inputs	Output per unit of input	Physical capital	Employment	Health and nutrition	Labor reallocation a/	Education (1)	Education (2)	(1)	(2)
Japan											
1955-68 b/	10.1	3.9	6.2	2.72	1.03	...	...	0.23	0.14	2.3	1.4
1961-71 c/	9.3	6.8	2.5	2.57	1.09	...	0.62	0.53	0.35	5.7	3.8
1953-61 c/	8.1	3.5	4.6	1.62	1.14	...	0.67	0.50	0.33	6.2	4.1
Venezuela d/	7.7	4.6	3.1	2.04	2.19	0.21	...	0.33	0.19	4.3	2.5
Germany e/	7.3	3.3	4.0	1.41	1.49	0.28	0.77	0.18	0.11	2.5	1.5
Mexico d/	6.0	5.7	0.7	2.82	1.43	0.93	...	0.11	0.05	1.8	0.8
1950-64 f/	6.0	4.4	1.6	2.81	1.46	...	...	0.41	...	6.6	...
Italy e/	6.0	1.8	4.2	0.70	0.42	0.28	1.04	0.65	0.40	10.9	6.7
Greece											
1951-64 g/	5.7	2.8	2.9	1.55	0.65	...	...	0.55	...	9.7	...
1951-61 h/	5.3	3.1	2.2	2.44	0.45	...	...	0.24	0.15	4.6	2.8
Peru d/	5.6	2.8	2.8	1.40	0.67	0.57	...	0.23	0.14	4.1	2.5
Brazil d/	5.5	4.1	1.4	1.66	1.83	0.43	...	0.30	0.18	5.5	3.3
1950-69 i/	6.0	4.4	1.6	2.00	1.65	...	0.33	0.50	...	8.3	...
France e/	4.9	1.3	3.6	0.79	0.07	0.15	0.65	0.47	0.29	9.6	5.9
Canada j/	4.8	3.0	1.8	1.20	1.50	...	...	0.45	0.30	9.4	6.2
Colombia d/	4.8	3.4	1.4	1.04	1.66	0.49	...	0.33	0.20	6.9	4.2
Netherlands e/	4.7	2.1	2.6	1.04	0.78	0.04	0.21	0.39	0.24	8.2	5.1
Ecuador d/	4.7	2.5	2.2	1.07	0.92	0.32	...	0.38	0.23	8.1	4.9
Honduras	4.3	2.9	1.4	0.95	1.06	0.82	...	0.48	0.29	11.1	6.7
Chile d/	4.2	1.4	2.8	0.32	0.65	0.20	...	0.33	0.20	7.9	4.8
1950-64 f/	4.2	1.8	2.4	0.56	0.78	...	...	0.54	...	12.8	...
Denmark e/	3.5	1.9	1.6	0.96	0.70	0.07	0.41	0.23	0.14	6.6	4.0
Norway e/	3.5	1.4	2.1	0.89	0.13	0.14	0.54	0.39	0.24	11.3	7.0
United States e/	3.3	2.2	1.1	0.83	0.90	0.02	0.25	0.78	0.49	23.5	14.8
Belgium e/	3.2	1.3	1.9	0.41	0.40	0.09	0.20	0.70	0.43	21.9	13.4
Argentina d/	3.2	3.0	0.2	1.43	0.93	0.12	...	0.88	0.53	27.6	16.6
United Kingdom e/	2.3	1.3	1.0	0.51	0.50	-0.03	0.06	0.47	0.29	20.5	12.7
India											
1950-60 f/	2.2	1.8	0.4	0.76	0.91	...	...	0.13	...	5.9	...

..., no data.

Sources: see notes below

a/ Directly estimated by Langoni (1970) for Brazil. For Europe, Langoni's adjustment of Denison's estimates for "reallocation of resources".

b/ Kanamori (1972).

c/ Denison and Chung (1976, p. 38).

d/ Correa (1970).

e/ Denison (1967).

f/ Selowsky (1967).

g/ Vouloudakis (1970, mimeo, cited in Nadiri 1972).

h/ Bowles (1967).

i/ Langoni (1970).

j/ Walters (cited in Nadiri 1972).

ranking of Table 3. I must let that pass, however. The most obvious features of this table are (1) the asociation between output per unit of input and the rate of growth (when growth is rapid much of it remains "unexplained"); (2) the high contributions of physical capital in Japan and Mexico, toward the top of the list, but also in Greece and Brazil toward the middle and (3) the lack of any systematic relation (or even an inverse relation) between percentage-point contributions of education and the pace of growth. Estimated growth point contributions of education (uncorrected for "ability") equaled or exceeded 0.50 in the Denison-Chung estimates for Japan; in Italy and in one estimate for Greece; in Brazil; in one of the estimates for Chile; and in the United States, Belgium, and Argentina. They were decidedly low for Germany, in one of the esstimates for Japan, in Peru, and in Denmark.

In percentages of growth explained, for most countries education turned out to be a minor factor. In this formulation, it accounted for more than 10 percent of growth in the four countries with the lowest overall growth rates (India excepted). Denison's finding (1967) that the United States (with Belgium) stood in marked contrast to the northwestern European countries of his 1967 study in the importance of education is by now well known. The cautions against too optimistic a faith in education that these findings must raise are reinforced by the estimates for other countries. Or is this the conclusion we should draw? Do the models distort the entire picture of growth processes and the roles of human development in them?

A number of biases have been suggested in earlier remarks. The simplest, even accepting all other aspects of these models, is the omission in all of them of the educational "maintenance" component. This omission is most serious where there have been large increases in the numbers of employed persons and where initial mean educational attainments were relatively high. Germany is the prime example; the contribution of increases in human capital in that country are the most grossly underestimated on this account.

For longer periods, and where there has been substantial structural change, the share of labor in GNP tends to rise; this means that constant-share weights will understate contributions of human resources to economic growth. Japan illustrates this bias.

There are some limitations to these accounting procedures that go beyond questions of inclusion of a "maintenance" component and use of a Cobb-Douglas constant-shares weighting (even when elaborated to introduce a CES function within the labor component to allow for elasticities of substitution among categories of labor). Although the observations on which the estimates given in Table 3 are based were taken over historic real or calendar time, the analytical models behind them are essentially static: they do not incorporate in contributions to growth the importance of a stock of human resources equipped to handle, and to generate, rapid change. The measures of "contributions of education to growth" in these models refer only to <u>increments</u> to a stock, not to the stock of human reserves available to complement the new physical capital. There is no lagged-process component in these models, nor is there any real clue to the extent of learning processes in adaptation to the new over the working years of people's lives. Valuable as the growth accounting has been, it says nothing about development processes; those processes still appear mainly in the unexplained residuals.

D. Effects of Nonconventional Inputs on Parameters of Conventional Production Function

Some of these problems were attacked by Saxonhouse in his econometric study of Japanese cotton spinning from 1891 to 1935 (1977). Saxonhouse, like Fallon and Layard (1975), challenged the common assumption that marginal rates of substitution between capital and labor were invariant to levels of "nonconventional inputs," such as education. He challenged also the unnecessarily restrictive assumptions that education was entirely labor augmenting or that it was simply another conventional input -- alternatives tested by Griliches (1970) among others. Saxonhouse set up a generalized production function as folows:

$$(1) \qquad Q = F\,(K,\, L,\, X_3 \ldots\ldots X_m;\; X^*_{m+1} \;\ldots\; X^*_r),$$

where Q is quantity of output,

X_i is conventional input i ,

X^*_j is nonconventional input j ,

L is labor services, and

K is machinery services.

In this formulation a change in any of the nonconventional inputs can define a new conventional production function; there is no a priori specification of the directions of technological bias. Saxonhouse tested the hypothesis that all parameters of the conventional K, L production function depend on the nonconventional inputs. In application to Japanese cotton-spinning firms, he started with a conventional CES production function that could be implicit in equation (1):

$$(2) \qquad Q = \left[(aK)^c \;+\; (bL)^c\right] \frac{1}{c}$$

On the assumption that the parameters a, b, and c are dependent on nonconventional inputs, he wrote:

$$a = a_0 + a_3 X^*_3 + a_4 X^*_4 \ldots + a_8 X^*_8$$

$$b = b_0 + B_3 X^*_3 + b_4 X^*_4 \ldots + b_8 X^*_8$$

$$c = c_0 + c_3 X^*_3 + b_4 X^*_4 \ldots + b_8 X^*_8$$

Assuming profit maximization at a given level of K, a given level of nonconventional inputs, and given output price and wage level, Saxonhouse set up a standard maximization equation. For several reasons he introduced the simplifying constraint that the nonconventional inputs varied only across time, but not across firms at a given time. With this simplification he was able to set up a manageable equation for the estimation of the parameters of a conventional production function with the nonconventional inputs as independent variables. These results (where the units of observation are individual firms) were presented for seven time intervals over the span of forty-five years. The article is addressed to two aspects of development: economic growth or productivity, and labor absorption or displacement. Saxonhouse found (p. 209) that, for the years from 1891 to 1910,

> ... productivity improvement went hand in hand with accelerated labor absorption. Indeed, during this period the increase in the demand for labor was so great that parametric change, by itself, suggested a decline in labor productivity at the same time that total factor productivity was increasing! By the 1920s and 1930s this relationship had completely reversed itself. Between 1922 and 1935 efficiency improvement was of such a nature as to cause not simply a deceleration of labor absorption, but an absolute decline in the level of labor services required....These results emphasize that the labor frontier has considerable breath and flexibility.

That conclusion is consistent with the very large effects Psacharopoulos (1968) obtained when he tested sensitivity of his aggregative analysis for Greece to use of technical coefficients from other Mediterranean countries.

Behind the results from Saxonhouse were some interesting findings concerning the effects of particular nonconventional inputs on the parameters a, b, and c of his equation (2) and on a derived scale parameter. He was highly successful in explaining the variance of those parameters, which were regressed on six "nonconventional" inputs: changes in firm managements' experience and education ("technical training"), changes in workers' experience and education, quality of machinery used, and working conditions (lengths of shifts). From these regressions, Saxonhouse found that workers' experience, education, and working conditions had large and pervasive effects on both productivity change and labor absorption. Management's education had little effect (and the signs even change on this between subperiods), and management's experience and age of equipment had no effect at all. A change in the incidence of primary education affected all the parameters. It had a strong output-increasing influence through its effects on both labor and capital augmentation and on returns to scale that outweighed its negative effect on the elasticity of substitution between capital and labor.

The conclusions in Saxonhouse's work of greatest interest here are:

- Long-term improvement in productivity in the Japanese cotton-spinning industry "occurred almost entirely because of modest changes in laborforce characteristics and working conditions" (p. 216). Saxonhouse's discussion of the process of formation of a more stable and sophisticated labor force is an insightful interpretation of this finding.

- Highly trained managers and technical help, while making a modest contribution to productivity improvement (in most years), had a negative effect on "labor absorption."

- Labor absorbing methods require a nucleus of experienced workers if large numbers of untrained workers were to be used.

- The findings confirm "the hypothesis that the conventional production function is very much a partial relationship, embedded in a more general production function that includes both conventional and nonconventional inputs as elements" (p. 219).

It follows from this that "conventional production function parameters, such as the elasticity of substitution, can hardly be thought of as fundamental elements in an explanation of long-term growth of output and employment" (p. 219).

VII. SCHOOLING, EXPERIENCE, AND ENTERPRISE

For many years I have argued that learning by doing is a crucial part of the process of economic development, that there are some dilemmas for growth efforts in this fact, and that a model that does not take into account interactions among schooling, experience, and investment in enterprise (public or private) as an integral set of activities will miss the essence of what development is. That is the main theme with which I shall conclude this paper. First, however, I want to note briefly some of the formal, theoretical models that have more of a dynamic thrust -- in particular, the writings of Kaldor and Arrow, which come closer to delineating processes (as does Svennilson) through which change comes about.

A. Disequilibria and Learning in Formal Models of Growth

One of the first theorists to ask not only how advances in knowledge may be fed into growth processes but also (in part, at least) what in economic processes may induce innovative change -- and to explore the interplay of these causes and effects -- was Nicholas Kaldor (1957, 1963). In some respects he was attacking marginal productivity theory, but not so much in the short as in the long run. Kaldor also attacked distinctions between production function and shifts in those functions. Furthermore, he emphasized the continuous condition of disequilibrium in a dynamic economy. Indeed, according to Kaldor (1963, p. 205):

> In an economy where capital accumulation is a continuous process this maximum output boundary is never attained -- since the actual assortment of capital goods at any time (even with a constant state of knowledge, whatever that assumption may be taken to mean) will consist of items appropriate to different states of accumulation, ... the system does not move along the curve, but inside it. Furthermore, the rate of shift of the production fucntion due to the changing state of "knowledge" cannot be treated as an independent function of (chronological) time, but depends on the rate of accumulation of capital itself. Since improved knowledge is largely, if not entirely, infused into the economy through the introduction of new equipment, the rate of shift to the curve will itself depend on the speed of movement along the curve, which makes any attempt to isolate the one from the other the more nonsensical.

Kaldor opted for what he termed a "technical progress function," which postulates a relation between the rate of increase of capital and the rate of increase in output and which embodies the effect of constantly improving knowledge and know-how as well as the effect of increasing capital per man. There is no attempt in Kaldor's work to separate the one from the other. With Mirrlees (1962) he has argued that, in the long run, the technical progress function entails an increase of output per capita on the latest machine as an increasing function of the rate of increase of investment per capita. Nevertheless, there ultimately is diminishing response to an increasing pace of investment. As Hahn and Matthews (1965) sum it up, Kaldor's technical progress has two elements: an exogenous increase in ideas, and the extension and exploitation of these ideas by learning. It leaves out organizational change and "the Horndall effect."

Kenneth Arrow (1962) has given the most elegant mathematical formulation of, and the label to, "learning by doing" in the aggregative economics of growth. Despite its title, Arrow probably would place his article in the physical-capital rather than in the educational-investment camp, although I would locate it quite firmly in both. He argued (1) that people learn by being challenged with new experiences; (2) that gross investment in physical capital (before depreciation) is the best index of rate of exposure to learning situations; and hence (3) that the best measure of capital inputs into aggregate production is gross physical capital formation. The use of net values has underestimated (Arrow argues) the role of physical capital in growth. Looked at in another way, (which was not Arrow's), his thesis could be turned around to read: (1) that increases in skill and knowledge are the main key to growth; (2) that exposure to new situations speeds learning; and hence (3) that rapid replacement of obsolescing equipment is a sound investment in people and, through people, in economic growth. Neither set of statements is complete; both are partial truths. Which investments will have the human-learning development potentials for growth? And how far does the viability of investments with such potential depend upon a human resource base that is taken for granted in Arrow's model? To what extent has the limited schooling and lack of skills among populations of the developing countries both checked the pace and cost effectiveness of investments and conditioned the form they would take? Is the economic dualism that plagues some of the countries that started from the lowest levels in education and economic performance after World War II -- in part at least -- a reflection of just such limitations on viable technologies? My view that this was indeed the case is fifteen years old and was first formulated in the essay "From Guilds to Infant Training Industries" (Bowman 1965).

Kuznets among others has emphasized the selectivity of imitation and choice of technologies in the development process, laying special stress on the capabilities of a population for innovative imitation. Japan's rapid agricultural modernization borrowed few innovations from the West except in methods of research and basic agronomic science. This kind of transfer, and the ensuing application, presupposes a developed educational system in the broadest sense -- in schools and homes, in places of work, and even in places of entertainment. Scientific and inovative capacities do not spring into being: they evolve, and are fed by small imitations along the way. Innovation is what is essential. If this is the heart of the transfer problem, the notion of "factor proportions dictated by technological leadership of advanced countries" -- neatly formulated by Eckhaus in 1955 and widely accepted as inevitable today -- may have quite different implications. Is there in fact such dictation and, if so, why does it occur?

B. Learning and Training at Work

As I review recent histories of economic development and economic problems in the Third World, together with the processes by which innovations have been transplanted from one to another (both recently and over the past century or more) I become increasingly convinced of the following propositions. (1) Learning by doing, which can take many forms, is at the heart of dynamic, sustained economic development. This is necessarily so if people are to continue to participate effectively in a changing economy and to take advantage of changing opportunities over the course of a lifetime. (2) Basic general education provides an essential foundation for the capacities to learn and to adapt to new situations -- whether in agriculture, industry, or trade. (3) Some customs or institutions that commonly have been regarded as inimical to progress (by impeding mobility or reducing flexibility, especially in labor markets) may nevertheless contribute to the internalization of externalities arising from investments in human beings -- and contribute, thereby, to continued learning and to rapid and sustained growth. One corollary of this set of propositions is the importance for growth of know-how, as distinct from schooling, along with the relations between these sources of productive capabilities. Unfortunately, as I see it, this problem has received little attention. Recent popular theories first of "nonformal education" and now of "recurrent education" -- do not get to the crux of the issue and have lacked integration into an analytical structure that could yield further insights. I suggest two main directions that may help us, and that I have already anticipated in the above remarks. These are: first, a reexamination of the concept of firm and specific training as developed by Becker (1962, 1964), but in application to the analysis of economic growth; second, an examination of asymmetries in the development opportunities of physical and human capital, with the attendant dilemmas this poses for some of the developing countries. (I bypass here the important topic of the associations among schooling, research, extension, and agricultural progress, on which I commented earlier and which have been reviewed by others at the Bank. I bypass also an analogous consideration of the formation of human resources and innovative progress in nonfarm, small-scale enterprises, which I discussed briefly in Section II.)

Becker's "specific" training is an extremely important type of construct, which refers to learning that increases productivity primarily (in the pure case) in the firm where the learning takes place. Such increments to human capital are not transferable to other settings. In more general terms, this specificity may rest on institutional constraints or it may depend solely on the inherent nontransferability of what is learned (Bowman 1965, 1971). In any case, there is investment in the development of human capital by the enterprise, which also reaps later, if only partial, benefits. To this extent there will be a persistent understatement of the social, marginal product of human capital -- some of which is, in a sense, "owned" by the firm, which paid the cost and receives the return. No aggregate production function or national accounting estimates will include this component in the contributions of human resources to economic growth. In some societies, and very clearly in the Japanese case, this leads to biased estimates of the sources of growth. Little attention as yet seems to have been paid to the implications for understanding economic growth. Such implications are important not only for estimating factors in growth, but also for consideration of public policies that may encourage or discourage mutually supportive processes of investment, development of human resources, and technological change.

It has been an accepted tenet of conventional economics that whatever impedes mobility diminishes efficiency in production and distorts the allocation of resources. It has also been common practice to distinguish between short-term equilibrium adjustments within the constraints of nonmalleability of capital (physical or human) and long-term adjustments in which the clay becomes putty. Less attention has been directed, however, to empirical implications of the duration of contracts (formal or informal), especially contracts in the labor markets. I suggest that more attention to this temporal dimension in labor-market institutions could significantly alter our understanding of processes of economic growth. Longer implicit terms of contract alter enterprise incentives to invest in human resources in the first place; they affect the treatment of obsolescence in both machines and people; and they increase the efficiency of the learning process. On all counts this will favor economic growth, as is most dramatically illustrated in Japan.

The leading sectors in the Japanese economy, with its rapid pace of technical progress, have been the large enterprises, which come closest to conforming to the stereotype of the "life commitment" system. This system could be interpreted, from an American point of view, as a legally informal but firmly entrenched seniority system for those who become "regular" members of the firm's labor force: such individuals will not be laid off. Along with this security goes a related (though less strong) commitment of the individual to the firm. This sets the stage for substantial Becker-specific training to start with, since employers can anticipate that trainees usually will stay with the firm. More than that, since management cannot get rid of regular employees before the normal retirement age (at 55) -- and up to that time must not only pay these workers but keep them busy at reasonably suitable jobs -- there is a strong incentive to prevent too early an obsolescence of skills. The cost of obsolescence of skilled people, which might otherwise be borne by the general society, are thus internalized in the enterprise. At the same time, so long as there was a rapid pace of economic expansion, together with a life-cycle pattern of wages that rise steeply only at a relatively late stage, current payrolls could be kept low relative to investments in both the physical and human assets of the firm. The reduced pace of economic growth and the changing demographic structure of the work force has been leading, however, to a substantial alteration in this situation, which in turn exercises a dampening effect on the growth process.

Reasonably long-term attachments between employer and employee, however informal, may be favorable for growth also on account of the experienced-group effect on efficiency in the training and learning of new recruits. This is the reciprocal of what I have earlier labeled the "raw group problem" (Bowman 1965), which can be severe in less developed countries and even in lagging regions of more advanced societies. Sherwin Rosen (1972) developed a similar analysis (which he formally modelled), referring to it as the internal externalities in the value of the firm of experienced workers. In part this is a matter of the cost of maintaining any given level of skill and efficiency in the firm; in part it goes beyond that. The experienced-group learning effect, which is easily documented in the United States as well, is related in some respects to the "organic" Penrose theory of growth of the firm, adopted by Uzawa (1969).

Periods of exceptionally rapid growth normally seem to begin with conditions of substantial disequilibrium in the composition of the capital stock, whether human or nonhuman. But we do not have to take such extreme examples to justify concern iwth disequilibrium in the process of growth. Economic growth will be understood as a real process only when we dmit disequilibrium into our analytical models. The whole problem of discrepancies between forward and backward estimates of the value of capital could be viewed as a phenomenon of disequilibrium, important even when we ignore biases in the formation of human capital and its utilization. That problem becomes crucial when human capital is given the attention it deserves.

I referred to the importance of "know-how" above, but did not define it. A simple definition would be "the ability to see why things are not working properly and to get them back on track" (Bowman 1979). This could be technical or mechanical know-how. It could be sorting out the anomalies that have distorted accounting in a business firm. The first dilemma of early industrialization among late-comer countries is unquestionably a gap in the middle range of skills and know-how -- sometimes technical, sometimes organizational. This gap was recognized by Frederick Harbison long ago (in the middle 1950s) when he studied the situation in Egypt. There is a fundamental asymmetry in the potentials for human-resource development relative to economic development that has not usually been recognized, however.

In time, schooling can easily lead development because the turning out of school graduates does not depend upon or require participation in or observation of production processes. By their very nature, schools are isolated from "work"; this is their advantage as well as their limitation. The mistake that people make all too often in talking about "what is wrong" with the schools is to assume that schools can substitute for all other agencies of learning, including the home and the workplace. The only real limitation of schools in leading development is a limitation in the ability of the society to pay for the schools. This fact has become clear even to the most reluctant observer during the past decade in most of the Third World. When England industrialized, limited schooling was probably a drag on development: it followed rather than led. In most countries today, though not in the poorest, schooling may be leading development -- partly because schooling has become a fashion, but also because this is where individuals see a road into the "modern sector" of a dual economy.

There is unquestionably a close connection between the difficulty of developing and diffusing know-how in a population and the emergence and persistence of economic dualism. Without intermediate skills and a fair admixture of know-how, enterprises that would use such skills will have difficulties. One of the results is the tendency to circumvent the gaps in skills by introducing ultramodern, labor-saving methods of production in formally organized sectors of the economy while "cheap labor" persists elsewhere. But this means that the opportunities for development and diffusion of skills at work are correspondingly limited. Lack of intermediate technical (and managerial-entrepreneurial) skills and of the know-how to resolve day-to-day problems blocks the establishment of production units in which those capabilities are best formed and diffused.

Although I have never been a great enthusiast for "manpower planning" as it appeared in most of the more ambitious, national-scale models and in the use of cross-national indicators of what the manpower mix "should" be, no good businessmen will consider a major new investment without looking into the availability of personnel qualified to implement it and without arranging for their training if need be. I see project-related training at the World Bank in the same light. But this training may be more than that. Through a combination of training and experience on a Bank-financed project, people may gain competencies that can be carried into other activities. The Bank does not need to be concerned, as does a private businessman, that such persons might "desert" it for other opportunities. In effect, the "firm" of Becker's specific-training model might be viewed at least as the entire nation, in which case the relevant turn-over problem becomes synonymous with the problem of "brain drain." Given the vicious circle that can develop with respect to mutually interdependent or complementary needs for physical capital and know-how in some of the developing countries, perhaps there is a criterion here, however difficult it may be to apply, that might receive more attention in plans for the encouragement of development in the Third World.

Long before I had any association with the World Bank, I was writing about some of the problems of biases in the sequences of investments in industry in less (perhaps I should say in the least) developed countries. In my judgment, the argument I presented then (Bowman 1965, pp. 119-20) still stands up:

> Given the limitations of simple imitation, the difficulties of more subtle transfer, the existing human-factor gaps, and the nature of modern world politics, there is undoubtedly a tendency toward an unfortunate sequence of investments in industry where there is virtually nothing at the start.

These unfortunate biases stem from at least four main sources:

> (1) It is much easier to transfer a technology intact (plant, staff, know-how, and all) than to innovate in line with the best interests of the new locale. And it is easier to transfer a package that includes much physical capital and small numbers of highly trained staff than a package requiring less physical capital but many less qualified workers and foremen.
>
> (2) The process of search for promising investment opportunities is an expensive one, justified only for those undertakings that will entail large total capital outlays. International agencies and governments evaluating alternative aid projects need not be so constrained by this second consideration but in practice their behavior is much the same. They are not organized to explore scores of smaller possibilities that might add up to a greater economic push in the long run.
>
> (3) Looking at each possible new type of enterprise by itself works against the smaller ones, for each one alone is likely to be highly risky. Only a large investor can spread this risk.
>
> (4) Finally, we come back to the heart of the human-factor dilemma. The serious disjunction between social and private returns inhibits initiation of ventures requiring large programs for labor-force training. This is where the complementary problem is most recalcitrant unless public policies are deliberately designed to overcome it; education in the widest, and at the same time most crucial, sense has some laws of its own, and these imperatives of the learning process have built into them their own logic of internal complementarities.

The second and third of these biases are simply statements of bankers' and foreign investors' biases of scale. The first takes its coloration from scale-of-investment bias, but it can have quite different implications for training and learning if the producing units are more modest ones. This is illustrated by the participation of Indian firms in the development of productive skills among the Africans of Kenya (Kenneth King, 1975b). Only the first and fourth biases are relevant to local entrepreneurial behavior.

C. Lessons of History

In the early postwar years there was widespread resistance to looking at history for clues about the present and the future, especially with reference to the less developed nations. The future was to be different, and it was to move at a faster pace: this indeed has happened. Nevertheless, there is much to be learned from history. The present becomes history with extraordinary speed, but we all can also observe the hand of the past in the present. This is one of the reasons that rules of thumb and generalizations about what would be the "best" policy or what should be the main emphasis in the World Bank's lending for education (or for any other general sector) elude us -- or thay they may become counterproductive.

From the start of his involvement in the study of the economics of education, T. W. Schultz has asked what we could learn from the successes and failures we can observe in efforts to encourage and sustain growth in one context or another during the postwar years. What, for example, may we learn from the success of the Marshall Plan in Europe, in contrast to the very different experiences and problems associated with efforts to build physical capital in developing countries? To ask this question as he did is to point to the stock of human capital available and ready to make effective use of new physical capital; this is not what is measured in any of the aggregative longitudinal models, whether they are growth models or aggregate production functions applied in econometric analyses of time series. In both Germany and Japan there was a period of physical capital's catching up with available, complementary human capital; in such a setting the expectation would be that the formation of physical capital would be the greater factor in economic growth as measured by the Denison and the Jorgenson-Griliches models alike. How appropriate then are the conventional models of aggregate growth? I suggest that the histories of postwar development in Germany and Japan do not merely illustrate a catching-up process that makes them deviant cases in a national-accounting framework.

Conventional models tell us nothing about the importance of a reserve of human capital (in embodied schooling and know-how) that can encourage and sustain investments in new physical capital and organizational innovation. The Japanese experience demonstrates that vast human-resource potentials embodied in a population can and do go underused. What they contribute to growth depends on other factors, but the reservoir of such resources determines how rapidly an economy can move ahead, given favorable conditions and a dynamic impetus. Whether the growth is attributed to the new physical investment or to the available underused stock of human resources is then a quibble: both are required. Economists can construct various sorts of ex post "aggregate production functions" to "explain" growth, but the meaning of "long-term equilibrium" itself becomes empirically elusive when what human beings do and might contribute to a changing scene is brought into the analysis.

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Part III

FARMER EDUCATION AND FARM EFFICIENCY: A SURVEY

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I. INTRODUCTION

One of the first questions asked after Mary Jean Bowman (1966) described the "human capital revolution" in economic thought was: what is the profitability of investing in this new form of capital? Hesitantly at first, but soon more eagerly, researchers around the world started estimating, from special samples, the social or private returns associated with educational and other related expenditures in human capital for diverse population subgroups. They used a variety of assumptions and methodologies, ranging from back of envelope calculations to extremely sophisticated econometric techniques.

The first claim to empirical cost-benefit analysis of education is that by a Soviet economist, Strumlin (1929). But the real activity in estimating rates of return did not start until the late 1950s, for example, Becker (1960). T.W. Schultz's (1961) presidential address to the American Economic Association and the publication of Becker's (1964) National Bureau of Economic Research book stirred further interest in the subject, especially as a topic for doctoral dissertations in US universities. The estimation procedure used during this first wave of the literature on rates of return was of the "elaborate type" (described in the next section).

The second wave of the literature starts somewhere in the early 1970s and is established with the publication of Mincer's (1974) National Bureau of Economic Research book. The estimation technique now becomes increasingly of the "earnings function" type (described in the next section). This technique is still in common use today and tends to be the dominant procedure for estimating of rates of return. (It is also interesting that the alternative to the rate of return cost-benefit measure, the "net present value," has lost ground in the recent literature, mainly because this alternative does not have a readily intelligible interpretation.)

The year 1973 was a landmark of sorts in the rate of return literature because of the publication of the first systematic comparative study of this methodology (Psacharopoulos 1973). A total of fifty-three rate of return case studies were reviewed, covering thirty-two countries.

This paper is an attempt to update the earlier evidence on rate of return by considering studies that have been conducted in the 1970s. The result of this updating is the addition of thirteen new country cases and a revision of most of the figures in the old country set. I go beyond the compilation of comparable figures, however, and discuss a series of controversies that have been associated with the rate of return studies of the 1970s. Following on application of the expanded data set, I try to give an interpretation of the summary findings.

II. PROCEDURES FOR ESTIMATING THE RATE OF RETURN

For the purpose of this paper, it is sufficient to distinguish three main methods for estimating the rate of return to investment in education: the elaborate method, the earnings function method, and the short-cut method.

A. The Elaborate Method

This follows from the exact algebraic definition of the rate of return, which is the discount rate that equates a stream of benefits to a stream of costs at a given point in time. For example, consider the estimation of the private rate of return to investment in higher education in Figure 1. If Y stands for labor earnings, and h and s subscripts for higher and secondary education, respectively, the rate of return (r) in this case is found by solving the following equation for r:

Discounted benefits to age 22 = Cummulated costs at age 22.

(+++ Area) = (——— Area)

(1) $$\sum_{t=1}^{n}(Y_h - Y_s)_t(1 + r)^{-t} = \sum_{t=1}^{c}(Y_s)_t(1 + r)^{t}$$

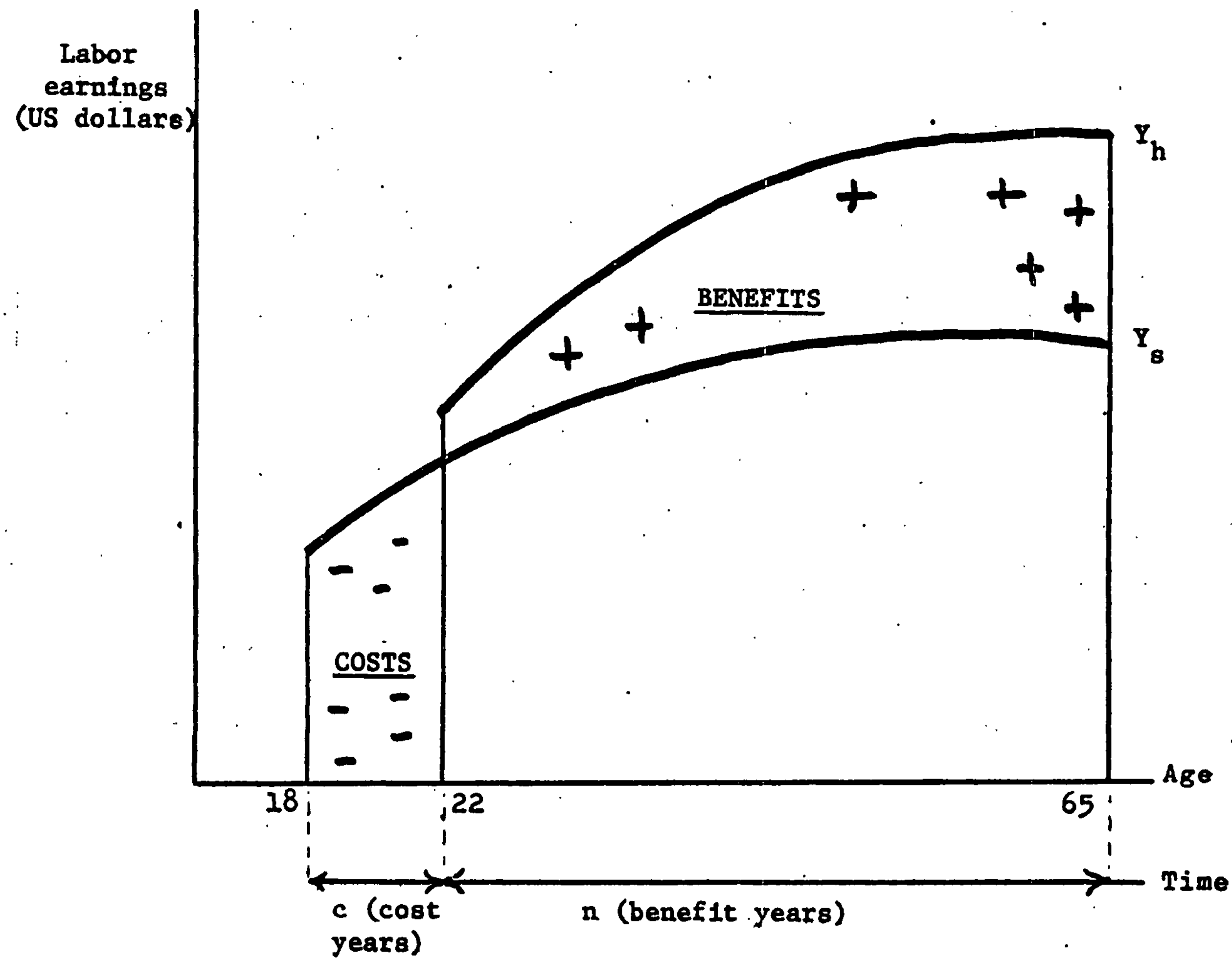
This high-power equation is usually solved by an iterative computer program that starts from an arbitrary value of r and keeps modifying it by small increments in the right direction until the left-hand side is equal to the right-hand side.

Note that, in the above private rate of return calculation, the only cost of the "education project" under evaluation is the opportunity cost of staying in school beyond the age of 18 instead of working in the labor market. This opportunity cost is measured by the earnings of labor with secondary school qualifications.

Should the estimation of a social rate of return be desired, one can simply add the resource cost of a university education in the right-hand side of equation (1) and repeat the calculation. Of course earnings in this case should be before tax, whereas in the calculation of private rate of return earnings should be after tax. But contrary to popular belief, the post- versus pre-tax treatment of earnings does not make a big difference in a rate of return calculation. It is the addition of the direct cost of schooling that mainly accounts for the fact that a social rate of return is lower relative to a private rate of return.

Figure 1

A RATE OF RETURN ESTIMATION ACCORDING TO THE ELABORATE METHOD



This way of estimating the profitability of investment in education requires, in the first place, detailed data on age-earnings profiles by educational level. This information is rare in most countries. Even if this information were available, the problem of small number cells arises. Namely, the plotted actual age-earnings profiles exhibit a saw-tooth pattern that makes the rate of return estimation very sensitive, especially regarding the initial years after graduation, which carry a high weight in the discounting.

It is for this reason that smoothing-out procedures have been used, the rate of return being estimated in three steps. In step 1, a regression of the type:

$$Y_i = a + b \cdot AGE_i + c \cdot AGE_i^2 \tag{2}$$

is fitted within subgroups of workers with the same educational level for the purpose of summarizing the data.

In step 2 an idealized age-earnings profile is constructed by predicting the value of Y for given ages and educational levels, using the estimated function (2).

In step 3, the predicted values of earnings are inserted in formula (1) to compute the rate of return.

B. The Earnings Function Method

Equation (2) in the above smoothing-out procedure should not be confused with what is known as the earnings function method of estimating the rate of return. This is a regression of the basic form

$$\ell nY_i = a + b \cdot S_i + c \cdot EX_i + d \cdot EX_i^2 \tag{3}$$

where S is the number of years of schooling of the individual (i) and EX his years of labor market experience. Equation (2) is an ad hoc fitting regression. Equation (3) is based on human capital theory, where b = r -- that is, the estimated regression coefficient (b) is interpreted as the average private rate of return to one extra year of schooling.

An illustrative proof of this proposition (that is essentially from Mincer 1974) is that

$$b = \frac{\partial \ell nY}{\partial S} = r \;; \tag{4}$$

that is, the rate of return is nothing else than the relative change in earnings ($\partial \ell nY$) following a given change in schooling (∂S).

There exist two ways one can add on the dimension of educational level to this concept of "average" rate of return. The first is to add an eS^2 term in equation (3), where e is the estimated coefficient on years-of-schooling-squared. In this case, differentiation with respect to S yields

$$(5) \qquad r = b + 2eS.$$

By substituting different values of S in the right-hand side of equation (5), one can arrive at a regression-derived structure of the rate of return corresponding, say, to primary education (S = 6), secondary education (S = 12) and higher education (S = 16).

The second way is to specify different educational levels in the earnings function by means of a series of dummy variables -- say, PRIM, SEC and HIGH, having a value of one if the individual belongs to the particular educational level, and zero otherwise:

$$(6) \qquad \ell nY = a + b \cdot PRIM + c \cdot SEC + d \cdot HIGH + e \cdot EX + f \cdot EX^2$$

In this case, the rates of return to the different levels of education are derived from the estimated coefficients b, c, and d in the above function as follows:

$$r_{\text{(primary vs illiterates)}} = \frac{b}{S_p}$$

$$r_{\text{(secondary vs primary)}} = \frac{c - b}{S_s - S_p}$$

$$r_{\text{(higher vs secondary)}} = \frac{d - c}{S_h - S_s}$$

where S stands for the number of years of schooling of the subscripted educational level (p = primary, s = secondary and h = higher).

The rationale of this procedure is that, effectively, one computes the rate of return by means of the following formula, which is educational level specific:

$$r_k = \frac{\ell nY_k - \ell nY_{k-\Delta s}}{\Delta S} \tag{7}$$

Here k is the higher educational level in the comparison and ΔS the difference in years of schooling between k and the control group.

The advantage of estimating the rate of return by the dummy variable method rather than the years-of-schooling-squared method is that a great deal of sensitivity is added; that is, the actual structure of the rate of return might not be as smooth as that suggested by formula (5).

The problem with the earnings function approach in general, however, is that the rates of return are estimated on the basis of the following implicit assumptions:

- The age-earnings profiles are either flat or equidistant between adjacent educational levels throughout their range.
- The age-earnings profiles last forever (to infinity).
- The only cost of schooling is the foregone earnings of the individual. (see Figure 2.)

These assumptions are not as damaging or unrealistic as they seem, and they have been sufficiently defended (and debated) in the literature on the earnings function method (for example, see Blinder 1976). For example, the fact that age-earnings profiles are assumed to last forever makes little difference to the discounted present value and, hence, the estimated rate of return.

The main problems with this method, however, are that one cannot readily incorporate cost data in order to estimate social rates of return and that this method understates the returns to primary education. The reason for the downward bias on the return to primary education is that <u>the estimation formula automatically assigns foregone earnings to primary school children</u>. This is just not true in settings in most countries and one should have this understatement in mind when interpreting the method's results.

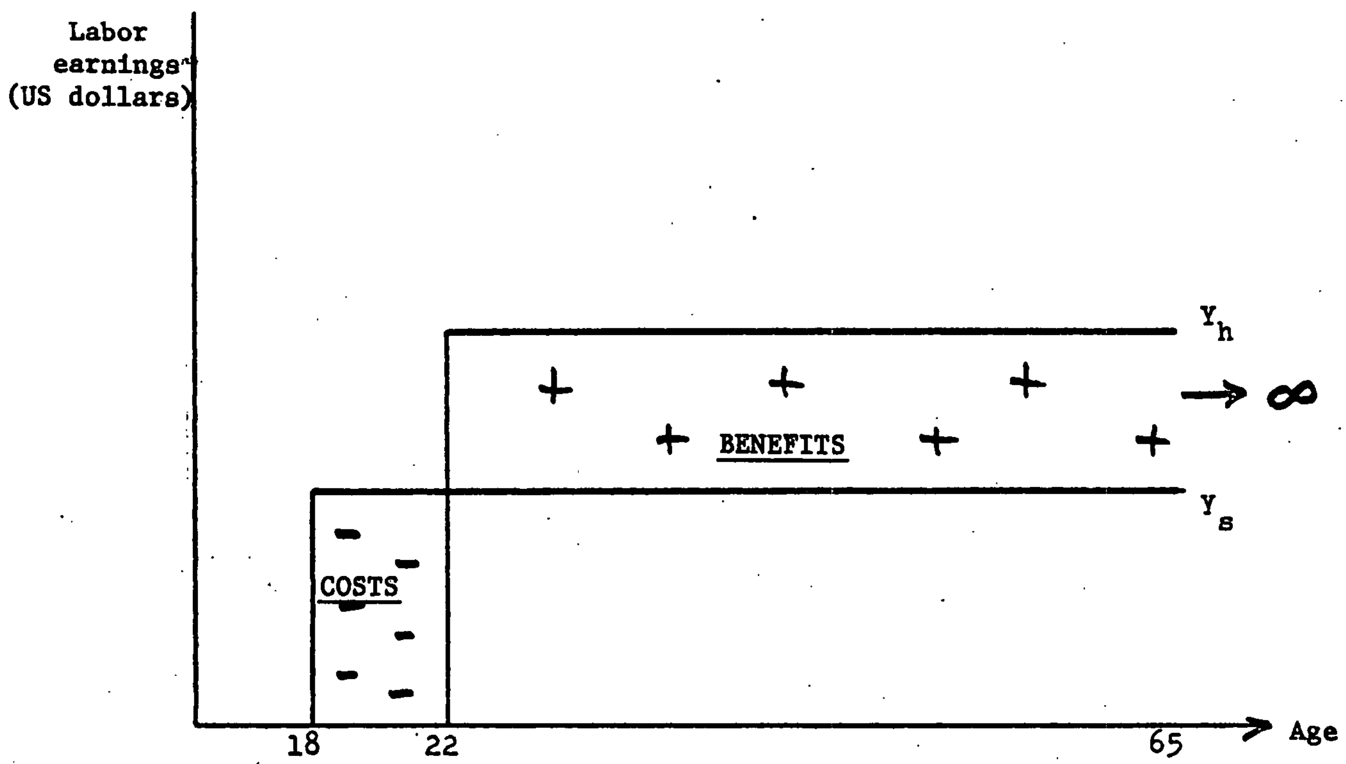
C. The Shortcut Method

This amounts to doing explicitly what the earnings function method is doing implicitly. That is, the returns to education are estimated on the basis of the simple formula

$$r_k = \frac{\bar{Y}_k - \bar{Y}_{k-\Delta s}}{S.(Y_{k-\Delta s})} , \tag{8}$$

FIGURE 2

THE PROCEDURE FOR ESTIMATING RATE OF RETURN IMPLICIT IN THE SHORTCUT METHOD



where $\bar{Y}$ refers to mean earnings of employees with the subscripted educational level. Formulae (7) and (8) are very similar, the difference lying in the mathematical approximation $\ln(1 + x) \simeq x$, which is good for values of x of the order of the rate of return to education. The great advantage of this formula is that one can use information already tabulated on the earnings of workers by educational level to estimate the private rate of return. Also, it is rather easy to add the resource cost of schooling in the denominator in order to estimate the social returns. Hence, it is of great value in cases where information on individual earnings is not available.

The main problem with this formula is, of course, that the age (or experience) standardization is absent. This can be rectified, however, in case the mean earnings by educational level are available for large age groups. Then choice of, say, the 35-45 age group for computation of the rate of return somehow prevents biases associated with the early experience profiles.

III. AN UPDATED RATE OF RETURN SET

Table 1 presents private and social rates of return by educational level in fourty-four countries. (This is an update of Table 4.1 in my 1973 book.) Estimates based on old surveys were replaced by newer ones when available -- as in the case of Kenya, India, the Philippines, Brazil, Colombia, Greece, Belgium, Japan, Malaysia, the United Kingdom, and the United States. New country observations were added for Ethiopia, Malawi, Morocco, Sierra Leone, Indonesia, Taiwan, Cyprus, Spain, Yugoslavia, Iran, France, and Italy. And, faute de mieux, the previous set of rates of return was retained in countries for whcih no newer estimates were available.

As in the previous compilation, an attempt was made to include rates of return as comparable as possible between countries. Thus, where the relevant information was available in the original study, the reported rates are:

- Marginal -- in the sense that they refer to investment at the margin between the educational levels considered (for example, primary graduation versus illiterates, secondary general versus primary, and higher education versus secondary general).

- Unadjusted -- for economic growth, ability differences, and unemployemnt. (The rationale for this choice is explained in Section IV of this paper.)

- Derived by the elaborate method -- in most cases (except in the cases of Colombia, Cyprus, and the United Kingdom, for which the regression method was used; and in the cases of Malawi, Indonesia, and Italy, for which the short-cut method was used).

A. Rate of Return Patterns

Nobody claims that the combination of diverse assumptions, estimation procedures, sample data, and years of reference can yield an absolutely comparable rate of return set to the last decimal point. But Table 1 contains some strong features that cannot be from comparability biases alone. The rate of return patterns in this table are fully compatible, and they validate and reinforce the conclusions reached on the basis of my 1973 international comparison. It is easier to discover the underlying patterns by averaging within country groups, as shown in Table 2.

- Pattern 1: The returns to primary education (whether social or private) are the highest among all educational levels.

- Pattern 2: The private returns are in excess of social returns, especially at the university level.

- Pattern 3: All rates of return to investment in education are well above the 10 percent common yardstick of the opportunity cost of capital.

Table 1

RETURNS TO EDUCATION BY LEVEL AND REGION OR COUNTRY TYPE
(in percentages)

		Rate of Return by Educational Level					
		Private			Social		
Country	Survey Year	Primary	Secondary	Higher	Primary	Secondary	Higher
Developing							
Africa							
Ethiopia	1972	35.0	22.8	27.4	20.3	18.7	9.7
Ghana	1967	24.5	17.0	37.0	18.0	13.0	16.5
Kenya a/	1971	28.0	33.0	31.0	21.7	19.2	8.8
Malawi	1978					15.1	
Morocco	1970				50.5	10.0	13.0
Nigeria	1966	30.0	14.0	34.0	23.0	12.8	17.0
Rhodesia	1960				12.4		
Sierra Leone	1971				20.0	22.0	9.5
Uganda	1965				66.0	28.6	12.0
Asia							
India	1965	17.3	18.8	16.2	13.4	15.5	10.3
Indonesia	1977	25.5	15.6				
South Korea	1967				12.0	9.0	5.0
Malaysia	1978		32.6	34.5			
Philippines	1971	9.0	6.5	9.5	7.0	6.5	8.5
Singapore	1966		20.0	25.4	6.6	17.6	14.1
Taiwan	1972	50.0	12.7	15.8	27.0	12.3	17.7
Thailand	1970	56.0	14.5	14.0	30.5	13.0	11.0
Latin America							
Brazil	1970		24.7	13.9		23.5	13.1
Chile	1959				24.0	16.9	12.2
Colombia	1973	15.1	15.4	20.7			
Mexico	1963	32.0	23.0	29.0	25.0	17.0	23.0
Venezuela	1957		18.0	27.0	82.0	17.0	23.0
Intermediate							
Cyprus	1975	15.0	11.2	14.8			
Greece	1977	20.0	6.0	5.5	16.5	5.5	4.5
Spain	1971	31.6	10.2	15.5	17.2	8.6	12.8
Turkey	1968		24.0	26.0			8.5
Yugoslavia	1969	7.6	15.3	2.6	9.3	15.4	2.8
Israel	1958	27.0	6.9	8.0	16.5	6.9	6.6
Iran	1976		21.2	18.5	15.2	17.6	13.6
Puerto Rico	1959		38.6	41.1	21.9	27.3	21.9

(Table continues on following page)

Table 1 continued

Country	Survey Year	Rate of Return by Educational Level					
		Private			Social		
		Primary	Secondary	Higher	Primary	Secondary	Higher
Advanced							
Australia	1969		14.0	13.9			
Belgium	1960		21.2	8.7		17.1	6.7
Canada	1961		16.3	19.7		11.7	14.0
Denmark	1964			10.0			7.8
France	1970		13.8	16.7		10.1	10.9
Germany	1964			4.6			
Italy	1969		17.3	18.3			
Japan	1973		5.9	8.1		4.6	6.4
Netherlands	1965		8.5	10.4		5.2	5.5
New Zealand	1966		20.0	14.7		19.4	13.2
Norway	1966		7.4	7.7		7.2	7.5
Sweden	1967			10.3		10.5	9.2
United Kingdom b/	1972		11.7	9.6		3.6	8.2
United States	1969		18.8	15.4		10.9	10.9

Source:

Ghana, Nigeria, Uganda, South Korea, Thailand, Chile, Mexico, Venezula, Israel, Canada, Denmark, Germany, Netherlands, New Zealand, Norway, Sweden, and the United Kingdom (social returns only) from Psacharopoulos (1973, p. 62).

Ethiopia	Hoerr (1974, Table 3);
Kenya	Private rates (Fields 1975, Table II);
Malawi	Preliminary estimate based on Heyneman (1980a);
Morocco	Psacharopoulos (1976, p. 136);
Sierra Leone	Ketkar (1974, Table 5);
India	Pandit (1976) as reported by Heyneman (1980b, p. 146);
Indonesia	Hallak and Psacharopoulos (1979, p. 13);
Malaysia	Lee (1980);
Philippines	ILO (1974, p. 635);
Singapore	Clark and Fong (1970);
Taiwan	Gannicott (1972);
Brazil	Jallade (1977, Table 4);
Colombia	Regression-derived, from Fields and Schultz (1977, Table 8A, Column 4);
Cyprus	Demetriades and Psacharopoulos (1979, Table 9);
Greece	Psacharopoulos and Kazamias (1978, Table 19.1);
Spain	Quintas and Sanmartin (1978, Table 1);

Table 1 continued

Turkey	Krueger (1972, Table 4);
Yugoslavia	Thomas (1976, Table 3);
Iran	Pourhosseini (1979);
Puerto Rico	Carnoy (1972);
Australia	Blandy and Goldsworthy (1973, P. 9);
Belgium	Mueldeɾs (1974, Table II);
France	Eicher and Lévy-Garboua (1979, Chapter 5);
Italy	Based on income data from Bank of Italy (1972, Table 10);
Japan	Umetani (1977, pp. 113-14);
United Kingdom	Private rates from Psacharopoulos and Layard (1979, Table IX);
USA	Carnoy and Marenbach (1975).

Notes:

a/ Social rates refer to 1968.
b/ Social rates refer to 1966.

Table 2

THE RETURNS TO EDUCATION BY LEVEL AND REGION OR COUNTRY TYPE
(in percentages)

Region or country type	N	Private			Social		
		Primary	Secondary	Higher	Primary	Secondary	Higher
Developing							
Africa	(9)	29	22	32	29	17	12
Asia	(8)	32	17	19	16	12	11
Latin America	(5)	24	20	23	44	17	18
Average	(22)	29	19	24	27	16	13
Intermediate	(8)	20	17	17	16	14	10
Advanced	(14)	a/	14	12	a/	10	9

N = Number of countries in each group.

a/ Not computable because of lack of control group of illiterates.

Source: Table 1

- Pattern 4: The returns to education in developing countries are higher relative to the corresponding returns in more advanced countries.

The four propositions above not only make economic sense but also have important policy implications, and these will be elaborated in the last section of the paper.

B. Evidence from Earnings Functions

Table 3 presents another compilation of rates of return, this one derived exclusively from earnings functions. In most cases, the reported coefficient is the partial derivative of the logarithm of earnings with respect to years of schooling, with years of labor market experience or age being held constant. As noted earlier, the resulting rate of return is private and does not refer to any particular educational level. In poor countries, however, it must refer to the typical year of primary education because the mode of the distribution of years of schooling corresponds to this level. It is in this sense that the rates of return reported in Table 3 are underestimates of the true profitability of education at the lower educational level, for they incorporate the implicit assumption of foregone earnings at an early age.

Table 4 provides a summary, by country type, of rates of return derived by earnings functions. Again, the same overall pattern is observed -- namely, the returns decline with the level of economic development.

IV. QUALIFICATIONS AND CONTROVERSIES

Use of the rate of return is still disputed in the literature, although it is now a more widely accepted measure than it was, say, fifteen years ago. Let us give a brief summary of the major objections to the usefulness of rates of return as tools for the formulation of educational policy, along with the responses of proponents of this use.

A. Data Quality

This is a problem common to all empirical work, and the rate of return estimation is no exception. In the international comparison above, I would put greatest faith in the estimates for the United States and the United Kingdom, since I know these numbers come from official census statistics that are results of rigorous sampling techniques covering the population as a whole. At the same time I would put least faith in the rate of return estimates for Yugoslavia because this information comes from a short article in which the reporting of the exact sampling procedures, response errors, and so forth, could not be described in detail. This does not mean, however, that one has to dismiss estimates such as those for Yogoslavia as unreliable. The criterion here is that a particular author, or journal referee, or Ph.D. thesis committee felt the quality of the work was suitable for "publication" (in the wider sense and implication of the term).

In some country studies I had a choice among alternative estimates from several authors using different estimation procedures or sample bases. The rates of return I retained in such instances of choice were from the study that, in my opinion, was the best in comparability with the rest.

Table 3

THE PERCENTAGE INCREMENT IN EARNINGS ASSOCIATED WITH ONE EXTRA YEAR OF SCHOOLING

Country	Year	$\frac{\partial \ell nY}{\partial s}$	Source
Developing			
Africa			
Ethiopia	1972	8.0	Hoerr (1974)
Kenya	1970	16.4	Johnson (1972)
Morocco	1970	15.8	Psacharopoulos (1977a)
Asia			
Malaysia	1978	22.8	Lee (1980)
Singapore	1974	8.0	Fong (1976)
S. Vietnam	1964	16.8	Stroup and Hargrove (1969)
Thailand	1971	10.4	Chiswick (1976)
Taiwan	1972	6.0	Cannicott (1972)
Latin America			
Brazil	1970	19.2	Psacharopoulos (1970a)
Colombia	1973	20.5	Fields and Schultz (1977)
Mexico	1963	15.0	Carnoy (1967)
Intermediate			
Cyprus	1975	12.5	Demetriades and Psacharopoulos (1979)
Greece	1977	5.9	Psacharopoulos and Kazamias (1978)
Iran	1976	10.7	Scully (1979)
Advanced			
Canada	1971	5.2	Gunderson (1979)
France	1964	10.9	Riboud (1975)
Japan	1970	7.3	Kuratani (1973)
Sweden	1974	6.7	Gustafsson (1977)
United Kingdom	1975	7.8	Psacharopoulos (1980b)
United States	1973	8.2	Young and Jamison (1975)

Table 4

THE RETURNS TO EDUCATION IRRESPECTIVE OF EDUCATIONAL LEVEL BY COUNTRY GROUP AVERAGES

Region or country type	N	Rate of return in percentages
Developing		
Africa	(3)	13.4
Asia	(5)	12.8
Latin America	(3)	18.2
Average	(11)	14.4
Intermediate	(3)	9.7
Advanced	(6)	7.7

Note: Rate of return is private and is estimated by an earnings function; it refers to the average year of schooling.

Source: Table 3.

B. The Social Productivity of Education

The most frequently cited objection to rate of return estimations is that one cannot approximate the true social productivity of education by working with the earnings of employees by level of their educational attainment. This commonsense objection has recently weakened because of an accumulation of studies on the effect of education on farmers' productivity (see Jamison and Lau in this volume). For example, if more educaton (mostly at the basic level) contributes (other things being equal) to extra rice production, this extra rice is an ultimate demonstration of the social productivity of education.

Regarding the higher levels of education, at which the producton of, say, university graduates cannot be measured in such tangible terms, objections have been raised to the use of earnings as a proxy for productivity. These objections have taken specific labels, and the major ones are known in the literature as "screening or certification," "bumping or job competition," and "labor market segmentation." All are sensible, commonsense hypotheses and have appealed both to many analysts and politicians. Yet these hypotheses are found wanting when put to the test of closer analysis.

C. Screening or Certification

This sub-section partly draws from Psacharopoulos (1980b), to which the reader is referred for further elaboration of points made. What the screening theory says is that schools produce only diplomas or sheepskins that help their holder to get a privately well paid job, although the social payoff of the human investment he has undertaken may be minimal. 1/ There exist, however, two major objections to this view. First, when one makes the distinction between "initial" and "persistent" screening, it is very hard to find evidence corroborating the latter -- namely, that employers keep paying wages above the worker's productivity after they have the employee under their observation for some time. 2/ Initial screening certainly exists; that is, employers may hire someone on the basis of his expected productivity and given his educational qualifications. But there is nothing wrong with initial screening because, after all, it has an informational social value. (See Psacharopoulos 1980c.)

D. Differential Ability

Embedded in the screening argument is the ability factor: because those who have more education than others allegedly also have a higher level of ability, wage differentials are not solely because of learning; a great part of them are because of differential ability. This highly intuitive argument -- combined with some aggregate, cross-tabulation evidence by Becker (1964) and Denison (1967) -- resulted in the enthronment of this myth. Micro data plus further scrutiny of what "ability" means yielded the highly counterintuitive finding that ability differentials do not account for much of the variation in earnings (see Psacharopoulos 1975 and Griliches 1979).

1/ For a formal analysis of the screening hypothesis, see Arrow (1973); for empirical tests, see Layard and Psacharopoulos (1974).

2/ For a theoretical distinction and an empirical test between the "weak" versus the "strong" version of the screening hypothesis, see Psacharopoulos (1980e).

E. The Job Competition or "Bumping" Model

This is another highly intuitive notion -- that workers compete for jobs rather than wages, and that workers with more educational qualifications "bump" from the labor queue those less qualified and get the job. 1/ This is certainly true, but where this view fails is in its neglect of why such bumping should be seen as socially wrong. If the more qualified perform better in the job they are in, this is socially healthy. There exists plenty of micro evidence that this is likely to be the case; the more qualified earn more relative to the less qualified even after one standardizes for occupation.

F. Is There a Dual Labor Market?

Another attack comes from the so-called dual, or segmented, labor market hypothesis (Gordon 1972). According to this argument, education helps workers belonging to the "primary segment" of the market (that is, those with good jobs) but not those in the "secondary segment" (that is, those in inferior jobs). For several reasons, the popularity that surrounded the dual labor market theory, beginning in the early 1970s, has already faded away, although it is still championed in some quarters. (For a critique, see Cain 1976.) In the first place, testing this argument is extremely difficult because the hypothesis itself has never been stated in a rigorous manner. Second, the separation of the upper from the lower segment is a major problem in its own right. Where should one draw the dividing line between the two allegedly separate labor markets? Also, empirical attempts to test whatever bits and pieces of the theory are testable have failed to reject the orthodox functioning of labor markets. (See Psacharopoulos 1978 and McNabb and Psacharopoulos 1980.)

G. Social Class

Another commonly held belief is that education serves the maintenance from generation to generation of the status quo (Bowles 1972). Although this might be true to a large extent, it does not constitute a challenge to the use of earnings as a proxy for productivity. On the contrary, two interesting recent results show that, first, family background (or social class) has only an indirect effect on earnings and, second, this effect is via education. The direct effect of social background on earnings is rather weak. Also, it is those who acquire more education who are socially more upwardly mobile. (Psacharopoulos 1977b and Psacharopoulos and Tinbergen 1978).

H. The Role of the Public Sector

In some instances, rates of return have been estimated on the basis of public sector earnings. Since the public sector is the major employer of educated labor in developing countries, its non-profit-maximizing behavior has been used as an argument against the use of earnings in computations of rates of return. Recent evidence from Brazil and Malaysia on public-private sector comparisons indicates, however, that the contrary is likely to be the case. That is, calculations of the rate of return based on the public sector are likely to underestimate the true returns to education, as judged from private sector employment (see Psacharopoulos 1980d).

1/ For the main variant of this model, see Thurow and Lucas (1972).

I. Graduate Unemployment

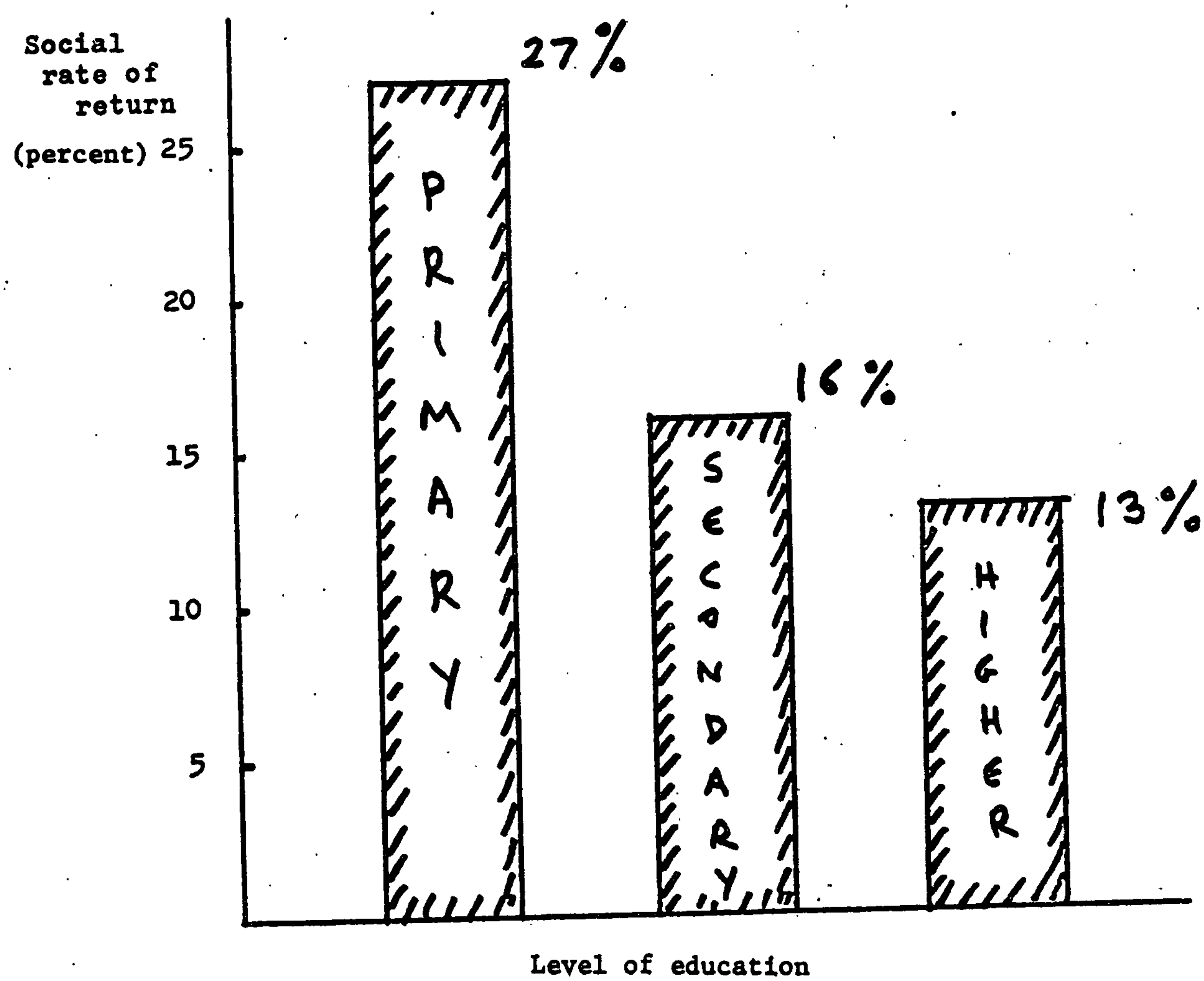
One widespread view is that education produces unemployed graduates. This is a more serious challenge than the ones mentioned above because it denies even the private benefits accruing to the individual investor. But this argument is put in the right perspective when a distinction is made between the incidence and the duration of unemployment. Unemployment is high among young people, yet in the majority of cases it lasts for a few months at most. (For detailed evidence on the incidence and duration of unemployment as it relates to education in developing countries, see Psacharopoulos 1980d.) Hence, one might consider the lack of employment immediately after graduation to be the reflection of a "job search" process. And, certainly, it would be a mistake to reduce a whole age-earnings profile by the average rate of unemployment, which mainly refers to young people.

V. SOME POLICY IMPLICATIONS

To the extent that the figures presented in section III represent valid indicators of the true relative structure of rates of return by level of education and country type, they have at least the following specific policy implications:

Figure 3

THE SOCIAL RETURNS TO INVESTMENT IN EDUCATION BY SCHOOL LEVEL IN DEVELOPING COUNTRIES



Note: "Developing countries" refers to twenty-two African, Asian and Latin American countries.

Source: As in Table 1.

- A look at Figure 3 leaves no doubt that top priority should be given to primary education as a form of investment in human resources.

- Secondary and higher education are also socially profitable investments and therefore should be pursued alongside primary education in a program of balanced development of human resources.

- The large discrepancy between the private and social returns to investment in higher education (24 versus 13 percent, respectively) suggests there exists room for private financing of university education. A shift of part of the cost burden from the state to the individual and his family is not likely to be a disincentive to investing in higher education, given its present high private margin of profitability.

- As a country develops, or the capacity of its educational system expands, or both, the returns to education definitely fall, although not to a great extent. The fear of a drastic fall of the returns to education following educational expansion is therefore unfounded. Because this fear is a common one among educational planning practitioners, the following subsection elaborates why it is exaggerated.

A. Educational Expansion and Rates of Return

The evidence needed to investigate this topic is time series data on rates of return, a luxury available only in several countries. But even if one had a complete, historical time trend of rates of return, this would be no guarantee that their structure would be valid in the future or beyond the available range of observations. In this respect, one must also, therefore, rely on a theory of some sort in making predictions.

The international comparison presented earlier provides the basis for a cross-sectional reconstruction of time series by comparing the returns to education at different levels of economic development. From Table 2, one gets the following global picture:

Country type	Social returns to investment in education (percent)		
	Primary	Secondary	Higher
Developing	27	16	13
Intermediate	16	14	10
Advanced	not applicable	10	9

The returns do fall as a country passes from one stage of development to the next, which occurs pari passu with educational expansion. The decline of the returns is minimal, however, when one considers the large steps in educational expansion implicit between rows in the above tabulation.

Furthermore, the same conclusion regarding the gradual fall of the overall rate of return associated with economic development (read, educational expansion) is supported by the international comparison of earnings functions, which yields the following picture of the returns to the typical year of schooling by country type:

Country type	Rate of return
Developing	14
Intermediate	10
Advanced	8

B. Time Series Evidence on Returns to Education

Moving beyond these extremely aggregate figures, we can concentrate on what has happened within single countries where time series evidence is available on the returns to education. One cannot be very selective in this respect, so here is the picture of what has happened in one DC and one LDC.

1. The United States

Rate of return estimates for this country exist for every census year (every ten years) since 1939 and for every single year since 1970. Table 5 gives a summary of the evolution of the U.S. rate of return over nearly forty years. The returns to education have been falling, although to a limited extent. The rate of return to secondary education has fluctuated at above the 10 percent level since 1959. The rate of return to higher education was virtually constant at the 11 percent level between 1939 and 1969, in spite of the tremendous expansion in college enrollment that occurred during the 1960s. Thereafter, it has been dropping, although there exists in the literature great controversy over the validity and interpretation of this decline. 1/

The apparent "puzzle" of the stability of the returns to education in the presence of educational expansion has been explained in terms of supply and demand -- namely, the demand for educated labor keeps pace with a rapidly increasing supply, the end result being a nearly constant rate of return (see Welch 1970). Or, as Tinbergen (1975) would see it, this phenomenon can be explained as a "race" between education (supply curve shifting to the right) and technology (demand curve shifting to the right), as shown in Figure 4.

2. Colombia

As shown in Table 6, the distribution of education among the Colombian labor force has shown a dramatic improvement in balance within a decade, with the proportion of university graduates doubling between 1964 and 1974. The question that remains, however, is what happened to the rate of return to education during this period?

1/ See Freeman (1976), Smith and Welch (1978), and the exchange in the Winter 1980 issue of the Journal of Human Resources.

Table 5

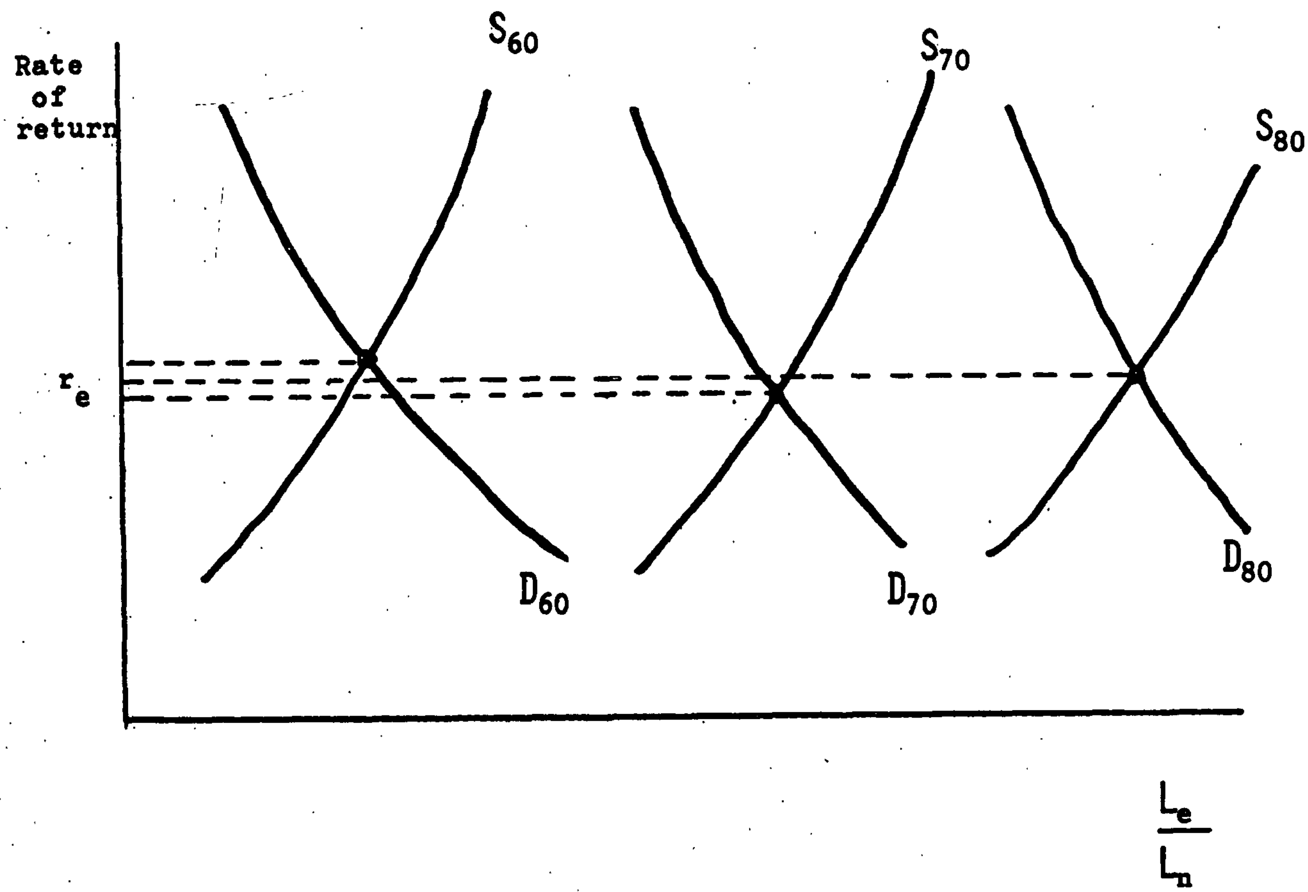
TIME SERIES RETURNS TO EDUCATION IN THE UNITED STATES
(in percentages)

Year	Educational level	
	Secondary	Higher
1939	18.2	10.7
1949	14.2	10.6
1959	10.1	11.3
1969	10.7	10.9
1970	11.3	8.8
1971	12.5	8.0
1972	11.3	7.8
1973	12.0	5.5
1974	14.8	4.8
1975	12.8	5.3
1976	11.0	5.3

Source: For 1939-69, social rates from Carnoy and Marenbach (1975, Table 2); for 1970-76, private rates from Psacharopoulos (1980f, Table 4).

Figure 4

A HYPOTHETICAL "RACE" BETWEEN EDUCATION AND TECHNOLOGY
THAT YIELDS A MORE OR LESS CONSTANT RATE OF RETURN TO EDUCATION OVER TIME



Note: S, supply curve; D, demand curve; L, labor; r, rate of return.
Subscripts: e, educated; n, noneducated; 60, 70, 80 = year.

Table 6

THE CHANGING EDUCATIONAL STRUCTURE OF THE COLOMBIAN LABOR FORCE
(in percentages)

Educational level	1964	1974
Illiterates	5.0	3.5
Primary	57.3	45.4
Secondary	29.5	34.8
Higher	8.2	16.3

Source: Bourgignon (1980, Table 1).

As expected, the rates of return have in fact fallen (see Table 7), although investment in education at all levels remains a highly profitable activity.

Table 7

PERCENTAGE RETURNS TO EDUCATION IN COLOMBIA
BY EDUCATIONAL LEVEL

Educational level	1963-66	1974
Primary	53.1	36.0
Secondary	31.7	21.9
Higher	29.2	18.5

Source: Based on Bourgignon (1980, Table 5). Rates are private and calculated by the short-cut method.

Additional evidence from earnings functions analysis corroborates this result:

Year	Rate of Return (percent)
1963-66	19.8
1965	17.3
1971	16.7
1974	15.1

Source: Bourgignon (1980, Table 4).

An earlier analysis by Dougherty (1971), using 1963-66 data, actually simulated the behavior of the rate of return as a function of educational expansion in Colombia. Figure 5 shows the expected path of the rate of return to secondary education if enrollments followed the historical annual growth rate of 10 percent (Path A) or a hypothetical rate of 15 percent (Path B). As expected, the returns to education fall, but not drastically enough for this kind of investment to become socially unprofitable across a sixteen-year interval.

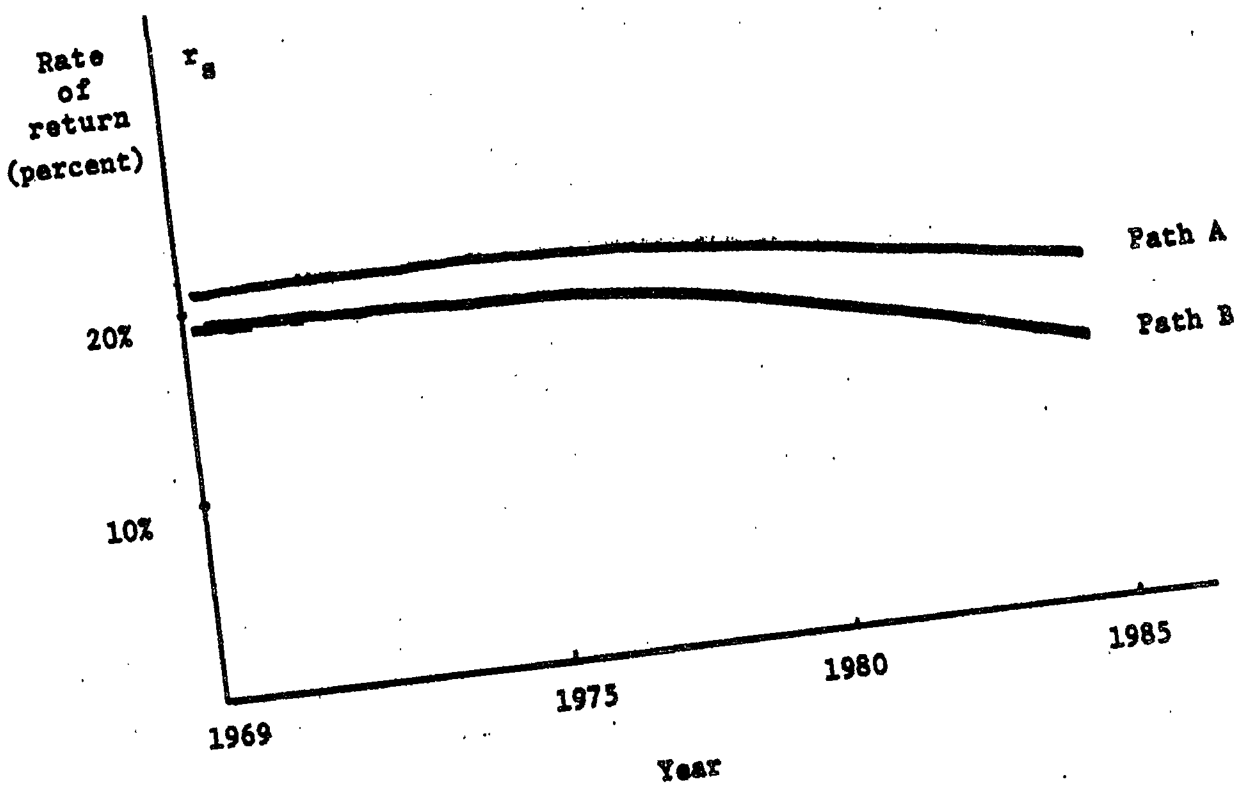
This earlier analysis has also demonstrated, using Colombian data, the importance of the "elasticity of substitution" among different types of educated labor in affecting the future structure of rates of return. 1/ This concept is a measurement of the degree of easiness or flexibility that exists in a given economy whereby different labor skill mixes are accomodated in production without affecting the relative labor rewards. The higher the value of the elasticity of substitution, the longer a present rate of return will remain valid in the future following educational expansion.

There exists an immense literature on empirical estimates of the elasticities of substitution between different types of labor in settings in a variety of countries. As shown in Table 8, this elasticity is on the high side -- that is, well above the value of unity. This evidence supports a theory by which one can confidently plan for educational expansion without the rate of return being affected to the point of such investment becoming socially unprofitable. At least this is what might be expected in the medium term in developing countries where the returns to the lower levels of schooling are of such magnitude that the possibility of overinvesting in education is extremely remote.

1/ See also Dougherty (1972).

Figure 5

AN ACTUAL SIMULATION OF THE SOCIAL RATE OF RETURN TO SECONDARY EDUCATION IN COLOMBIA AS A FUNCTION OF ENROLLMENTS.



Note: Figure is approximate; r_s, rate of return to secondary education. Path A is based on the assumption of a 10 percent historical annual expansion of enrollments; Path B is based on a hypothetical 15 percent annual growth of enrollments.

Table 8

ESTIMATES OF THE ELASTICITY OF SUBSTITUTION
BETWEEN HIGHLY TRAINED AND OTHER LABOR
(Absolute values)

Nature of Study	Elasticity Estimate	Source
Cross section (22 countries)	1.0	OECD (1971)
Cross section (22 U.S. states)	3.3 to 9.0	Dougherty (1972)
Cross section (12 countries)	4.8	Bowles (1969)
Cross section (18 countries)	2.2	Psacharopoulos and Hinchliffe (1972)
Time series (USA, 1956-68)	3.8	Dresch (1976)
Cross section (22 countries)	0.6 to 3.5	Fallon and Layard (1975)
Time series (USA, 1929-68)	4.9 to 6.1	Berndt and Christensen (1974)
Time series (USA)	2.3	Freeman (1971)
Time series (USA, 1900-63)	1.5	Ullman (1972)

Source: Compiled from original sources by Tinbergen and Psacharopoulos (1980).

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PART II

RETURNS TO EDUCATION: AN UPDATED INTERNATIONAL COMPARISON

Farmer Ed + Farm Eff[illegible]
Lockhead, Jamison and
Lau

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Table of Contents

Our purpose in this review 1/ is to synthesize the conclusions of a number of studies -- many of them quite recent -- of the effects of a farmer's educational level and exposure to extension services on his productivity. 2/ We focus on studies using data from individual farms in low-income regions. 3/ We examine these studies for the information they contain concerning the correctness of three hypotheses: (1) that higher levels of formal education increase farmers' efficiency; (2) that education has a higher payoff for farmers in a changing, modernizing environment than in a static, traditional one (as suggested by Schultz); 4/ and (3) that exposure to extension services improves farmers' productivity. Following the suggestion of Glass, we draw quantitative data from each study on the magnitude of the effects of education; 5/ this is done in a format that allows comparison across studies. As the studies differ from one another along many dimensions (including, in particular, the quality of data and data analysis), any conclusions from comparisons across them must be drawn with care. Nonetheless, mindful of a number of caveats, we are able to draw generalizable conclusions from the existing literature. In this review we include a discussion of our own results from Korea, Malaysia, and Thailand.

The paper is organized as follows: Section A briefly discusses the methods of analysis used in the studies we review; B describes the studies; and C summarizes the results of 18 studies of the effect of formal education on agricultural productivity. Nine of these 18 studies contain information on the exposure of farmers to nonformal education (extension), and Section D reviews the findings of the effectiveness of extension in these studies. Section E summarizes our conclusions.

A. Methods of Analysis

Yotopoulos (1967) conducted the first of the studies we review and used a production function for agricultural output as his basic tool for analyzing the effect of education on productivity. Subsequent studies have used much the same methodology. We begin this section with a discussion of how a farmer's productivity and efficiency can be assessed from use of production functions and, if available, from price data.

The studies we review typically use data from a survey of several hundred farm households in a particular locale. These surveys contain data, for each farm, on some or all of the following variables: gross output of the farm (in, say, kilograms of rice), land area under cultivation, person-days of family labor used, quantity and type of equipment used, the educational levels of the members of the household, and exposure of the farmer to extension services. Given a data set of this sort, the researcher can assess the effect of education on productivity by estimating a production function relating the quantity of farm output to the level of each of the inputs, including the farmer's education.

To take a simple example: let V = gross output (in kilograms); T = area under cultivation (in hectares); L = labor input (in person-days); E = education level of the household head (in years of formal schooling completed); and EXT = an indicator of the exposure of the farmer to extension (EXT = 1 if exposed, EXT = 0 if not exposed). The studies we review use variations of either the Cobb-Douglas (or ℓn - ℓn) production function or the linear production function to relate output, V, to the various inputs in one of the following ways:

(1) $\ell n\, V = \alpha_0 + \alpha_1 \ell n L + \alpha_2 \ell n T + \beta \ell n E + \gamma EXT$, or

(2) $\ell n\, V = \alpha_0 + \alpha_1 \ell n L + \alpha_2 \ell n T + \beta E + \gamma EXT$, or

(3) $\ell n\, V = \alpha_0 + \alpha_1 \ell n L + \alpha_2 \ell n T + \beta D + \gamma EXT$,

where D is an indicator variable that takes the value 1 if E takes a value in a specified range, and 0 otherwise; or

(4) $V = \alpha_0 + \alpha_1 L + \alpha_2 T + \beta E$, or

(5) $V = \alpha_0 + \alpha_1 L + \alpha_2 T + \beta D$.

In specifications (1) through (3), the α_i's give the elasticities of output with respect to the various inputs.6/ In specifications (4) and (5), the α_i's give the marginal product of the various inputs. In specification (1), β gives the elasticity of output with respect to years of education. In specification (2), β gives the percentage increase in output in response to a unit change in education. In specification (3), β gives the percentage increase in output of a farm with the farmer's educational level specified as D, compared with the base case, which is usually no education. (For example, if D signified "completed primary school", β would give the percentage increase in output of a farmer who graduated from primary school over that of one who had received no schooling.) In specification (4), β gives the marginal increase in output in response to a unit change in education. In specification (5), β gives the increase in output of a farm with the farmer's specified number of years of education, compared with the base case.

All of the studies we review use production functions of one of these general forms, in which β provides a measure of the productivity of education. Similarly, γ provides a measure of the productivity of agricultural extension. In the better empirical studies that we review, far more complete specifications of the production function, including many more independent variables, are used than in this simplified example.

Most estimates of the effects of education on labor productivity use wage rate as a proxy for marginal productivity and examine the effect of an individual's educational level, with other variables controlled, on the wage he or she receives. This is reasonable, assuming competitive labor markets and an absence of "screening" mechanisms, whereby the individual's education may simply signal productive qualities to an employer without actually enhancing them. (Bowman provides a valuable discussion of screening and its implications, with references to a now extensive literature.)7/ Direct estimation of the marginal product of education through its coefficient in a production function provides an alternative to using wages that is superior in a number of respects: (1) no assumptions need be made about equivalence of wages and the marginal product of labor; (2) the possibility of screening does not confound an interpretation of the results (though omitted variables may); and (3) only in this way is it possible to obtain estimates of the effect of education on productivity in sectors, such as agriculture, that may rely relatively little on wage employment. 8/

In addition to examining the effect of education on productivity, it is also possible to examine whether it affects allocative efficiency, i.e., the extent to which farmers optimally choose their mix of input and output in light of their production functions and prevailing prices. In a seminal article, Welch (1970) discusses ways of assessing the effect of education on allocative efficiency. Several of the studies we review have examined the issue of allocative efficiency by comparing actual with optimal allocation decisions in light of an estimated production function, and, in our larger work (Jamison and Lau, forthcoming), farm-specific price data are used for estimation of profit and factor demand functions to test allocative efficiency. This was done for a sample of farms in Thailand. Chapter 3 of Farmer Education and Farm Efficiency provides a thorough discussion of alternative types of efficiency, and Lau (1978) has explicated the use of profit functions as a tool for assessing allocative efficiency. Studies by Muller (1974) and by Shapiro and Muller (1977) have analyzed the relationship between information and technical efficiency and provided empirical support that familiarity with information sources improves productivity in dairy farming in the United States and cotton farming in Tanzania. In this paper we note those studies that examine allocative efficiency as well as productivity.

B. Studies: Bases of Comparison and Criteria for Selection

This review summarizes the analyses of thirty-seven data sets discussed in eighteen studies on education and small farm production in thirteen countries of Africa, Asia, Europe, and Latin America. In seventeen of the data sets, the effects of education on technical efficiency in the production of a cereal crop (rice, wheat, or maize) were examined; in the remaining data sets, the effect of education on the production of a mixed crop, typically including a cereal, was examined. Only a study of dairy farms by Sadan, Nachmias, and Bar-Lev (1976) did not examine efficiency in terms of field crop production. Table 1 summarizes salient features of the

Table 1

DESCRIPTION OF DATA BASE USED IN EACH STUDY

Reference	Country, Date of Data Collection, and Sample Characteristics
Calkins (1976)	Nepal, 1973-74. Sample of small farms in five *panchayats* of Nuwakot District of central Nepal. Rice and wheat.
Chaudhri (1974)	India, 1961-64. Reanalysis of a sample population of twenty-one villages in the wheat belt of Punjab, Haryana, and Uttar Pradesh. Wheat.
Halim (1976)	Philippines, 1963, 1968, 1973. Subsample of an earlier random sample of households in twenty-eight representative rice-producing *barrios* of Laguna district.
Haller (1972)	Colombia, 1969. Stratified random sample of farms in Chinchina, Espinal, Malaga, and Moniquira regions. Tobacco, coffee, corn, cassava, guayaba, cotton, sesame, rice, and livestock.
Harker (1973)	Japan, 1966. Representative sample of 971 middle-aged rice farmers in central and southern Honshu, Shikoku, and in the Fukuoka areas of Kyushu. Rice.
Hong (1975)	Korea, 1961. Subsample of random census sample of 1,200 farm households in nine provinces. Rice and other crops.
Hopcraft (1974)	Kenya, 1969-70. Subsample of a stratified random sample of 1,700 small farms collected for the Small Farm Enterprise Cost Survey. Maize, livestock, and tea.
Jamison and Lau (forthcoming)	Malaysia, 1973. Subsample of U.N. Farm and Agriculture Organization/World Bank survey of 800 rural farming households in monoculture paddy area of Muda Irrigation Project, Kedah and Perlis States, West Malaysia. Rice.
Jamison and Lau (forthcoming)	Korea, 1973. Subsamples of a national survey of 2,254 farms in nine regions of South Korea. Rice and other crops.

Table 1 (continued)

Reference	Country, Date of Data Collection, and Sample Characteristics
Jamison and Lau (forthcoming)	Thailand, 1972-73. Reanalysis of a stratified random sample of farm households from twenty-two villages in the Chiang Mai Valley. Rice.
Moock (1973)	Kenya, 1971-72. Farms in Vihiga Division that received loans for the purchase of hybrid maize seeds and fertilizer and comparison farms that were not loan recipients. Maize.
Pachico and Ashby (1976)	Brazil, 1970. Sample of farm households in four communities of southern Brazil collected by University of Rio Grande de Sul. Mixed field crop and livestock.
Patrick and Kehrberg (1973)	Brazil, 1969. Survey of 620 farms in five regions of eastern Brazil. Maize, beans, coffee, beef cattle, and dairy cattle.
Pudasaini (1976)	Nepal, 1975. Random sample of 102 traditional and mechanized farms in Bara District. Rice, wheat, and sugarcane.
Sadan, Nachmias, and Bar-Lev (1976)	Israel, 1969-70. Population of 1,841 dairy farms under the supervision of the Settlement Agency in Israel.
Sharma (1974)	Nepal, 1968-69. Subsample of a stratified random sample of households in fifteen village _panchayats_ in Rupandehi. Rice and wheat.
Sidhu (1976, 1978)	India. See p. 2.9
Wu (1977)	Taiwan, 1964-66. Records of bookkeeping farms: 249 farms in twenty-five _Hsiangs_ collected in 1964; 246 farms in twenty-six _Hsiangs_ collected in 1965; 154 farms in thirteen _Hsiangs_ collected in 1966. Rice, banana, pineapple, sweet potatoes, sugarcane, and poultry.
Wu (1971)	Taiwan, 1964-66. Reanalysis of a sample of 310 bookkeeping farms in three mixed farming regions; presumably same data set as Wu (1971).
Yotopoulos (1967)	Greece, 1963. Subsample of a random sample of 650 households in 110 villages and three cities of Epirus. Wheat and cotton.

data bases. (Table A.1 of Lockheed, Jamison, and Lau 1980) provides more detail on the variables used in each analysis.) In this section we review some sources of inconsistency across the studies, describe the criteria by which we restricted the sample of studies for further analysis, and indicate the limitations of a broad comparative summary of this sort.

Although we have attempted to identify similarities across widely differing studies, a number of factors limit the scope of generalizations. The most important of these are differences in the sample characteristics, differences in the methods of analysis, and differences in the specification or measurement of both dependent and independent variables (particularly the education variables). Furthermore, as previously noted, there is substantial variation across studies in the quality of data, data analysis, and reporting; this further limits the adequacy of our comparisons across studies.

1. Sample characteristics

Of the thirty-seven data sets, only sixteen were reported to have been collected using an explicit sampling design. The data sets also varied in the number of farms that were surveyed, the size distribution of the farms, the type of crop grown, and in regional characteristics. Moreover, education was frequently not of primary importance to those undertaking the original efforts of data collection.

2. Methods of analysis

The primary method of analysis used in the studies was multiple regression with both dependent and independent variables in logarithmic form, resulting in a production function commonly referred to in economic literature as the "Cobb-Douglas" type [see equation (1) of Section A, above]. In several of the studies, however, the description of the specification of the production equation was so inadequate that we were unable to determine whether the variables were actually expressed in logarithmic form. (Table A.1 of Lockheed, Jamison and Lau 1980 indicates the specifications of the equations where we were able to determine them.)

3. Specification and measurement of the dependent variable

Although most of these studies were described as studies of production, the analysis of twenty-three of the thirty-seven data sets used the value of crop production as the dependent variable. Since the value of a crop is dependent upon price structures (which may vary widely both among and across regions), comparisons between studies that examine the quantity of output and those that examine the value of output must be made with some caution. The studies also included a variety of different field crops; the dependent variables included both single field crops (typically rice, wheat, or maize) and mixed field crops (including bananas, cotton, vegetables, sugarcane and so forth), both separately or in combination with cereal crops.

4. Specification and measurement of the independent education variable

There are three sources of variations across studies regarding the education variable used: (1) whose education is measured; (2) what the education measure is; and (3) how the measure is expressed. The educational level of the production unit was measured in these studies by either the education of the head of the household, the aggregate education of the family members, or the aggregate education of farm workers. Education aggregates typically excluded the education of nonworkers, the very young, or the very old. The quantity of education was either the number of years attended or completed or the number of grades or levels attended or completed, or simply a measure of literacy. Educational level was expressed as either an indicator or a continuous variable; continuous variables were sometimes entered in the production functions in logarithmic form, sometimes in natural form.

Whenever possible, we have reported results of equations in which we use the number of years or grades completed by the head of the household; when more than one education variable has been analyzed, however, we have attempted to note differences in the estimated effects.

5. Specification and measurement of other input factors

The widest discrepancies among these studies is reflected by the extent to which other production variables are included in the specification of the production function. Land, labor, and capital are generally included, but in different ways. Land may be entered into the function as a quantity or as a value. Labor is often differentiated into family or hired, and the variable may be expressed in time or value. Capital may be entered as a single variable or differentiated into several factors. Other factor input variables may include the quantity or use of fertilizer, the use of irrigation, the types of seed, and regional indicator variables.

Because of the differences in samples, outputs, and factor inputs among these studies, we restricted our summary histograms and regressions to include:

- Only agricultural production function studies (this eliminated the study by Harker (1973));

- Only studies in which the dependent variable was a field crop or an aggregate of several field crops (this eliminated Sadan, Nachmias, and Bar-Lev (1976));

- Only studies in which a percentage gain per year of education could be computed (this eliminated works by Calkins, Chaudhri, and Hong); 9/ and

- We also did not include Hopcraft's maize production function (reported in Table 2) because of its finding of a negative effect of labor on output. 10/

This process of elimination reduced to thirty-one the number of data sets whose analyses we report.

C. Formal Education's Effects on Efficiency

We have hypothesized that education will have a positive effect on farmer efficiency; overall, we find confirmation for this hypothesis.

1. Overall Effects

Table 2 reports, for each of our thirty-seven data sets, the coefficient of education on agricultural productivity, the statistical significance of the estimate, and (for the thirty-one data sets where it was possible) the estimated percentage increase in output for each additional year of education. Perusing Table 2 will give a broad sense of the range of findings and the diversity of the studies. In six of these data sets, education was found to have a negative (but statistically insignificant) effect, but, in the remaining thirty-one, the effect was positive and usually significant. [See Appendix A of Lockheed, Jamison, and Lau (1980) for additional information -- in particular, for information about the environment from which the farm samples were drawn.]

The percentage increase in output for one additional year of education at the mean educational level of the sample can be computed for most of the studies we review. The appropriate formula depends on the particular specification of the production function that is used in the study. Let $\bar{E}$ be the average educational level of the sample and β be the estimated coefficient of education; then the percentage increase in output for one additional year of education may be calculated by computing the ratio of the value of output when the level of education is half a year greater than $\bar{E}$, V_1, to the value when it is half a year less, V_0, subtracting 1, and multiplying by 100. If the production function is specified as in equation (1) of Section A, we have:

$$\text{Percentage increase} = \left(\frac{V_1}{V_0} - 1\right) \times 100 = \left[\frac{(\bar{E} + 0.5)^{\beta}}{(\bar{E} - 0.5)^{\beta}} - 1\right] \times 100$$

$$= \left[\left(\frac{\bar{E} + 0.5}{\bar{E} - 0.5}\right)^{\beta} - 1\right] \times 100$$

For production function (2),

$$\text{Percentage increase} = \left[\frac{e^{\beta(\bar{E} + 0.5)}}{e^{\beta(\bar{E} - 0.5)}} - 1\right] \times 100$$

$$= \left[e^{\beta} - 1\right] \times 100.$$

Equation (continued)

For production function (3), if there are N years of education in the level specified by D,

$$\text{Percentage increase} = \left[\frac{e^{\beta} - 1}{N}\right] \times 100.$$

[In the calculation for production function (3), it is assumed that the percentage increase due to education can be proportionally attributed to the years of education.]

For production function (4),

$$\text{Percentage increase} = \left[\frac{\alpha_0 + \alpha_1 L + \alpha_2 T + \beta(\bar{E} + 0.5) + \gamma EXT}{\alpha_0 + \alpha_1 L + \alpha_2 T + \beta(\bar{E} - 0.5) + \gamma EXT} - 1\right] \times 100$$

$$= \left[\frac{\beta}{\alpha_0 + \alpha_1 L + \alpha_2 T + \beta(\bar{E} - 0.5) + \gamma EXT}\right] \times 100.$$

For production function (5), if there are N years of education in the level specified by D,

$$\text{percentage increase} = \left[\frac{\beta}{\alpha_0 + \alpha_1 L + \alpha_2 T + \gamma EXT}\right] \times 100/N.$$

Table 2:

FORMAL EDUCATION AND AGRICULTURAL PRODUCTIVITY

Study	N	Coefficient of education on agricultural productivity	t-statistic	$\bar{R}^2$	Estimated percentage of increase in output for one additional year of education a/	Comment
BRAZIL, Candalaria (Pachico and Ashby 1976)	117	0.126	0.89	.71	2.69	Education was positively related to output among highly commercialized farms.
BRAZIL, Garibaldi (Pachico and Ashby 1976)	101	0.207	1.92	.69	4.60	Education was positively related to output among highly commercialized farms.
BRAZIL, Guarani (Pachico and Ashby 1976)	63	0.072	0.55	.67	1.49	Preliminary analysis of data indicated that less than five years of schooling had no significant effect on output.
BRAZIL, Taquari (Pachico and Ashby 1976)	101	0.244	1.66	.68	5.53	Education was positively related to output among highly commercialized farms.
BRAZIL, Alto Sao Fransisco (Patrick and Kehrberg 1973)	82	-0.013	-0.65	.44	-1.29	Returns of schooling were negative in the traditional agriculture regions but became positive and increased as the regions became more modern among the five samples in the Patrick and Kehrberg study.
BRAZIL, Conceicao de Castelo (Patrick and Kehrberg 1973)	54	-0.009	-0.75	.82	-0.90	None
BRAZIL, Paracatu (Patrick and Kehrberg 1973)	86	-0.017	-1.41	.59	-1.69	None
Brazil, Resende (Patrick and Kehrberg 1973)	62	0.010	1.11	.55	1.01	None

Table 2 (continued)

Study	N	Coefficient of education on agricultural productivity	t-statistic	$\bar{R}^2$	Estimated percentage of increase in output for one additional year of education a/	Comment
BRAZIL, Vicosa (Patrick and Kehrberg 1973)	337	0.023	2.86	.62	2.33	None
COLOMBIA, Chinchiná (Haller 1972)	77	-0.008	-0.13	.75	-0.29	
COLOMBIA, Espinal (Haller 1972)	77	0.140	1.80	.71	6.10	
COLOMBIA, Málaga (Haller 1972)	74	0.047	0.94	.53	3.09	
COLOMBIA, Moniquirá (Haller 1972)	75	-0.049	-1.02	.79	-3.12	
GREECE (Yotopoulos 1967)	430	0.138	2.06	.79	6.47	The marginal product for one year of education was 606.40 drachmas.
INDIA, Punjab, Haryana, and Uttar Pradesh (Chaudhri 1974)	1,038	Family average 0.116	5.04	.59	Insufficient information to calculate	Marginal product of family education was calculated as 107.04 rupees yearly. Marginal product of education of household head was calculated as 153.12 rupees yearly. No base was given. Chaudhri (1979) provides further analysis based on this same data set and calculates rates of return to education that are high indeed.
		Household head 0.114	3.65	.59		

Table 2 (continued)

Study	N	Coefficient of education on agricultural productivity	t-statistic	$\bar{R}^2$	Estimated percentage of increase in output for one additional year of education a/	Comment
INDIA, Punjab (Sidhu 1976)	236 (Traditional and Mexican wheat varieties)	0.038	1.90	.92	1.49	Education was found to be related to production efficiency but more strongly to allocative efficiency.
India, Punjab (Sidhu 1976)	369 (Mexican wheat)	0.036	2.25	.92	1.41	In an analysis using gross farm sales as dependent variable, Sidhu finds a positive effect of education, not quite statistically significant, resulting in a 1.1 percent increase in value of sales for one year of education. Sidhu and Baanante (1978) use profit and factor demand functions with the same data and find a positive (but statistically insignificant) effect of education.
ISRAEL (Sadan, Nachmias and Bar-Lev 1976)	1,841	21.100	4.20	Not given	Marginal value added was US$21 per year of wife's schooling (1.08 percent of gross value added of production).	None
JAPAN, Honshu, Shikoku, and Kyushu (Harker 1973)	971	Correlation: With gross farm sales, 0.02; with communication behavior and agricultural adoption variables added, 0.31	Not significant; ($p<0.001$)	.38	Not applicable	None
KENYA, Vihiga (Moock 1973)	152	Indicator (4 or more years) 0.067	1.60	.64	1.73	An indicator variable for one to three years of education had a negative coefficient.

Table 2 (continued)

Study	N	Coefficient of education on agricultural productivity	t-statistic	$\bar{R}^2$	Estimated percentage of increase in output for one **additional year** of education a/	Comment
KENYA (Hopcraft 1974)	674	Indicator (2-3 years) -0.023	-0.30	.56	-3.26	These results are for maize production, for which the coefficient of labor on output was negative. The production functions for aggregate output, which had a positive labor coefficient, had education coefficients that were essentially zero.
		Indicator (4-6 years) -0.163	-2.19			
		Indicator (primary school) -0.148	-1.50			
KOREA (Hong 1975)	895	Log-linear 0.712	3.05	.85	Units of equation were hard to interpret so this figure could not be computed.	Some empirical conclusions of this study are difficult to interpret.
		Cobb-Douglas 0.927	1.46	.85		
KOREA (Jamison and Lau, forthcoming)	1,363 (mechanical farms)	Continuous 0.022	4.97	.66	2.22	Analysis also undertaken with discrete variables representing different education levels.
KOREA (Jamison and Lau, forthcoming	541 (non-mechanical farms)	Continuous 0.023	2.95	.61	2.33	Analysis also undertaken with discrete variables representing different education levels.
MALAYSIA, Kedah and Perlis (Jamison and Lau, forthcoming)	403	Indicator (literate) 0.109	1.61	.69	5.11	None
		Indicator (1-3 years) 0.071	1.14			
		Indicator (≥4 years) 0.186	2.60			

Table 2 (continued)

Study	N	Coefficient of education on agricultural productivity	t-statistic	$\bar{R}^2$	Estimated percentage of increase in output for one additional year of education a/	Comment
NEPAL, Bara (Pudasaini 1976)	102	0.014	1.71	.90	1.3	There was a positive effect of schooling on farm revenue. Tractor-hiring and pumpset-owning farms (the modernizing variable) were found to be more efficient than traditional, although tractor-owning farms and farms owning both tractors and pumpsets were not significantly different from traditional farms in efficiency.
NEPAL, Nuwakot (Calkins 1976)	540	Indicator (7 or more years) 0.53	3.53	.77	Could not be computed because means of other independent variables not given.	The coefficient for zero years of education was not significantly different from the one for one to six years education. However, for seven or more years of education the coefficient was significant. The evidence thus suggest a minimum threshold of six to seven years before education affects productivity.
NEPAL, Rupandehi (Sharma 1974)	87 (wheat farms)	Indicator (literate) 0.142	1.80	.84	5.09 (Computed using literate as equivalent to three years of education)	None
NEPAL, Rupandehi (Sharma 1974)	138 (rice farms)	Indicator (literate) 0.082	1.78	.95	2.85 (Computed using literate as equivalent to three years education)	None

Table 2 (continued)

Study	N	Coefficient of education on agricultural productivity	t-statistic	$\bar{R}^2$	Estimated percentage of increase in output for one additional year of education a/	Comment
PHILIPPINES, Laguna, 1963 (Halim 1976)	274	0.020	1.53	.77	2.0	None
PHILIPPINES, Laguna, 1968 (Halim 1976)	273	0.019	1.26	.70	1.92	None
PHILIPPINES, Laguna, 1973 (Halim 1976)	220	0.027	2.25	.80	2.74	None
TAIWAN (Wu 1971)	333 (rice farms)	0.007	0.53	.60	0.7	Simple rate of returns for one year of additional schooling computed from one to twelve years decreased at a steady rate. Thus, there was no evidence of a threshold effect.
TAIWAN (Wu 1971)	316 (banana and pineapple farms)	0.038	2.83	.65	3.87	None
TAIWAN (Wu 1977)	310	0.009 Quadratic form(s) -0.066 0.005	0.95 1.82 2.12	.87	0.9	Marginal productivity of education in crop production changes from negative to positive at 6.6 years of schooling of the farm operator. The quadratic formula shows this clearly: Where $a_1S + a_2S^2$ was entered in equation -- $a_1 = -0.066$, $a_2 = 0.005$.

Table 2 (continued)

Study	N	Coefficient of education on agricultural productivity	t-statistic	$\bar{R}^2$	Estimated percentage of increase in output for one additional year of education a/	Comment
THAILAND, Chiang Mai (Jamison and Lau, forthcoming)	91 (farms using chemical fertilizer)	0.031	2.10	.76	3.15	The coefficient for education has an increase between the indicator for primary education (4 years) and over 4 years for all equations: Indicator (<4 years) = 0.030 Indicator (4 years) = 0.124 Indicator (>4 years) = 0.280
THAILAND, Chiang Mai (Jamison and Lau, forthcoming)	184 (farms not using chemical fertilizer)	0.024	2.27	.81	2.43	The coefficient for education has an increase between the indicator for primary education (4 years) and over 4 years for all equations: Indicator (<4 years) = 0.066 Indicator (4 years) = 0.108 Indicator (>4 years) = 0.132

a/ These figures were computed from the formulas in Section C of the text.

In order to summarize our findings, we created histograms (based on the thirty-one studies that were not omitted for technical reasons or reasons of comparability) or number of studies by percentage decrease or increase in output attributable to a farmer's having four years of education rather than none. Our estimate of the effect of four years is, however, simply four times the effect of one year, as computed from the formulas just given (which averages out threshold effects of the sort that some of the studies we review found). We use four years because it is an often-stated minimum for the cycle of basic education. 11/ Change was rounded to the nearest one-half of a percent so that the studies, which were aggregated in 4 percent intervals, could be grouped. (The histogram in Figure 1 of Lockheed, Jamison, and Lau 1980 shows that the mean gain in production for four years of education was about 8.7 percent, with a standard deviation of 9.0 percent.)

To assess the reliability of our estimates of percentage gain in production for four years of education, we also estimated the standard errors of these estimates, based on the estimated standard errors of the coefficients in the respective studies. (Table A.2 of Lockheed, Jamison, and Lau 1980 shows these estimated standard errors, which varied greatly across studies.) To compensate for these differences in reliability, we weighted the percentage gains by the reciprocals of the corresponding estimated standard errors and generated a bar graph, shown in Figure 1. Thus, the more reliable an estimate is, the heavier the weight. Figure 1 differs little from the unweighted Figure 1 of Lockheed, Jamison and Lau (1980) with a mean gain for four years of education estimated as 7.4 percent and a standard deviation of 6.8 percent -- figures slightly lower than those estimated from the unweighted sample.

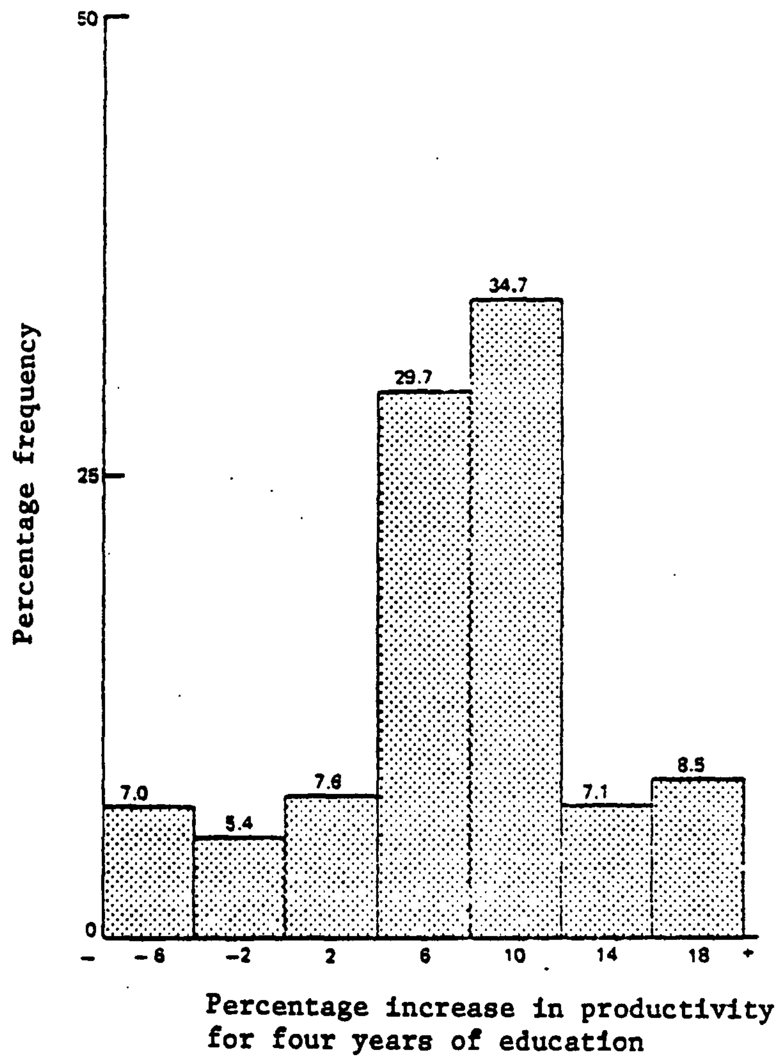
As we have noted, aspects of the environmental context may be important determinants of the effects of education on production. In particular, Schultz has argued that education is likely to be effective principally under modernizing conditions. In order to test this hypothesis, we divided the studies according to whether they reflected modernizing or nonmodernizing environments.

2.1. Effects in Modernizing Environment

The criteria for identifying an environment as nonmodern included primitive technology, traditional farming practices and crops, and little reported innovation or exposure to new methods. The criteria for identifying an environment as modern, conversely, included the availability of new crop varieties, innovative planting methods, erosion control, and the availability of capital inputs such as insecticides, fertilizers, and tractors or machines. Some other indicators of this type of environment were market-oriented production and exposure to extension services. In some cases, authors of the studies were explicitly testing Schultz's hypothesis, and for those we simply accepted the author's classification of whether the sample's environment was modernizing. In other cases, where information was available, we made our own subjective assessment. We were able to make a modern-nonmodern classification for twenty-three of the thirty-one studies.

Figure 1:

RESULTS OF STUDIES RELATING SCHOOLING TO AGRICULTURAL PRODUCTIVITY
(Weighted by reciprocal of the standard error)



Note: Mean = 7.4 percent; standard deviation = 6.8; and total data sets = 31.

Source: World Bank.

We assess the impact of a modernizing environment in two separate ways. First we divide the bar graph of Figure 1 into modern and nonmodern subsamples; Figure 2 displays the results of this division. Under modernizing conditions, the effects of education are substantially greater than under traditional conditions. Over all of the studies, the mean increase in output for four years of education under traditional conditions was 1.3 percent compared with 9.5 percent under modern or modernizing conditions.

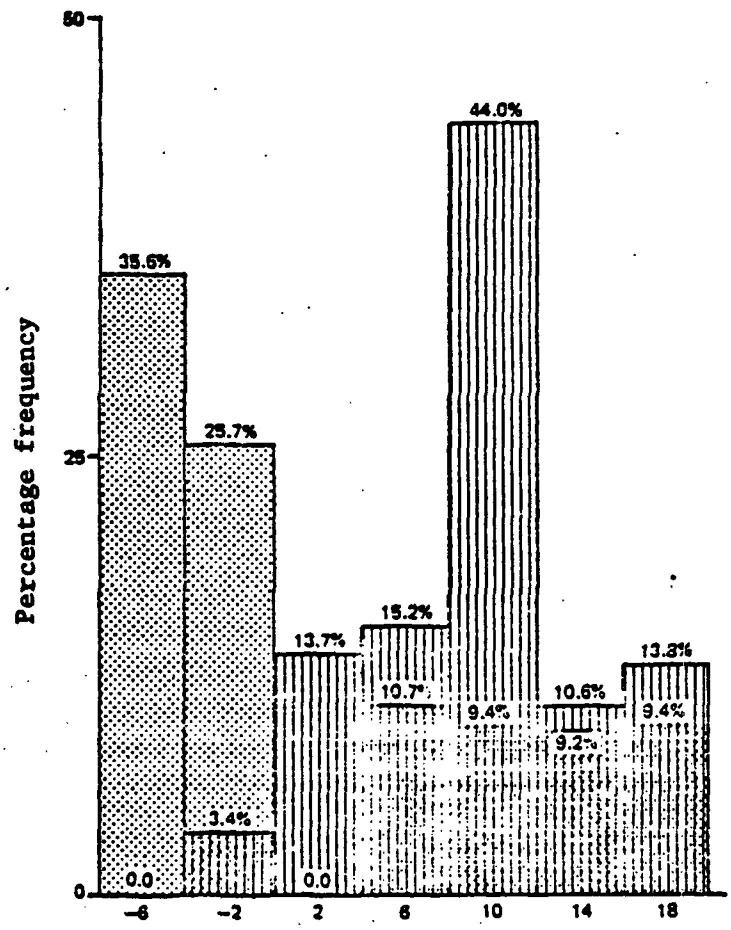
A second way of assessing the effect of a modernizing environment on the productivity of education is to conduct a regression analysis of our estimates of the percentage of increase in farm output per four years of education as a function of such environmental characteristics as the adult literacy rate in the country, modernizing environment, regional availability of extension services, the type of crop (rice vs. other crops), and real gross national product (GNP) per capita. Because our estimates of the percentage gains are themselves random variables with different variances, the ordinary least-squares estimator is inefficient, although it remains unbiased under standard assumptions. To correct for the heteroscedasticity, we have used the generalized least-squares estimator with an estimated diagonal variance-covariance matrix constructed from our estimates of the variances of the percentage gains. The detailed definitions of the independent variables used are given in Table 3. For a number of studies, it is not possible to determine whether the environment was modernizing or whether agricultural extension was available. We resort, therefore, to the use of two indicator variables, each to represent the effects of modernizing environment and agricultural extension.

A number of regressions with different combinations of the independent variables were run. We report in Table 4 only those regressions with at least one statistically significant estimated coefficient (defined as a coefficient with a t-statistic exceeding 1.96 in absolute value). We uniformly find, on the one hand, that agricultural extension, crop type, real GNP, and literacy rate have statistically insignificant effects on the percentage gain. On the other hand, a nonmodernizing environment appears to have a decidedly negative effect on the percentage gain. The difference in the percentage increase in productivity between a modern and a nonmodern environment is consistently estimated to be around 10 percent. The equation with the highest $\bar{R}^2$ -- the coefficient of multiple correlation adjusted for degrees of freedom -- indicates that, in a nonmodern, non-rice-growing environment, the mean percentage increase may even be negative.

In order to identify further the nature of the environmental influence on the effectiveness of education, we dropped from our regression analysis those studies for which the modernizing/nonmodernizing classification is unavailable, and with the reduced sample ran further regressions. Table 5 reports the results. The variable for modernizing environment is strongly significant. On average, the percentage gain as a result of four years of education is 10 percent higher in a modernizing environment than in a traditional environment. The coefficient of the variable for crop type remains statistically insignificant. Even by splitting the independent variables into four indicator variables, as defined in Table 3, we found no evidence of interaction between environment and crop type.

Figure 2:

EFFECTS OF SCHOOLING ON AGRICULTURAL PRODUCTIVITY:
STUDY RESULTS GROUPED BY MODERN AND NONMODERN SAMPLES
(Weighted by the reciprocal of the standard error)



Percentage increase in productivity
for four years of education

Key: Modern sample
Nonmodern sample

Note: For the modern sample, mean = 9.5% and standard deviation = 5.7; for the nonmodern sample, mean = 1.3% and standard deviation = 11.0. Total data sets = 23.

Source: World Bank.

Table 3:

NAMES AND DEFINITIONS OF VARIABLES USED IN REGRESSIONS REPORTED IN TABLES 4 AND 5

Variable	Definition
MOD1	Indicator of modernizing environment (1 = modernizing; 0 = either traditional or no information available)
MOD-1	Indicator of traditional environment (1 = traditional; 0 = either modernizing or no information available)
EXT1	Indicator of availability of extension services (1 = services available; 0 = either no services available or no information available)
EXT-1	Indicator of lack of extension services (1 = services not available; 0 = either services available or no information available)
CROP	Indicator of crop type (1 = rice; 0 = other)
GNP	Per capita gross national product in 1975 U.S. dollars
LIT	Adult literacy rate expressed as percent
MOD	Indicator of modernizing environment (1 = modernizing ; 0 = traditional)
MICI	See p. 2.30.
M1CO	Indicator of sample partition (1 = modernizing non-rice environment; 0 = other)
MOC1	Indicator of sample partition (1 = traditional rice environment; 0 = other)
MOCO	Indicator of sample partition (1 = traditional non-rice environment; 0 = other)

Table 4:

REGRESSION ANALYSIS -- DETERMINANTS OF PRODUCTIVITY GAIN AS A RESULT OF FOUR YEARS OF EDUCATION (N = 31)

Independent variables	Alternative specifications 1	2	3	4	5	6	7	8
Constant	6.33 (4.52)	6.00 (3.45)	5.48 (3.28)	6.77 (4.32)	5.04 (2.16)	6.33 (4.45)	3.19 (0.97)	6.05 (3.41)
MOD1	2.25 (1.31)	2.46 (1.27)	2.85 (1.55)	3.27 (1.39)	0.96 (0.38)	2.10 (1.17)	0.65 (0.25)	2.32 (1.15)
MOD-1	-8.05 (-2.55)	-8.01 (-2.29)	-7.20 (-2.18)	-6.24 (-1.47)	-9.03 (-2.59)	-8.05 (-2.51)	-9.39 (-2.50)	-7.92 (-2.22)
EXT1	--	0.34 (0.18)	--	--	--	--	0.61 (0.33)	0.18 (0.09)
EXT-1	--	1.07 (0.32)	--	--	--	--	3.19 (0.80)	1.03 (0.30)
CROP	--	--	1.93 (0.95)	--	--	--	--	--
GNP	--	--	--	0.00 (-0.65)	--	--	--	--
LIT	--	--	--	--	0.03 (0.70)	--	0.06 (1.00)	--
MODICROP	--	--	--	--	--	1.09 (0.37)	--	1.02 (0.32)
$\bar{R}^2$	0.46	0.42	0.46	0.45	0.45	0.45	0.42	0.40

-- Variables not included in the specification.

Note: The data on which the regressions are based are presented in Appendix Table A.2 of Lockheed, Jamison and Lau 1980. This table shows the estimated coefficients with their t-statistics in parenthesis underneath. To take into account the differences in the variances of our estimates of the percentage gains in productivity, we used generalized least squares with an estimated variance-covariance matrix for our regression. Our dependent variable is the percentage increase in output for four years of education. Let $Y_1, \ldots, Y_T$ be the percentage gains and the row vectors $X_1, \ldots, X_T$ be the independent variables; our regression model is:

$$Y_i = X_i\delta + \xi_i, \; i = 1, \ldots T$$

where

$$V(Y) = V(\varepsilon) = \begin{bmatrix} V(Y_1) & & 0 \\ & V(Y_2) \ddots & \\ 0 & & V(Y_T) \end{bmatrix}$$

By transforming both the dependent and the independent variables, we obtain:

$$\frac{Y_i}{\sqrt{V(Y_i)}} = \frac{X_i\delta}{\sqrt{V(Y_i)}} + \frac{\xi_i}{\sqrt{V(Y_i)}}, \quad i = 1, \ldots, T$$

This, by a redefinition of variables, becomes:

$$Y_i^* = X_i^*\delta + \xi_i^*, \; i = 1, \ldots, T$$

with

$$V(\xi_i^*) = I$$

so that ordinary least squares can be applied. But V (Y) is unknown. We substitute for V (Y) by a consistent estimator of V (Y) calculated from the estimated variance-covariance matrices of the coefficients of each of the underlying studies (see footnote b, Appendix Table A.2, Lockheed, Jamison, Lau 1980).

Table 5:

REGRESSION ANALYSIS -- DETERMINANTS OF PRODUCTIVITY GAIN AS A RESULT OF FOUR YEARS OF EDUCATION (N = 23)

Independent variables	Alternative specifications 1	2	3	4
Constant	-1.72 (-0.56)	-1.72 (-0.57)	7.14 (5.47)	--
MOD	10.16 (3.07)	10.31 (3.22)	--	--
CROP	1.09 (0.34)	--	2.39 (0.64)	--
M1C1	--	--	--	9.53 (3.20)
M1CO	--	--	--	8.44 (7.15)
MOC1	--	--	--	--
MOCO	--	--	--	-1.72 (-0.56)
R	0.47	0.50	0.26	0.47

-- Variables not included in the specification.

Note: This table shows the estimated coefficient with their t-statistics in parenthesis underneath. See also note to Table 4 for information on data sources and regression methods.

We could not reject the hypothesis that the effect of a modernizing environment is independent of the type of crop (rice or nonrice) -- the t-statistic for the null hypothesis has a value of 0.34.

D. Nonformal Education and Efficiency

We have further hypothesized that exposure to extension or other nonformal agricultural education experience should have a positive effect on output. In Table 6 we summarize the analyses of sixteen of our data sets for which information on nonformal education was provided. 13/ Of these studies, eight provided evidence that extension was significantly positively related to productivity, one provided evidence that extension was significantly negatively related to productivity, and the remaining seven showed no significant effect.

Comparability of these results across studies is limited because of the actual measure of exposure to nonformal education, which may be indicated by the number of contacts a farmer has with the extension agent, the monetary investment in extension in that region, or the years of exposure to nonformal education. In addition, extreme variability in the program content and method of communication may also reduce cross-study comparability.

We also explored whether formal education and nonformal education acted as substitutes or complements. A few studies incorporated terms of interaction between formal and nonformal education in their production function regressions. Most of the coefficients of interaction were positive, suggesting therefore a possible complementary relationship between the two forms of education, even though few of the coefficients were statistically significant.

E. Conclusions

This paper has surveyed the findings of eighteen studies conducted in low-income countries and has concerned the extent to which the educational level of small farmers affects their production efficiency. 14/ The eighteen studies include analyses of thirty-seven sets of farm data that allow, with other variables controled, a statistical estimation of the effect of education. In six of these data sets, education was found to have a negative (but statistically insignificant) effect, but in the remaining thirty-one, the effect was positive and usually statistically significant. Though combining the results of disparate studies must be done with caution, our overall conclusion is that farm productivity increases, on the average, by 7.4 percent as a result of a farmer's completing four additional years of elementary education rather than none; the 7.4 percent is a weighted average of values from those studies for which an estimate could be computed. A number of studies showed evidence of a threshold

Table 6:

NONFORMAL EDUCATION AND AGRICULTURAL PRODUCTIVITY

Study	N	Nonformal education variable	Coefficient on productivity	t-statistic	$\bar{R}^2$	Evidence of interaction with formal education	Comments
BRAZIL (Pachico and Ashby 1976)	382 (total sample)	Number of contacts between the farm operator and government extension agent	-0.010	-2.50	.65	The interaction term between schooling and extension indicates these factors to be complements, but the relation was statistically insignificant	None
BRAZIL, Alto São Fransisco (Patrick and Kehrberg 1973)	82	Number of direct contacts between farmer and extension agent	0.004	0.98	.44	Not applicable	Mean social benefit-cost ratio for extension contacts = 1.35.
BRAZIL, Conceicao de Castelo (Patrick and Kehrberg 1973)	54	Number of direct contacts between farmer and extension agent	0.009	2.65	.82	Not applicable	Mean social benefit-cost ratio for extension contacts = 3.02.
BRAZIL, Paracatu (Patrick and Kehrberg 1973)	86	Number of direct contacts between farmer and extension agent	0.001	0.20	.59	Not applicable	Mean social benefit-cost ratio for extension contacts = 0.42.
BRAZIL, Resende (Patrick and Kehrberg 1973)	62	Number of direct contacts between farmer and extension agent	0.001	1.11	.55	Not applicable	Mean social benefit-cost ratio for extension contacts = 0.165.
BRAZIL, Vicosa (Patrick and Kehrberg 1973)	337	Number of direct contacts between farmer and extention agent	0.003	1.03	.62	Not applicable	Mean social benefit-cost ratio for extension contacts = 0.68.

Table 6 (continued)

Study	N	Nonformal education variable	Coefficient on productivity	t-statistic	$\bar{R}^2$	Evidence of interaction with formal education	Comment
JAPAN (Harker 1973)	971	Use of agricultural magazines, extension agents, and agricultural broadcasts	r = 0.14	(p <.001)	.38	Not Applicable	A path analysis was utilized; coefficient is standardized partial correlation coefficient
KENYA (Hopcraft 1974)	674	Extension visits:					
		Indicator (one to three)	0.153	1.67	.56	The interaction between schooling and extension was significant and negative	None
		Indicator (four to seven)	0.272	2.72			
		Indicator (>seven)	0.035	0.47			
		Farmers Training Centre Course:					
		Indicator (1 course)	-0.014	0.12			
		Indicator ($\geq$ 2 courses)	0.135	1.23			
		Demonstrations:					
		Indicator (1 or 2)	0.393	4.68			
		Indicator ($\geq$ 3)	0.197	1.83			
KENYA (Moock 1973)	152	Extension index computed by multiplying rotated factor scores of different extension measures by standardized observations and summing the products	0.003	0.77	.64	Moock (1978), in a reanalysis of his original data, finds a negative interaction between schooling and extension	None

Table 6 (continued)

Study	N	Nonformal education variable	Coefficient on productivity	t-statistic	$\bar{R}^2$	Evidence of interaction with formal education	Comment
KOREA (Hong 1975)	895	Log-linear: Investment in extension	0.832	3.55	.85	Log-linear: Ext. x Ed. B = 0.6039 t = -3.871	Investment in extension had a significant effect on both technical and allocative efficiency. One won investment in extension per farm yearly brought 4.49 won to rice production yearly. Extension efforts for older farmers with more schooling contributed more than extension efforts for younger ones.
		Log-log: Investment in extension	3.240	6.00	.85	Cobb-Douglas: Ext. x Ed. B = 0.605 t = 121.0	
MALAYSIA (Jamison and Lau, forthcoming)	403	Exposure to Adult Agricultural Extension classes	0.237	1.73	.69	Not applicable	None

Table 6 (continued)

Study	N	Nonformal education variable	Coefficient on productivity	t-statistic	$\bar{R}^2$	Evidence of interaction with formal education	Comment
PHILIPPINES 1963 sample (Halim 1976)	274	Number of weighted extension contacts	0.00663	3.44	.77	Ed. x Ext. B = -0.00028 t = 0.205 Ed. x Ext. x Barrio Development Index B = 0.00008 t = 0.727	Overall rate of return to extension was ₱8.12 for each ₱5.69 invested or 70 percent (combined samples). Schooling and extension effects were found to be negatively related in all periods, but when a development index (constructed by Guttman scaling) was added the relation was positive. Schooling and extension effects could substitute for each other in less developed barrios, but the effects could be complementary in the dynamic conditions of more developed barrios.
PHILIPPINES 1973 sample (Halim 1976)	273	Number of weighted extension contacts	0.004	2.40	0.70	Ed. x Ext. B = -0.00038 t = -0.118 Ed. x Ext. x Barrio Development Index B = 0.00001 t = 0.333	See comments for 1963 sample

Table 6 (continued)

Study	N	Nonformal education variable	Coefficient on productivity	t-statistic	$\bar{R}^2$	Evidence of interaction with formal education	Comment
PHILIPPINES 1973 sample (Halim 1976)	220	Number of weighted extension contacts, 1963-68	-0.000	-0.77	0.80	Ed. x Ext. B = -0.0006 t = -0.352 Ed. x Ext. x Barrio Development Index B = 0.0001 t = 1.00	See comments for 1963 sample
THAILAND (Jamison and Lau, forthcoming)	91 (farms using chemical fertilizer)	Number of extension visits to village	-0.123	-1.53	0.78	A_5Ext_1 = 1 if extension available B = 0.015 t = 0.718 A_5 Ext_0 = 1 if extension not available B = 0.036 t = 2.316	Extension had negative coefficient and education had positive coefficient on farm profits for farms using chemical fertilizer
THAILAND (Jamison and Lau, forthcoming)	184 (farms not using chemical fertilizer)	Whether extension was available in village	0.085	2.22	0.81	A_5 Ext_1 = 1 if extension available B = -0.032 t = 2.695 A_5 Ext_0 = 1 if extension not available B = -0.016 t = 1.291	Education and extension had positive coefficients on farm profits for farms not using chemical fertilizer

number of years (four to six) at which the effect of education became more pronounced. None of the studies we have reviewed has addressed the issue of through which of its outcomes (that is, literacy, numeracy, modernity, and so on) education has the effects that it does; research now underway in Nepal and Thailand is addressing this question. 15/

The effects of education were much more likely to be positive in modernizing agricultural environments than in traditional ones, which we ascertained both by inspection and by regressing (across studies) the measured effects of education on productivity against the degree of modernization of the environment and other variables. Our results lend support to T.W. Schultz's (1975) hypothesis that the effectiveness of education is enhanced in a modernizing environment.

Footnotes

1/ This review is drawn from Lockheed, Jamison, and Lau (1980).

2/ A number of studies have examined the effects of education on farmers' willingness to adopt innovations; an early and important study in this area is that of Roy, Waisanen, and Rogers (1969). Villaume (1977, Chapter II) provides a valuable review of this literature as well as an assessment of the direct and indirect influence of literacy on the adoption of innovations in Brazil and India.

3/ In Farmer Education and Farm Efficiency (Jamison and Lau, forthcoming, chapter 3.1), we discuss advantages and disadvantages of using farm-level rather than aggregated data. Other authors (for example, Griliches 1963, 1964; Fane 1975; Khaldi 1975; and Huffman 1974, 1977; Evenson, Waggoner, and Ruttan 1979, Table 3) have studied the effect of education on agricultural productivity using aggregated data (at the county or state level) in the United States; they found educational levels positively associated with increased efficiency. Gisser (1965), also using aggregated U.S. data, found education associated with an increased propensity to outmigrate from rural areas. Using similar methods, Hayami (1969) and Hayami and Ruttan (1970) found that educational level is an important determinant of differences in agricultural productivity among nations. Herdt (1971), using much the same methodology with Indian data aggregated at the state level, found no positive effects of education, although Ram (1976), using data disaggregated from the state of the district level, found that education contributed strongly to the productivity of Indian agriculture. Also using Indian district-level data, Harker (n.d.) found that average literacy levels increased productivity and, more strongly, increased the utilization of fertilizer. In other related studies, Beal (1963) found that both education and extension utilization contributed to a subjective measure of farmer performance in England. Page (1978, 1979) found that exposure to technical education increased foresters' efficiency in Ghana but that experience, rather than formal education, was related to productivity of entreprenuers in the Indian soap industry. Gerhart (1975) found that more-educated Kenyan farmers were more likely to adopt hybrid maizes, and Rosenzweig (1978) found that more-educated Punjabi farmers were more likely to adopt high-yielding varieties. In contrast to these findings, Morss et al. (1976) concluded that the average literacy level of farmers being reached by agricultural development projects was not a determinant of project success. Although economists only began to pay systematic attention to these issues in the 1960s (beginning with the seminal work of T. Schultz), the educational research literature in the 1920s had already begun to consider the role of education in improving agricultural productivity. Folks (1920), for example, reported on studies showing a strong influence of education on agricultural productivity in Indiana, Missouri, and New York.

4/ When agricultural conditions are static, proper practices can be formalized and passed from generation to generation by example and adage. Buck (1937) provided interesting examples from China (that is, from Shantung): "Plant millet after millet and you will end by weeping." Evenson (1974), Bowman (1976a), Ram (1976), and Sachs (1979) provided thoughtful interpretations of how research, extension, and education on the one hand, and market conditions on the other, are interrelated in transforming static environments into modernizing ones, and Harma (1978) discussed specific ways in which education and information would be useful in improving productivity in a range of agricultural activities. Hopper (1979) and Schultz (1979) discussed how governmental price and regulatory policies can facilitate or impede farmers' incentives to modernize their practices and, thereby, indirectly influence the returns to education.

5/ See Glass (1976).

6/ The "elasticity" of variable Y with respect to variable X is the percentage change in variable Y induced by a 1 percent change in variable X. An elasticity of 0.2, for example, would imply that a 1 percent increase in variable X would result in a 0.2 percent increase in variable Y. The coefficients of an indicator variable, like D in specification (3), is approximately the percentage increase in output that would result if the indicator variable had the value "1" rather than "0".

7/ See Bowman (1976b).

8/ Though estimation of the direct effects of education on production is in principle possible in other sectors, studies so far have focused on agriculture. Four partial exceptions are Simmons'(1976) study of Tunisian shoe manufacturing, Horowitz and Sherman's (1980) study of the effect of sailors' education on ship maintenance in the U.S. Navy, an examination of the effects of literacy in the nineteenth century U.S. textile industry (mentioned in Bowles and Gintis, 1976, p. 110), and Friedman and Kuznets's (1945) study of income from independent professional practice. Both the shoe and textile studies used piece rates to approximate marginal productivity. The "output" variable in the classic Friedman-Kuznets study, value of the sale of professional services, is sold, for independent practioners, directly in a market of multiple ultimate users; it is plausible to view earnings functions for independent practioners as, essentially, production functions for their services. Another sector in which there have been studies of the direct effect of education on output is in the education industry itself, in which there have been numerous studies of the effects of teachers' educational levels on their productivity (as measured by their students' performance on tests; for a tabular summary of results see Jamison, Suppes, and Wells 1974, p. 13). Perhaps the most comprehensive single study of the direct effect of education on productivity outside the agricultural sector is Saxonhouse's (1977) study of productivity change in the Japanese cotton spinning industry. Using data at the firm level over a 45-year period he concluded that the percentage of workers with primary education was an important determinant of productivity increase, but that the education of managers was less important.

9/ See Calkins (1976), Chaudhri (1974), and Hong (1975). Chaudhri's work on India was extended and published at greater length after the present manuscript was completed -- see Chaudhri (1979).

10/ See Hopcraft (1974). Although Hopcraft's production function for maize did have a surprising, negative coefficient for labor, in his production function for aggregate crop output, labor had a positive coefficient on output.

11/ Four years is the UNESCO standard for minimum primary education. Rogers (1969) provides empirical support for this as a threshold in a study of Colombian farmers, and the World Bank has a research project underway (RPO 671-55, "International Study of the Retention of Literacy and Numeracy") to assess where the threshold is.

12/ See Schultz (1975) and note 4, above.

13/ We should explicitly stress that this survey of the literature is not intended to cover all studies of the effectiveness of agricultural extension or other nonformal education provided for farmers; see Orivel (1980) for such a review. We merely report here any results available concerning extension effectiveness in the eighteen studies listed in Table 1; those studies were ones including an assessment of the contribution of formal education to agricultural productivity. Benor and Harrison (1977) reported experiences with extension services considerably more effective than those reviewed here. These authors provide an extensive discussion of the possibilities for reforming extension systems to improve productivity.

14/ A number of studies have been published or come to our attention subsequent to completion of this report; among these is a paper by Welch (1979) including a review with (qualitative) conclusions similar to ours. In other specific studies, Bhalla (1979) found that education enhanced productivity in an all-Indian sample of over 2,000 farmers; Bhati (1973) found that the technical knowledge of Malaysian farmers was related to their productivity; Freire (1979) found that education is significantly associated with the productivity of Guatemalan farmers and with their propensity to use innovative methods. Halim and Husain (1979) found the education of farm operators in Bangladesh to enhance output, though not quite statistically significantly, whereas the highest educational level of anyone in the farm household bore a negative but insignificant relation to productivity. Pachico (1979) found education to increase productivity of farmers in Nepal. Singh found, in the Haryana State of India, that education (particularly secondary education) enhanced farmers' productivity; and Valdes (1971) found that the education of agricultural laborers in Chile was significantly associated with their daily wages. These results, though not incorporated in the analyses we report, are consistent with our findings. (Bhalla's findings are not yet reported, but a description of his sample and a report of other analyses based upon it appear in Bhalla 1979.)

15/ Cole, Sharp, and Lave (n.d.) provide an insightful discussion of the role of the cognitive consequences of education, and Chou, et al. (1980) report preliminary results from Nepal suggesting that numeracy is probably an important consequence of education for improving productivity.

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PART IV

EDUCATION, INCOME, PRODUCTIVITY, AND URBAN POVERTY

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I. THE BENEFITS OF EDUCATION: QUALITATIVE ASPECTS

A. Introduction

Systematic educational planning, with a view to aiding the development process, dates in most developing countries from the post-World War II period. Around 1950, for example, educational levels were quite low in absolute terms. Not surprisingly, initial planning efforts -- often coming after a nation's political independence -- tended to conclude that a significant expansion of education was needed. Exercises in manpower planning highlighted potential shortages of various skills, from those of manufacturing workers to those of professionals, and contributed to the rapid growth of various branches of postprimary and postsecondary education. There was a less general recognition of the productive value of primary schooling, but high demand for it by the population, combined with a general feeling on the part of many governments that provision of universal primary education was an obligation to be satisfied with all deliberate speed, also expanded primary education quickly in many countries (Table 1).

Table 1:

EXPANSION OF EDUCATION, BY GROUPS OF COUNTRIES, 1960-76

(Numbers enrolled as percentage of relevant age group) a/

Group	Educational Level					
	Primary		Secondary		Higher	
	1960	1976	1960	1976	1960	1976
Low-income countries b/	51	73	14	24	2	5
Middle-income countries c/	79	92	16	36	4	10
Industrialized countries	114	102	58	82	16	24

a/ Figures are weighted averages across the countries in each category. For more details on methodology, definitions of age groups, country coverage, see the source, p. 185.

b/ Market economies with per capita income up to US$300 in 1977.

c/ Market economies with per capita income from US$301-3,200 in 1977, excluding Ireland, which was classed as industrialized though its income per capita was only US$2,880 in 1977.

Source: World Bank (1979, pp. 170-71).

Many developing countries have registered good growth performances in the last few decades; this performance has been accompanied by an educational expansion that frequently has been, perhaps more or less generally, greater than that which accompanied comparable growth in the now-developed countries. 1/ Over several decades the percentage growth in the share of school-age students attending school, especially at the postprimary levels, has been dramatic. The changing educational composition of the labor force lags well behind that of the school-age population and has therefore changed more slowly, but the current levels of achievement by the young, if maintained in the future, would over time lead to a marked upgrading of educational levels in the labor force. And, of course, educational achievement continues to rise quickly in many countries.

Developing countries still spend a smaller share of gross national product (GNP) on education than do developed ones, but the difference is no longer marked: in the early 1970s, a "typical" developing country allocated

Table 2:

RATIO OF CURRENT PUBLIC EDUCATIONAL EXPENDITURES TO GNP
BY EDUCATIONAL LEVEL, FOR "TYPICAL COUNTRIES," BY REGION, CIRCA 1973

Region	Educational Level			
	Total	Primary	Secondary	Higher
Developing Countries				
Eastern Africa	3.92	2.04	1.13	0.59
Western Africa	3.51	1.64	1.20	0.49
Asia	3.04	1.33	0.93	0.56
Europe, Middle East, and North Africa	4.24	1.71	1.54	0.84
South America	3.63	1.65	0.99	0.86
Central America and Caribbean	2.79	1.52	0.73	0.38
Total of above	3.47	1.67	1.05	0.58
OECD	4.40	1.68	1.79	0.71
Japan	2.92	1.30	1.23	0.38
United States	5.98	1.72	2.34	1.91
Sweden	5.00	2.86	1.11	1.03

Note: The source's author notes (p. 3) that the data used are from World Bank documents and do "not include in many instances out-of-school education, nor education provided by the private sector." One would expect data on the private educational sector to be rare. Inclusion of capital costs would raise the figures, as would inclusion of opportunity costs faced by students, especially at the secondary and higher levels.

Source: Zymelman (1976).

1/ In other words, the elasticity of educational expansion relative to per capita income growth has been greater in the developing countries than was the historical norm in the now-developed countries.

3.5 percent of GNP to current public expenditures on education, the typical Organization for Economic Development (OECD) country allocated 4.4 percent in that direction and even a very high spender like the United States allocated only 6 percent (Table 2). When capital costs are added to current ones, education's share in public spending is 25 to 40 percent in many developing countries, and many countries' total costs of education (public and private, current and capital, plus opportunity costs of student time) probably reach 10 percent of GNP.

The allocation of public expenditure by level of education differs between developing countries and developed ones, with the former spending a somewhat higher share at the primary level and a lower share at the secondary level (Table 3). What is striking, however, is the extreme difference in relative costs by different levels of education. According to one estimate, the cost for a student receiving higher education in a typical OECD country is only about 3.5 times as much that for one receiving primary, whereas the corresponding ratio in a typical developing country is 24 times.1/

Table 3:

PERCENTAGE DISTRIBUTION OF EDUCATIONAL BUDGETS
BY LEVEL OF EDUCATION, CIRCA 1973

	Educational Level		
	Primary	Secondary	Higher
OECD	38.1	40.7	16.2
Developing countries	48.1	30.2	16.7
Unit cost per student in relation to GNP (developing countries/OECD countries)	0.94	2.48	6.58
Unit cost per student by educational level (primary = 1.0)			
OECD	1.0	1.31	3.44
Developing countries	1.0	3.47	24.13

Source: Zymelman (1976, p. 81)

Both the absolute pace of expansion and the growth relative to historical precedents raise the question of whether education has proceeded faster than desirable in a number of countries and whether the marginal costs may now or soon exceed the marginal returns, in general or for certain types of education. To raise these questions is not to doubt the prominent role of

1/ These figures are not precise for a variety of reasons, but the contrast in relative costs by level of education is undoubtedly a striking one.

education in the development process nor the wisdom of its expansion from the low levels that were obtained in most developing countries a few decades ago. It is simply to recognize that the social benefits to a given level of education may fall as the supply expands relative to other factors of production in the economy; to presume the contrary would be incautious.

Consideration of the optimal number of students at each level of education should not, of course, be separated from either the matter of educational content and quality or the issue of efficiency in the achievement of desired outputs with the least cost for inputs. More may be gained in net social benefits from education by focusing on the organization of the educational system than by adjusting educational flows up or down. And in some cases an increase in the efficiency of the system (for example, a lowering of unit costs) would permit an otherwise impossible or undesirable expansion in enrollments.

B. The Urban Context

This paper explores the potential benefits from raising educational levels of urban populations, especially the urban poor. The paper by Lockheed, Jamison, and Lau(in this volume) has analyzed the benefits to education in agriculture and has reached generally positive conclusions. Separate treatment and the application of discrete methodologies are appropriate to the assessment of benefits to education in rural and urban areas because the differences between these two settings are major. One difficulty in constructing an overall picture of the benefits from education on the basis of such separate studies, however, is the failure of both to allow for the phenomenon of migration. When concern is directed to the problem of poverty, it is also necessary distinguish the effect of educational expenditures on poverty in the area where they occur from the effect on overall poverty.

To the extent that such an expansion of urban education improves the educational opportunities of urban children relative to rural ones, migration, both of children who move to urban areas to study and of whole families, will be accelerated. Whether this effect is quantitatively significant is not clear. But it is relevant that, although such a gap in educational opportunity between rural and urban areas is large in many countries, there is no evidence to suggest that excessive rural-to-urban migration has occurred in any general sense. As always, however, countries may differ widely in this respect. 1/

1/ The most persuasive evidence of excessive rural-urban migration would be a tendency for incomes of persons with given skill levels to be lower in urban than in rural areas, but the opposite is observed in most developing countries. Some African countries in which the urban labor force is still small relative to the total labor force but has grown very rapidly are probably the most likely exceptions.

Probably a more serious issue arises from the fact that in most countries poverty is concentrated in rural areas. Expenditure on urban primary education may therefore have the desired effect of improving the urban distribution of income but have ambiguous effects on the national distribution of income. The issue is especially serious for countries in which urban educational levels and incomes are already well above those of rural areas, usually countries in the early or middle stages of development. 1/ These issues will not be treated empirically here but they imply the need for careful attention to the relations between rural and urban educational levels.

C. The Contributions of Education

Formal education is part of the more general process of learning in a society, whereby manual and nonmanual skills (including, one would hope, the ability to learn itself) are developed, knowledge is built up, and attitudes and expectations are created. To predict the effects of any change in the pattern of education in a country (for example, an increase in the level of education of a specific group), it is necessary to understand the milieu in which learning occurs. A country's formal educational system is intertwined with its culture, creating considerable complexity for judging what is the result of the formal system and what the result of other learning processes.

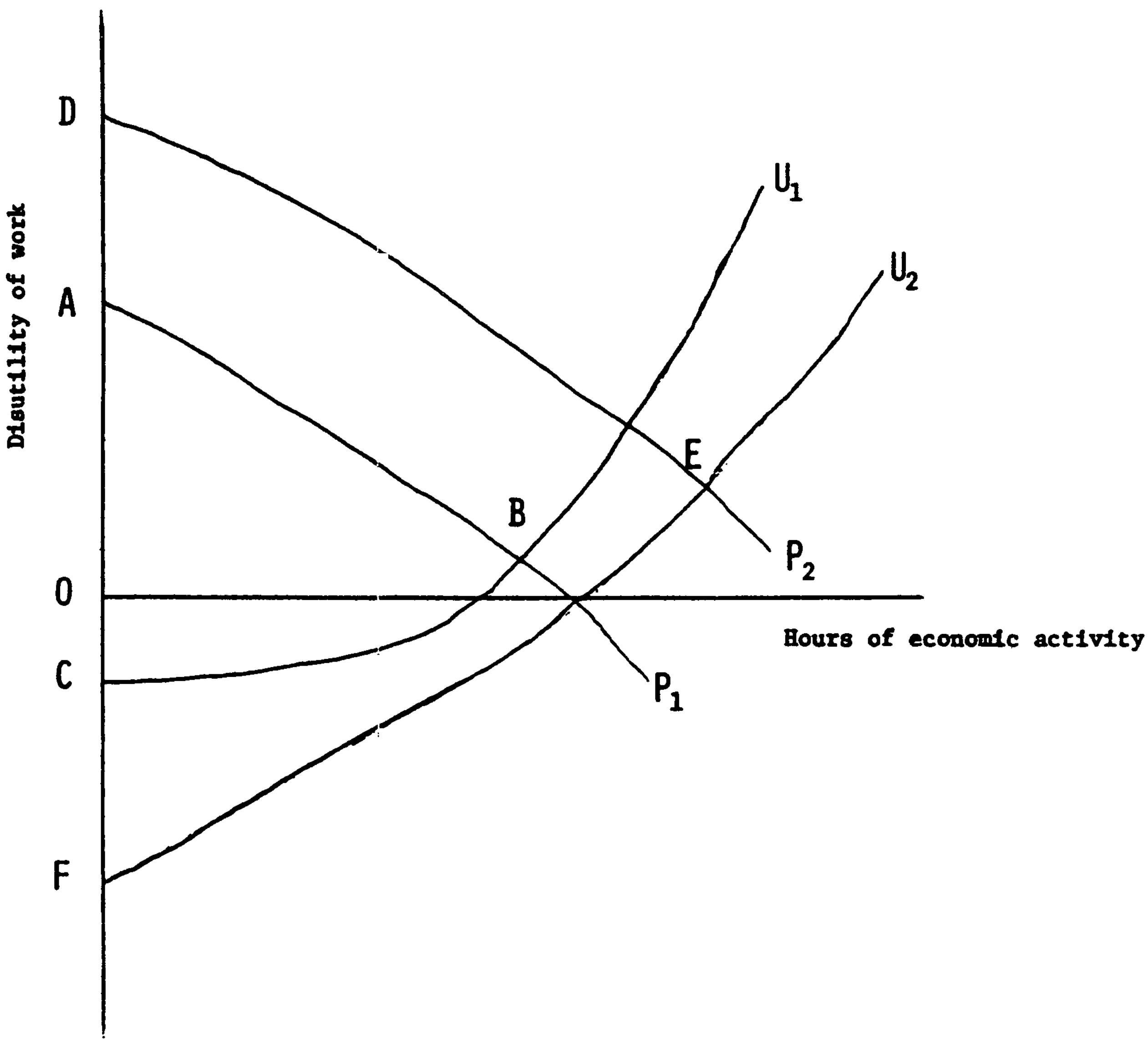
The content, style, and tone of formal educational systems also vary widely. Permissiveness and discipline rote learning and problem solving, technical skills and the "liberal arts" vary in their emphasis they receive. It would be surprising if the effects of education in general, or of the formal system in particular, were to be closely similar across such variety of contexts. At the same time, of course, there are many features common to all educational systems -- for example, reading, arithmetic, and so on -- and these undoubtedly have effects on productivity.

The major effects of education on an individual's welfare include the gains from improved economic opportunity (defined broadly to include housework, production for own consumption, and so forth); and the direct benefits from raising the capacity for cultural enrichment and enjoyment. The first effect involves the relations among education, an individual's income (monetary and imputed), and the utility or disutility of his work. In a diagramatical representation of these relations (Figure 1), one might expect a certain increase in education to shift the curve for productivity (P) of work from P_1 to P_2 and the curve for utility (U) of work from U_1 to U_2. Accordingly, the total benefits would increase from area ABC to area DEF. At this level of generality, the argument is independent of whether an individual is a member

1/ Pakistan, for example, exemplifies a wide gap in educational levels between rural and urban areas.

Figure 1:

RELATIONS BETWEEN ECONOMIC ACTIVITY AND DISUTILITY OF WORK



Note: P = productivity; U = utility. When a U curve lies below the horizontal axis, an additional hour of work raises utility directly; that is, the additional activity is enjoyed.

of the labor force or not. Practically speaking, most individuals whose work greatly increases their consumption potential are classified as employed and sell either their time or the product of their work. The effect of education on income is likely to be primarily through its effect on hourly income -- but possibly also through hours worked when employed, through the amount of time employed as opposed to unemployed 1/ or out of the labor force. If management (directly or indirectly) of one's capital is included under the term "economic activity," the effect of education on this must also be taken into account, for it may be considerable.

Education of course has benefits as an item of consumption as well as of productivity-raising investment. Similarly, in the context of distribution of welfare, the disparity in levels of education of different people is important. One of the sources of feelings of inferiority (and of superiority) in a society is this disparity, which helps to produce injustices -- as, for example, when illiterates are unable to get equal treatment in the legal system or to make their political weight felt. The economic analysis of education has tended to disregard this consideration, partly because of the difficulties in quantifying the effects of the disparity.

Satisfaction of aspirations is another important component of welfare and probably of social and political stability as well. The way in which education affects aspirations, both in their level and rigidity, may be important, depending on the consistency of aspirations with realities and on how mismatches of aspiration and opportunity affect behavior and satisfaction. This whole relationship has been left aside in the economic literature.

For a variety of reasons, including tradition and analytic simplicity, western economics has for the most part taken individual preferences have been given and that the molding, changing, or otherwise influencing of preferences as not a proper concern for economics. Yet economists have edged into this field, at least by implication, when they consider the benefit-cost ratios of criminal rehabilitation or crime prevention through education and training, even if they have resisted analysis of more general attempts to alter preference systems. The neglect of such considerations is particularly problematic in the analysis of education because its function in the formation of attitudes and preferences is obvious. The welfare implications of a shift in preference patterns toward a lesser desire to surpass others and a more favorable attitude toward their success are also obvious; any general evaluation of an educational system can hardly neglect this aspect without running the risk of becoming frivolous. Equally evident is that formation of attitudes toward one's own success, independent of that of others, can be important in affecting overall welfare. Study of education draws one into the philosphical question of what is a good society.

1/ Unemployment may be a poor measure of labor market difficulties; the real issues in casual labor markets may be the instability and insecurity of income.

In the educational process, more narrowly economic questions are intertwined with broader social issues. There is always the issue of whether the goals (for example, attitude formation) that are pursued in the educational system are pursued efficiently, using the minimum possible resources in the process. Further, the relations among skill formation, knowledge acquisition, and attitude formation as joint product must be analyzed for a system to do the job expected of it in a given society Some goals -- perhaps acquisition of certain skills and formation of certain attitudes 1/ -- may be relatively competitive, whereas others may be quite complementary.

This study is restricted primarily to the more narrowly economic aspects of education. Whether one considers only these or the more complete set of issues involved in educational policy, it is evident that not all of the benefits (or negative effects) of education accrue to an individual who receives it; there may be important spillover effects on others. Two types of positive externalities are particularly worthy of attention.

Of major importance to the future of developing countries is the process of technological improvement, which involves discovery, innovation, adaptation, and imitation. It is evident that education contributes at each stage of this process, and that individuals who effect improvements do not always receive the full benefits of their contributions. Also of great significance in many countries, especially the poorer, densely populated ones, is the negative effect that education usually has on fertility and, therefore, on population growth. A related benefit may be the improved health of women who undergo pregnancy and childbirth less frequently. A fuller picture of education's benefits might include also a positive effect on the savings rate and a negative effect on crime and the social costs associated with it. 2/

Some of the spillover effects of education on society may be negative, just as some of its effects on the individual recipient may be (as when education leads to unfulfillable aspirations). Education may contribute to antisocial activities that lower national income, such as white-collar crime, socially unproductive speculation, and the like. More important, though, are situations in which -- although education raises the income of the recipient and of the country as a whole -- it lowers that of other people (but less than it raises that of the recipient). Those are the situations in which the private benefits

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1/ This conflict is, of course, longstanding and well recognized in educational theory, and it is widely disputed whether a vocational orientation is less effective in creating good, responsible citizens than is a broader or more academic education.

2/ These effects are not discussed below because there is too little availalb evidence to reach conclusions of interest. Even in the United States, the magnitude of such effects is not clear.

from education exceed the social benefits; how common they are is a major issue of dispute. The credentialist argument, discussed below, is that education is frequently used as a criterion to select among job candidates -- this makes it valuable to the job seekers -- even when it does not have much effect on the worker's productivity.

II. THE EMPIRICAL EVIDENCE ON THE BENEFITS OF EDUCATION IN URBAN AREAS

The wide differences in average income of people with different educational levels suggest that increases in education could play a major role in raising national income and in the alleviation of poverty in developing countries. The relationship between education and income appears, on the basis of evidence to date, to be more direct in urban areas than in the rural (mainly agricultural) areas.

It has generally been assumed that the major benefits of education are directly embodied in the higher productivity of the individuals who have received it, rather than less directly -- for example, in the productivity of others or via higher savings rates, lower fertility, and the like. If this is so, the benefits may be broadly estimated by comparing the income levels of persons with different levels of education, assuming that differences in productivity are reasonably well reflected in differences in incomes. When this latter assumption is not valid, the "human capital" model loses most of its value as a tool for measuring the benefits in question, and several alternative approaches, not considered here in detail, take on additional interest. The conceptually more satisfying methodology involves "production function" analysis to explain differences in labor productivity over time or across countries, firms, or individual workers. It involves the study of how output varies with level of education (for example, in an economy over the course of time), after allowing for other factors that contribute to output growth (for example, physical capital or natural resources). It requires no a priori assumption about the relationship between individuals' income and their productivity. Unfortunately, it does require an understanding of how all the other factors involved in the growth process interact, plus much data. As a result, the approach has provided results of only limited usefulness thus far.

Had one sufficient confidence in either the human capital or the production function approach, the measure of benefits (social or private) from education would not require an understanding how they come about. In fact, such confidence would, at present, be misplaced, so that consideration of the detailed links between education and productivity or income constitute another important source of insights into the overall relationship. An independent understanding of these links is important in improving the content and organization of education so that it will be as productive as possible as weell as in throwing light on the validity of the human capital model.

It is taken for granted that certain specialized training (for example, for the professions) raises productivity by providing relevant knowledge and skills.

Many studies have been undertaken with respect to countries' needs for more or fewer individuals with specific kinds of training. These manpower planning studies usually estimate existing or future demands for a skill category, and a few study the effects of excess or short supply on the wage level of the category and on the development of hiring industries. A few implicitly or explicitly provide an estimate of the social productivity of the workers in question, allowing for the indirect benefits associated with relieving the shortages, but most begin with an exogenously given "need" for various skills based on the predicted or sought-after evolution of the economy. For lower levels of education, in which training is less, if at all, directed to specific occupations, it is presumed that literacy, numeracy, and similar skills are productive, though their absolute and relative importance is debatable. Note that when major interest attaches to the relationship between education and income distribution, as is the case when one considers education as a poverty-redressed strategy, it becomes less important whether a person's income is a good reflection of his/her productivity; evidence on income differentials by educational level is always relevant.

Educational levels are universally higher for urban than for rural families in developing countries; this usually reflects (directly and indirectly) the higher average income levels of the former, as well as the greater ease of providing educational services in urban areas. Except in quite poor countries, it appears that the productivity and income benefits of formal education and training accrue mainly to persons living in urban areas. Most studies of rates of return to education have been undetaken in urban areas; many have concluded that social rates of return are higher for primary than for postprimary levels of education, and also that the former are striking in absolute terms. 1/ In most developing countries, the majority of the urban poor have no more than a primary education; that is, they have no education or primary (partial or complete). Accordingly, the substantial benefits that higher levels of education might yield for the urban poor suggest that this may be one of the most potent instruments of public policy on their behalf.

A. The Evidence Viewed in the Context of the Human Capital Model

1. Human Capital Model for Urban Areas Indicates Substantial Marginal Benefits of Education Likely for Individuals, Possible for Society

As indicated above, income differentials by level of education tend to be large in developing countries, suggesting that more education raises individual incomes and, with less certainty, that it raises individual productivity. It is useful to use as a framework for analysis the human capital model, which presumes that learning, both in school and on the job, raises individual productivity and accounts for some part of the observed income differentials by education and by age. The discussion will return later the

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1/ Studies undertaken in rural areas have not usually identified such high returns to education.

the possible biases in the estimates of benefits from education as usually calculated with this methodology -- concluding that, although they seriously decrease the precision of estimates for some levels of education, they neither render such estimates irrelevant nor create any general presumption, at this time, of serious overestimation of benefits. 1/ In those cases in which serious overestimation is possible, the figures on rate of return emerging from typical calculations following the human capital model are still a useful benchmark from which to proceed in the (then difficult) delineation of a range within which the true rate of return may lie. When the human capital model cannot be applied, considerable ambiguity as to the true returns to education is inevitable. Other approaches are of little help in reducing the ambiguity.

There are two further reasons why benefits of education are difficult to quantify. First, effects of education in spheres other than the productivity and income of recipients (for example, on their fertility), though possibly important, are neither precisely known nor easy to translate into simple income terms. Second, even to the extent that the model's assumptions are acceptable, it is evident that the empirical application of the human capital model has not been sufficiently consistent across countries or over time to permit many conclusions on how the returns to education may vary -- for example, over time in given countries or across countries at different levels of development.

The social rate of return to education as calculated under human capital assumptions depends jointly on (a) that part of the gross earnings differentials across educational levels attributable to the differences in education and (b) the costs of education. The first factor may be further subdivided into income differentials among persons who are working and differences in the share of available time spent working, which are determined by the participation and unemployment rates. The private rate of return is calculated on the basis of the same benefits (minus the marginal taxes resulting from the income increases from education) and on the costs of education borne by the individual family. This definition of the private rate of return is directed exclusively to the earnings of persons who work, but is too narrow to reflect the full effects of education. Among the benefits of additional education are the personal contacts made; the families whose children reach any given educational level are, on average, more affluent than those of children who only reach lower levels. Some of the benefits of contacts made are reflected in a person's subsequent earnings and would thus be captured in a typical calculation of private returns. But another benefit involves the greater likelihood of marriage into a well-to-do family; this factor is especially important for women who marry, for their subsequent consumption levels are likely to be determined mainly by their husband's income. Most of the discussion that follows will not examine this factor, however, because of the lack of quantitative information. Instead, it will focus on direct educational benefits in the form of the increase in a recipient's own income. We turn first to income differentials, then to participation and unemployment rates by level of education, and finally to rates of return to resources invested in education.

1/ As detailed below, especially in Section II B, more information could change this conclusion.

2. Education as a Determinant of Income Variance

The power of education (or of education and experience) as a factor in explaining the variance of labor incomes among individuals in developing countries has been widely noted. 1/ This simple human capital model tends to explain a higher share of income variance in the urban areas of developing countries than in developed countries. (In developed countries the whole labor force is usually included, but the great majority of it is urban. One reason for this -- perhaps the dominant one -- is the greater variance of education levels in the developing countries. Mazumdar's comparison across Malaysia, Britain and the United States (see Table 4) reveals that the inequality in the distribution of annual earnings, as measured by its log variance, is substantially higher in Malaysia than in the United States, and much more so than in the Britain -- but so is the variance in schooling. One would therefore expect the simple human capital model to be of considerably greater significance in the explanation of earnings in Malaysia (Mazumdar 1979a).

In fact, in almost all analyses of income variance across individuals in the urban areas of developing countries, education and age (or experience) are the best predictors. Typcally, they can together explain 30-50 percent of the variance, and other variables add relatively little explanatory power when included in the analysis. 2/ Earnings differentials by levels of education are both large and systematic relative to differentials by other variables (such as sectors of the economy) and underlie a substantial portion of the overall income inequality observed in most developing countries.

3. Evidence on Earnings Differentials by Level of Education

In the urban areas of developing countries, persons with completed primary education typically earn 60-100 percent more than persons with no education. This corresponds to an average increase in earnings of about 8-12 percent with each year of primary schooling (although in a number of countries the last year makes more difference than the previous ones). For graduates of secondary and higher education, the typical income advantage over the next lower level is probably a little greater on a yearly basis. Earnings differentials by (completed) level of education tend to be greater in the developing countries than in the developed ones at all educational levels. (An early compilation is that of Psacharopoulos 1973, presented here as countries (Mexico and India are

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1/ When the data permit, most authors use labor incomes, excluding income from capital, on the grounds that the benefits from education should show up in the former. But sometimes it is impossible to exclude capital income; often the self-employed are included in such analyses, and the capital component of their incomes thus enters.

2/ The reverse is not true, that is, education and age usually add considerable explanatory power when included in a set of other variables and also reduce the explanatory role of other variables.

Table 4

COMPARATIVE PERFORMANCE OF THE SIMPLE CAPITAL MODEL
IN MALAYSIA, UNITED KINGDOM, AND THE UNITED STATES, EARLY 1970s

Item	Malaysia (1970)	United Kingdom (1972)	United States (1960)
Variance			
Log of annual earnings	0.755	0.436	0.668
Years of schooling	19.437	4.805	12.250
Years of experience	197.0	207.0	
$\bar{R}^2$	0.492	0.316	0.285
Coefficient			
Years of schooling	0.140	0.097	0.107
Years of experience	0.098	0.091	0.081

Source: Mazumdar (1979a). The original sources he used are as follows: Malaysia, Anand, (n.d.; p. 252); Britain, Psacharapoulos and Layard (1978); United States, Mincer (1976).

Table 5). 1/ Medium- and low-income countries appear, on the average, to have similar earnings ratios for the primary/no schooling levels; for secondary/primary levels and higher/secondary levels, however, the earnings ratios are much greater in the low-income countries. Although the data in Table 5 must be viewed as more illustrative than precise, it is clear that the higher/primary earnings ratios are markedly higher in low-income than in high-income countries -- an average of 2.4 in high-income countries to 3.4 for low-income countries. There appears to be a general tendency in low- and middle-income

1/ The table does not specify completed levels, but this emerges from the Psacharopoulos' discussion on p. 130.

Table 5

RATIOS OF AVERAGE ANNUAL EARNINGS OF LABOR
BY (COMPLETED) EDUCATION LEVEL, LATE 1970s

Country	Ratio: Primary over none	Secondary over primary	Higher over secondary	Higher over primary	Higher over none
High-income					
United States	..	1.48	1.65	2.44	..
Canada	..	1.44	1.83	2.63	..
Great Britain	..	1.45	1.61	2.33	..
Netherlands	..	1.29	1.74	2.24	..
France	..	1.50	1.73	2.59	..
Norway	..	1.40	1.50	2.13	..
Average	..	1.43	1.68	2.39	..
Middle-income					
Greece	..	1.39	1.58	2.20	..
Israel	1.60	1.36	1.51	2.05	3.28
Mexico	3.32	1.40	2.25	3.15	10.46
Chile	1.67	2.22	2.00	4.88	8.15
Colombia	3.00	3.00	1.50	4.50	13.50
Average	2.40	1.87	1.81	3.36	8.85
Low-income					
Malaysia	3.81	4.28	1.80	7.73	29.49
Philippines	2.08	1.60	1.41	2.24	4.55
Ghana	2.28	1.87	4.87	9.11	20.77
South Korea	..	2.14	1.20	2.57	..
Kenya	1.63	2.33	2.35	5.47	8.92
Uganda	2.40	3.27	3.69	12.07	28.97
Nigeria	2.38	2.20	4.36	9.55	22.63
India	2.45	1.42	1.67	2.37	5.81
Average	2.42	2.39	2.67	6.39	17.31

... Not available.

Source: Psacharopoulos 1973.

Note: The figures appear to be based exclusively on earnings for completed levels of education. For standardization, primary schooling is defined as eight years in most cases (that is, incomes refer to persons with eight years of schooling), even in some cases in which this was not in fact the case.

exceptions in the table) for the eight years of secondary and higher education to increase earnings in relation to the primary level more than the eight years of primary education increase earnings in relation to no education at all. On the basis of this evidence, Psacharopoulos (p. 134) concluded that

> ... the low-income countries cannot expect the primary/no schooling ratios to narrow until higher levels of development are reached. On the other hand the evidence indicates that the higher/secondary ratio and the secondary/primary ratio should narrow rapidly, the average ratio at this level for the middle-income countries being much below that for the low-income countries.

But the level of development is by no means the only or major determinant of these ratios, if the figures of Table 5 are at all close to the mark. The relatively small differentials for India and the Philippines would seem consistent with their high educational levels relative to average income. 1/ Drawing any further conclusions from the data in Table 5 would be inappropriate, since there are considerable inconsistencies among sources and a variety of problems with the data that reflect the early stages of the analysis of earnings differentials to which these data largely correspond. 2/

4. Age-Earnings Profiles

The aggregate ratios just cited -- of average income among persons grouped by educational level -- can be misleading because they ignore differences in the age composition of workers at different educational levels. Because educational opportunities have increased rapidly, persons with more education are on average younger than those with less. Age-earnings profiles are a useful device to isolate education-income relationships more effectively. In developed countries, the age (or experience) profiles tend to be roughly parallel with earnings measured logarithmically; that is, the percentage

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1/ A more recent and detailed study for the Philippines is reported in ILO (1974, pp. 313-18). Although the calculated rates of return differ substantially from those of the study whose data are reported in Table 5, the earnings differentials are of the same order of magnitude.

2/ To exemplify how different two results for the same country can be, we may contrast the studies of Malaysia by Hoerr (cited by Psacharopoulos (1973) and reported in Table 5 as "Malaysia" (1979) and Mazumdar. Although the data are not directly comparable, it is clear from Mazumdar's age-income profiles that the 16-fold differential between secondary and no education (implied in Hoerr's figures) could not even be approached (Mazumdar, p. 5.27). The samples come from different regions, but even this can hardly be expected to account for such different results.

differences in earnings for different levels of schooling are roughly constant over the entire working years. 1/ This appears not to be the case in developing countries; no systematic age-earnings pattern emerges between primary and no schooling; but between primary and higher levels the age-earnings profiles show a pattern that diverges with age. In Malaysia (for which profiles have been derived by Mazumdar from the earnings function of the World Bank's survey of 1974), the profiles for persons with no formal schooling and for persons with primary schooling are more or less parallel, but there is a perceptible narrowing of the gap in earnings with increasing age. For other levels of education, the profiles diverge with age, at least up to the age corresponding to peak earnings (see Figure 2). 2/ The profiles for Colombian urban areas as of 1973 (Figure 3) show a general tendency to diverge up through the middle-age categoies. This apparently rather general pattern in developing countries poses a problem of interpretation. If we believe that the earnings of today's young people will in the future show the same pattern of income differentials by level of education as that of today's older groups, then we might conclude that as a cohortages the labor market generates widening earnings gaps by educational level. But the cross-section need not reflect lifetime profiles. An alternative interpretation would be that the returns to postprimary education have fallen in recent years. 3/

5. Evidence on the Relations among Education, Participation Rates, and Unemployment Rates

Earnings differentials of the type just discussed refer to those subsets of all persons at a given educational level who are working and earning an income. The payoff to education depends also, clearly, on how much time people spend involuntarily inactive or unemployed. Benefits from more education are sometimes measured simply as the associated increase in income, whether this is because of a higher income per unit of time worked or a higher share of time worked. As noted earlier, this approach needs modification if the direct utility or disutility of work is altered by the chance in the kind of work that results from having a higher level of education. Modification is also needed if the amount of work changes and the individual is not indifferent between work and leisure at the margin. For many females the reservation wage below which they will not work is high enough to keep them out of the labor force,

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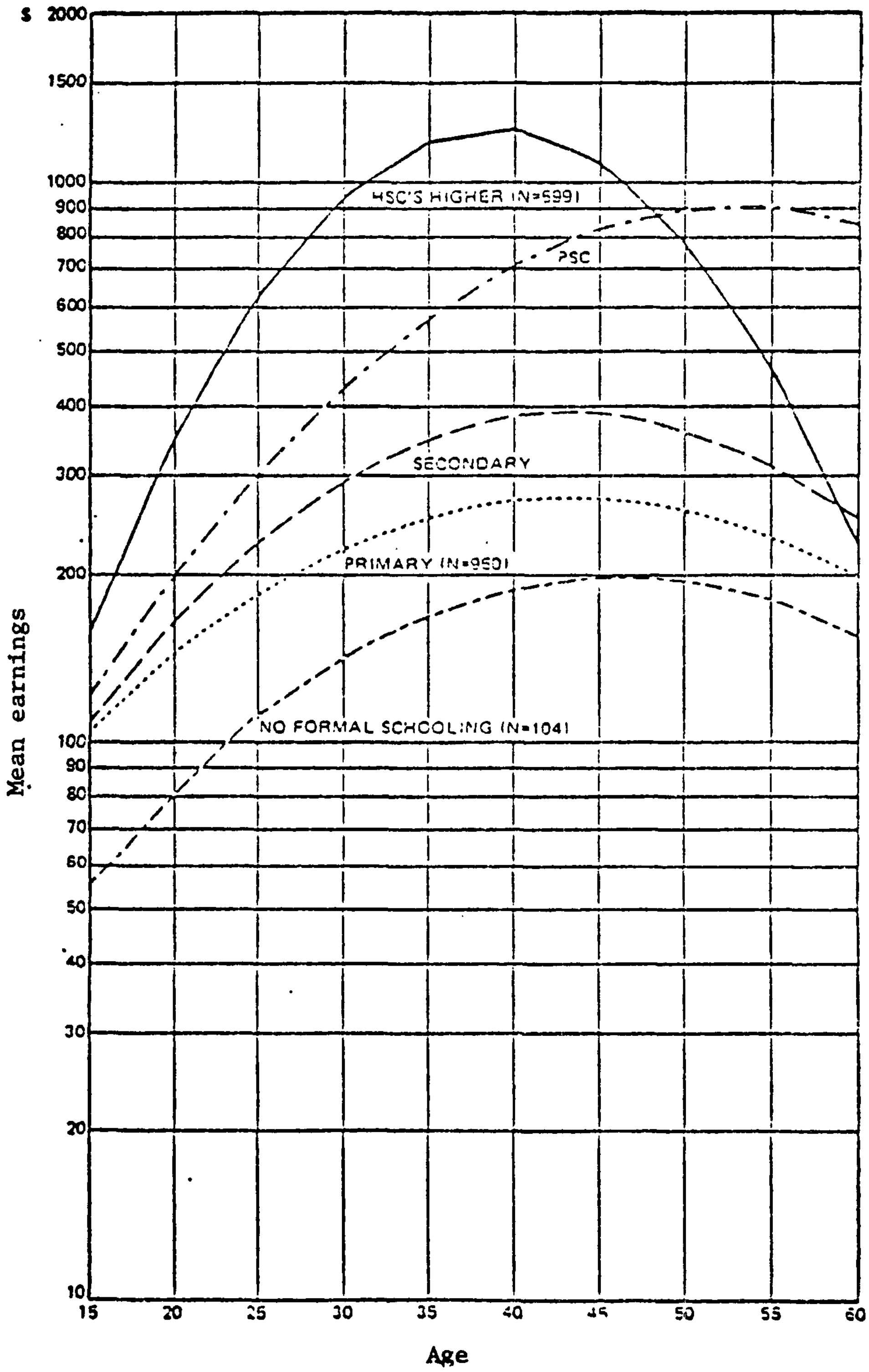
1/ Compare Psacharapoulos and Layard (1978).

2/ Mazumdar (1979a). Since the profiles are derived from the earnings section of the Bank survey, they are smoother than had average incomes been simply plotted for each age-education group, but they are not directly comparable with the profiles shown for Bogota (see Figure 3).

3/ Mazumdar makes this point for Malaysia (1979a), p. 5.26-28).

Figure 2

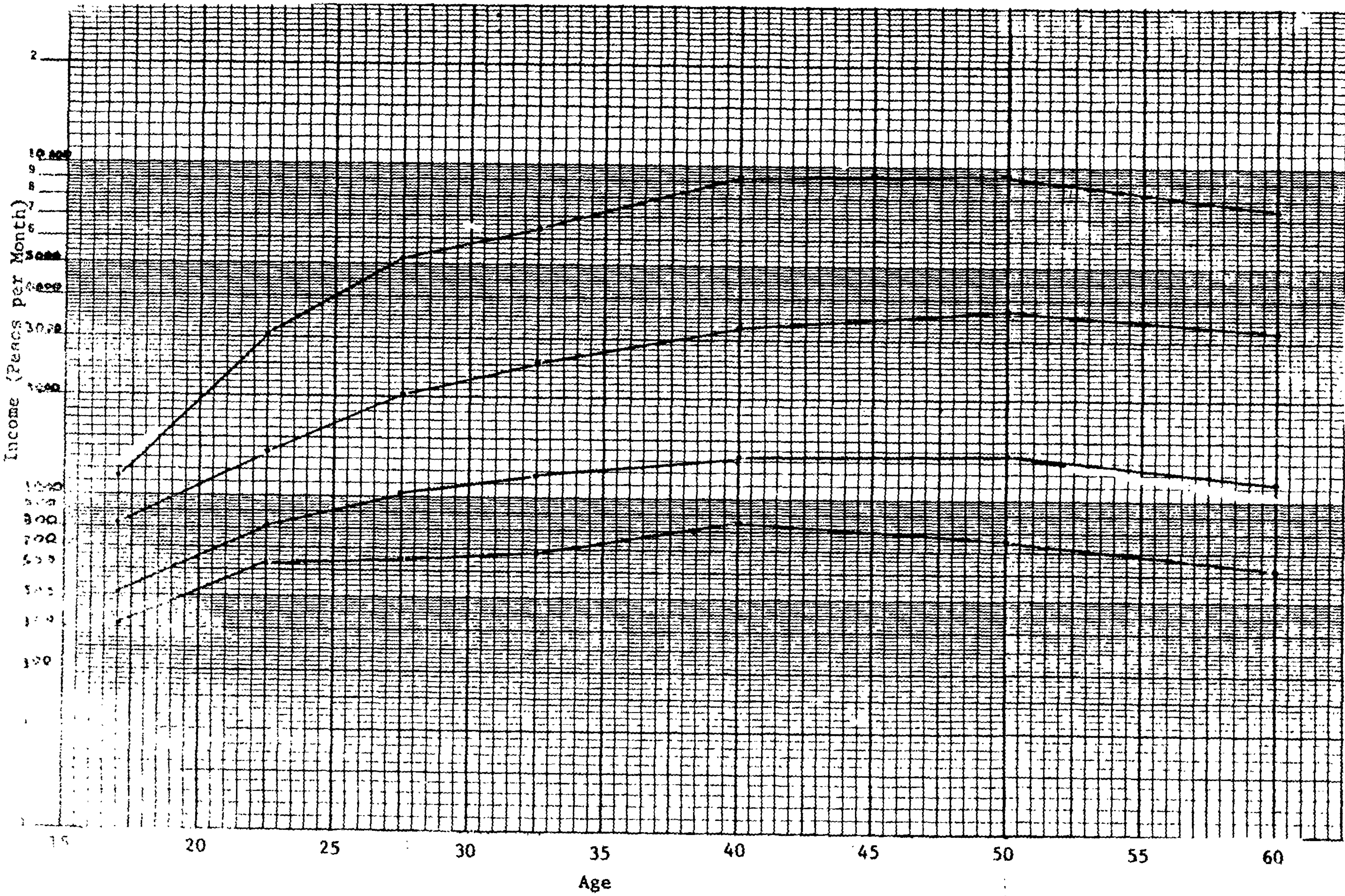
MEAN EARNINGS FOR MALES BY AGE AND EDUCATION LEVEL, SELECTED CITIES OF MALAYSIA, 1974



Source: Mazumdar, "Urban Labor Market," p. 5.27

Figure 3

COLOMBIAN AGE-EARNINGS PROFILES -- URBAN MALE EMPLOYEES, 1973



a reflection of their own or their families' preferences that they not work. 1/ When a person with a high reservation price does enter the labor force, the resulting net gain, both to the individual and to the society, may be only a fraction of income earned. In general, one might expect income changes related to changes in participation rates to imply smaller welfare gains per unit of income than those from changes in wages. Fortunately, the resulting ambiguity (there is no information available on reservation wages) is usually not great for males, whose participation rates are high and whose unemployment rates are usually lower than those of women. For women the implications of changes in participation rates are complicated, as we shall see below.

Education and Participation. Education, at least beyond the primary level, has the immediate effect of lowering participation rates of both males and females in the school-age ranges. Beyond school age, the norm appears to be a slightly positive relation between educational level and male participation rates, though evidence is scanty. Education may have more important effects on female participation rates, which are quite variable across countries and groups. Assessment of these effects involves difficult, general equilibrium questions. It is also important to consider the impact of changes in participation rates not only on incomes but also on factors such as fertility, training of children, and the like. One would hope that the expansion of education for women would increase their access to good jobs and thereby contribute to an increase in the female participation rate. It might also raise marriage age by giving women greater independence, actual and potential, from men. Within the family, too, it could improve the position of women. In the majority of the analyses reviewed by Standing (1978), the relationship between education and female participation was positive -- or largely so, when it differed by age group or some other control variable. It seems likely that, if and when a comprehensive theory is developed, the normal effect of education (other variables held constant) will be positive. The range of results observed is striking, however: the relation between female participation and level of education is clearly affected by age, religion, customs, and other factors.

Fairly frequently in studies of female education and participation, a U-shaped relation emerges with higher participation by those with very little or a lot of education than by those with an intermediate level. But in Lima, where this relation shows up in the aggregate data, it is less clear (if present at all) within age categories. For the younger cohorts, the participation of women with any education was dramatically higher than that of the cohort of women aged 50-64, but for women with no education this was not the case (Standing 1978, p. 148). Often thresholds seem to be marked. Thus, in Khartoum in 1974 less than 10 percent of the women aged 20-44 who had not completed primary schooling were in the labor force, in contrast with over 20 percent for more educated groups (Standing 1978, p. 151). In Chile in 1972 there was a positive association between participation and education for most young cohorts, but not for those over age 35.

1/ A major reason for women's preference against participation is their desire to give adequate care to their children.

Available cross-sectional data therefore provide some support for the expectation that education raises female participation, and the raising trends in female participation rates in the urban areas of many developing countries are at least consistent with the proposition. Standing notes (1978, p. 141) that a positive correlation has usually been postulated, but that the theoretical basis for this assumption has remained unclear because little attempt has been made to draw the economic and sociological research together into a coherent body of theory:

> It is possible to discern at least three separate, albeit related, hypotheses underlying this assumed relationship. First, there is the opportunity cost argument of neo-classical economics; second, the association may merely reflect the effect of education on relative employment opportunities; and third, the association could be due to the effect of education on income aspirations. None of these hypotheses is entirely convincing and none justifies the confident prediction that for women education and the likelihood of labour force participation will be positively correlated.

In any case, the welfare interpretation of such a relation, if it did exist, would differ depending on which of the mechanisms was at work. Increases in participation from either of the first two effects would be expected to produce genuine benefits. Education may, however, also make young people unwilling to participate in the informal sector of the economy, as Standing further notes (1978, pp. 145-46):

> Typically, participation in the informal sector implies low-status activity, which may be considered degrading by persons with secondary or higher education. It is one of the great dilemmas of modern capitalist development that, whereas education seems necessary to secure a stable and committed labor force, it also tends to produce unwilling or ineffectual workers for the informal sector, where most of the non-agricultural income-earning opportunities are to be found.
>
> Thus increased female education may reduce female labour force participation by making women reluctant to work in the informal sector. And since the latter has traditionally provided employment for large numbers of women the effect could be considerable. Moreover, to the extent that the spread of education reduces the number of men and women prepared or even able to work in informal activities, it could be seen as undermining the sector's viability and tending to increase the number of unemployed seeking wage employment. That in itself is likely to discourage active participation in the labour force by some of the disappointed jobseekers.

Evidence presented in Section C seems inconsistent with the proposition that educated persons working the informal sector are notably "ineffectual." None of our data bears on the question of whether unwillingness to work in the informal sector may lower overall participation rates, though this is consistent with much of what is known about workers' preferences and behavioral patterns.

Part of the complexity of the pattern of empirical evidence on the relationship between education and participation may be attributable to the level and structure of aggregate demand for labor (Standing 1978, pp. 146-47).

> The association may be positive at both high and low levels of demand but negative at some intermediate level. In conditions of low aggregate demand for labour and high levels of unemployment, employers are most likely to indulge in rigid screening practices, largely restricting selection to the more educated jobseekers. In a relatively tight labour market, educated women are more likely to secure jobs for which their education and training have prepared them, and the persistence of a tight labour market will tend to weaken the barriers preventing them from acquiring such jobs, thus ensuring a positive association between education and female labour force participation. Yet at some intermediate level of demand such barriers may be considerable, and in these circumstances the job and income opportunities available to educated women may fall short of their reservation or aspiration levels, thereby neutralising any positive association. This points to the need for detailed multivariate analysis, a need which many empirical studies have neglected.

Education and Unemployment. High unemployment rates among school leavers, especially secondary school leavers have been commented upon in many countries. Apart from its other negative implications, this problem may substantially lower the rate of return to investment in education. If unemployment in most developing countries had shown a secular rise, and if there were good grounds to believe that increasing education had contributed to that rise, the implications for educational policy would be of paramount importance. No such trend in unemployment rates appears to be present, however. Further, much of the U-shaped relation between the unemployment rate and education observed in many countries -- that is, lower unemployment rates among persons with no education, with primary schooling, or with university training than among persons with secondary -- appears to be because of the different age composition of these groups. Thus, in urban Colombia (as of June 1978) -- although the unemployment rate for persons with secondary education was 9.5 percent and that for persons with primary or no education was 6.9 percent and 4.5 percent, respectively -- the average unemployment rate a person would suffer over a normal working career 1/ was virtually the same for secondary graduates

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1/ Defined in these calculations as the average of the rates suffered by each of the age groups making up the normal working years -- from labor force entry to age 65.

(6.2 percent) as for primary graduates (6.0 percent). The unemployment rate for persons with higher education falls even more than that for those with secondary schooling when one switches to this "career span" concept -- from 7.5 percent to 2.9 percent. 1/ In short, unemployment may well be less of a problem for persons with secondary and higher education than for those with less: those having had secondary education -- and higher -- experience quite high rates early in their careers, but relatively little unemployment later. When the fact that the "U" relationship is by no means universal across countries 2/ (see Table 6) is added to this consideration, it appears that no general case can be made, on the basis of current understanding, against further education on the grounds that it generates unaceptable levels of unemployment.

A few glaring exceptions, Malaysia and Sri Lanka among them, 3/ may represent a state toward which many other countries are moving, albeit with the movement somewhat disguised. For Malaysia, Mazumdar has noted that the high unemployment young persons who have completed (or nearly completed) secondary education exceeds that among primary school leavers, but is not as high as the rate of 50 percent or more among persons having reached the middle years of secondary. The high overall rate among Malaysian youth is explained by the remarkably high rates among secondary school leavers, which persist even for the age group 20-24 (Mazumdar 1979). And it seems clear that the very high aspirations of secondary school leavers, coupled with the relatively small size of the informal sector, is a major factor in this high unemployment.

That aspirations are a factor in urban Malaysia is suggested by the fact that the unemployed are predominantly seeking first jobs; in 1967-68, 60 percent of male, and 72 percent of female, unemployed fell in this category (Mazumdar 1979). 5/ The typical long period of unemployment is striking for

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1/ It could be argued that the rates for persons in middle and later career with secondary and higher education will rise under the influence of the increasing supply portended by large numbers of youth now in those categories. But there is as yet no evidence of such an effect.

2/ Even in countries where the "U" relation sometimes appears, in other surveys it does not. It remains to be seen how robust any given pattern is over time in specific countries.

3/ For data on the latter country for 1967-70, see ILO (1971, p. 28).

Table 6:

UNEMPLOYMENT RATES BY LEVEL OF EDUCATION

(in percentages)

Country	Education level None	Primary	Secondary	Higher
Argentina	3.8	4.3	5.7	3.3
Ceylon	7.1	n.a.	11.8	2.3
Chile	12.1	4.6	1.3	0
Colombia	11.5	15.3	14.9	¿3.2
Dominican Republic	22.4	17.9	9.2	n.a.
India	1.2	2.7	7.0	2.8
Iran	10.0	8.1	13.0	2.6
Kenya	21.0	21.9	13.0	17.0
Kenya	21.0	19.0	17.0	12.0
Malaysia	10.4	19.5	30.9	¿5.5
Nicaragua	23.8	14.0	12.2	n.a.
Sudan	2.0	2.5	5.5	5.0
Syria	4.3	n.a.	11.5	4.4
Venezuela	4.3	7.0	10.2	2.3

n.a. Not available.

Note: Comparability between countries and educational levels is limited because of different definitions and sample populations.

Source: Psacharopoulos (n.d., Table 15).

this group. 1/ Seeking more direct evidence on the effect of aspirations, Mazumdar regressed the employment rate (the percentage of an age group that is employed) on ten predictors, finding that an earnings variable -- reflecting the gap between earnings of the employed and expected earnings of the unemployed -- was by far the most important (Mazumdar 1979a). Mazumdar's figures on expected earnings show that many school leavers have very high expectations. Malaysian secondary school graduates had previously commanded a high premium over those less educated. But by the time of the survey, their expectations appeared to be unrealistic: when asked how much they expected to earn after leaving school, school leavers' average reported expectations substantially exceeded the earnings of the group in the sample who were, in fact, employed. For persons at the different educational levels the differences between expected and average earnings, as a percentage of average earnings, were as follows (Mazumdar 1979a):

	Malaysian school leavers			
	Males		Females	
Educational level	Malays	Chinese	Malays	Chinese
Lower certificate	49.8	97.1	132.2	82.1
Middle certificate	67.6	96.6	82.4	81.9
Middle vocational certificate	61.7	77.5	61.6	57.1

1/ Leavers with the lower secondary certificate wait longer for employment than those with the middle certificate, as Mazumdar (1979a) found:

> It is as if the extra time available to this group because of leaving school earlier merely meant that they spent that much longer waiting for a job. This rather surprising result suggests a hypothesis about the way the labor market might work in Malaysia. It appears as though there might be a minimum age at which school leavers might get accepted for employment in most sectors of the Malaysian economy. Such a minimum age must be set by conventions and unknown social factors, since no institutional reasons for it could be identified. With such an age bias on the part of employers, an earlier age of leaving school will not be reflected in a higher probability of employment, but will only add to the time spent looking for work."

The typical school leaver was anxious to get both a high salary and a white-collar job, preferably with the government, and was unfavorably disclosed to the typical sales/services job in the "informal" sector, a fact that may have both reflected and contributed to the relatively small size of this sector in urban Malaysia. 1/

Mazumdar's analysis illustrates clearly what can happen given the combination of rapidly expanding secondary education, 2/ high aspirations, family income levels adequate to allow job seekers to "hold out" for extended periods of time, and pay scales in an important sector of the economy (here the public sector) that are little influenced by the market. This is a case where the rates of return to secondary education would be significantly affected by unemployment levels, possibly arguing against continued rapid expansion. As is evident from Table 6, Malaysia is a typical in its extent of unemployment among middle educational groups. Nonetheless, Malaysia's experience may have important implications for other countries in the future. One issue is the welfare cost of unemployment among the educated. Another is the political dynamics of such an apparently large disequilibrium: how quickly do pressures come to bear on wages in protected sectors? Is the Malaysian case unique because of the powerful political motive for maintaining high public sector wages -- the advance of the politically dominant but economically disadvantaged Malays vis-a-vis the Chinese? There is evidence (still limited for lack of studies) that income differentials between educational levels can decline over time without creating unusually high levels of unemployment. 3/ Much attention must be given to understanding both the economics and the political dynamics of labor markets in order to assess the likelihood of serious disequilibria and the key factors that help to create them. As yet there is no reason to believe that educational expansion will lead to such important increases in unemployment as to constitute a strong argument against such expansion, but neither can the possibility be ignored.

1/ Mazumdar 1979a:

> An economy in which 40 percent of employment is in the public sector cannot obviously pride itself on the extent of its non-formal sector. A further problem might be the dominance of the informal sector -- particularly in sales -- by the Chinese. Given the racial segregation of employees in the private sector to which we have drawn attention, the opportunity for employment of Malay youths in this sector is probably limited.

2/ The low private costs of Malaysia's secondary education have speeded its expansion; a very high proportion of secondary students are in public schools (see below).

3/ The marked decline in the relative earnings of university graduates in Colombia in the 1970s is an example. See Bourguignon (1979a).

6. Evidence on Rates of Return to Schooling

In principle, calculations of the rate of return to investments in education take account of all the factors discussed above (income, participation rate, and unemployment rate differentials by level of education) as well as cost data. They entail arbitrary assumptions (some of which will be discussed later) and are inevitably of varying quality and not fully comparable with each other. Nevertheless, such calculations are an important input to the discussion of education as an investment.

In his review of rate of return studies as of the early 1970s, Psacharaopoulos found that the social rate of return for all levels of education taken together tended to be high in developing countries (defined as those with per capita income below US$1,000), at an average of around 15 percent. 1/ Social rates of return were greater for primary than for secondary, and for secondary than for higher education (Table 7), whereas private rates -- all over 20 percent -- seemed about the same. But there were many methodological problems with most studies, leaving some doubts as to how general these patterns really were. 2/

Among the major difficulties in most studies of rates of return is the problem of sorting out the effects of education on personal income from those of ability, motivation, family background, and other contacts. The frequent assumption that about two-thirds of the increase in earnings associated with education (after allowing for age) is because of the education may turn out to be a good one, but little evidence is yet available to support it. The possibility cannot be dismissed that the better it is possible to

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1/ Psacharopoulos (1973, p. 93). This figure excludes the rates quoted in two of the less credible studies he reviewed -- those for Venezuela and for Uganda.

2/ The results summarized in Table 7 from Psacharopoulos (1973) may give a more accurate impression of the relative returns to different levels of education than of the absolute rates. The studies which he reviewed naturally varied widely in methodology and probably in quality as well. The figures in the table are rough also in that the same group of countries could not always be used in effecting comparisons across educational levels. As a best guess it seems unlikely that standardization of methodology would erase the differences which appear in the table.

Table 7:

AVERAGE RATES OF RETURN
BY EDUCATIONAL LEVEL AND PER CAPITA INCOME

Per capita income level (US$)	Rate of return by educational level					
	Social			Private		
	Primary	Secondary	Higher	Primary	Secondary	Higher
Under 100	28.7 (5)	19.4 (4)	12.6 (4)	29.1 (3)	21.1 (3)	25.2 (3)
101-200	15.6 (5)	14.6 (5)	11.6 (5)	24.8 (4)	20.2 (4)	25.4 (4)
201-350	24.6 (4)	17.5 (4)	13.5 (4)	32.0 (1)	27.5 (2)	22.2 (2)
351-650	38.5 (3)	10.7 (5)	12.0 (5)	27.0 (1)	11.9 (5)	17.2 (5)
651-1,600	..	6.8 (3)	9.0 (5)	..	10.3 (3)	12.3 (6)
1,601-2,200	21.0 (2)	11.1 (5)	9.8 85)	155.1 (1)	13.0 (4)	11.5 (5)
Up to 350	22.9	17.0	12.5	27.3	22.1	24.6

.. Not available.

Note: Numbers in parentheses refer to the number of observations.

Source: Psacharopoulos (1973, p. 91). Figures for countries with per capita income levels "up to 350" were calculated by me.

measure such characteristics as drive and ability, the more these will cut into education's explanatory power. 1/

The wide differences income among people at a given level of education (even for one sex and a given age) create a second concern; whether it is appropriate to use the average incomes of given age-education cells in calculations of rate of return. Possibly a significant part of the variance in income reflects ability differences, in which case it would raise no new difficulty. But it may also reflect a spectrum of opportunities across segmented markets, so that additions to the supply of jobs at a given point of time need not be distributed in the same way as the existing labor force; the majority of such additions might be of lower productivity and income. It would not be hard to believe that situations of this sort would imply true marginal rates of return of say one-fifth less than calculated ones (for example, 8 percent instead of 10 percent), at least in some countries. 2/

1/ Taubman's study (1976) of twins in the United States perhaps comes as close as any to making an effective distinction between ability and environmental factors. It led him to the conclusion that each additional year of schooling added no more than 6 percent and probably as little as 4 percent to annual earnings for men 46-56 years of age (the range of men in the sample). Such results cannot, of course, be generalized beyond the United States, but they create some presumption that returns to education may be systematically overstated in developing countries through failure adequately to isolate the effects of personal characteristics. Most analyses that somehow take account of family background (for example, father's income or education) find that it has relatively little influence. But this could result from a negative correlation, among students at a given educational level, between family background and ability. Such a correlation would imply that the effect of family background was typically understated; if to it were added the effects of ability, the two together might considerably reduce the estimated returns to education.

2/ A few figures help to exemplify. In Brazil among male 20-24 year olds with either 5 or 10 years of education, the average income reported in the 1960 population census by the 20 percent with lowest income was about 40 percent of the overall average. Part of the income variance is no doubt because of regional factors, ability, and so forth, but one cannot rule out the possibility that a significant share is a result of segmentation of the labor market. It is not infrequent for estimates of modern sector/traditional sector income differentials (age and education held constant) to fall in the range of 20-40 percent; so if the marginal persons at a given educational level all went to the traditional sectors, their incomes could be 20 percent below the average. This would happen, for example, if the differential were 40 percent and the employment shares 50:50 between the two sectors for the level of education.

If the marginal students (that is, the ones who would not study if total enrollment were lower) are of below average quality, as they are in many countries, the difference between their marginal productivity and the average productivity could be larger still. Finally, if the marginal average ratio varies markedly between two levels of education, the biasing effects of using average income figures could be substantially magnified.

Inadequate income data are a third problem, though probably less serious than the two just cited. If the underreporting of income in surveys were proportional across income and education categories, it would lower the estimated rate of return to education at all levels by the same proportion. However, it seems likely that the proportion by which income is underreported varies according to the category of income being measured. It is estimated that, in most surveys, income from all sources is underreported by 30 percent or more. Labor income may typically be underreported by about 20 percent -- probably a small enough average bias to be disregarded in rate of return calculations, even if persons at different educational levels underreport by somewhat different amounts. Sometimes the income figures include not just earnings from work but from all sources; underreporting may then be 30-40 percent, and biases in the rates of return to education may become significant. 1/ The biases are more likely to be downward than upward unless underreporting is considerably greater among persons at lower educational levels. 2/ This probable downward bias may be partially offset by a tendency to underestimate monetary costs -- that is, capital costs or out-of-pocket costs. The opportunity costs of attending school, usually from the bulk of total costs at the

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1/ Inclusion of capital income in the data from which rate of return estimates are made may be expected to lead to an upward bias in the age coefficient and to have uncertain effects on the education cofficient.

2/ Underreporting is usually assumed to be substantial for persons with high incomes, but it may be large also for low-income people -- for example, the self-employed, for whom the calculation of income is in itself difficult. If one compares persons at one level of education (for example, secondary) whose average reported income is twice that of persons at another level (for example, primary), and if the level of underreeporting is 30 percent at the higher level, underreporting would have to be over 46 percent at the lower level for the calculated rate of return to be an overestimation of the true rate. Such a differential is unlikely, so that underreporting will normally have the effect of biasing rates of return downward.

secondary and higher levels. 1/ For analysis of returns to education by income groups in a population, it is important to recognize that the opportunity costs for people at the same educational level could vary widely across income groups.

Of the four methodological problems cited, the first (separating the effects of education from those of ability, and so forth) is the most worrisome, since available information gives no basis for judging the likely upper limit of the bias it could create. The other problems, individually, are unlikely to reverse major conclusions. But it is clear that, if several of the potential sources of bias worked in the same direction, their total effect could turn a 20 percent rate into a 5 percent rate -- that is, a clearly good investment into a fairly bad one. 2/ Still, there is no strong reason to believe that these problems lead to a systematic overestimation of rates of return. Rather, they create a substantial gray area on each side of the estimates, within which the true values could lie. This error of estimate is probably smaller

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1/ Most studies insert a value equal to the expected income of the individual with the lower educational level he or she would otherwise have had, allowing for participation rates (not always done) and unemployment rates. This procedure is not valid for all families: some clearly would not let their children work were they not, for example, in the first year of secondary school. For such families, this opportunity cost is zero or low. Some proportion of children, especially in early and middle secondary school, should be assigned an opportunity cost below the wage rate corresponding to one less year of school. A related problem involves those students who work while studying. If there is an opportunity cost to their schooling it is only part of a regular wage (many of them probably have part-time jobs), or it takes the former lost leisure. In urban Colombia (June 1978) 9.5 percent of secondary school students were working (11.2 percent were in the labor force -- 1.7 percent being unemployed) and 38 percent of university students were working (45 percent in the labor force). (DANE 1978; pp. 33, 41, 59.) Especially at the university level, a correction of opportunity - cost figures to allow for this phenomenon could affect calculations of returns significantly. If half the students worked half time, their opportunity cost would be reduced by 25 percent in the aggregate, and the rate of return increased by about 15 percent in a country with a reasonably typical cost structure.

2/ One might be inclined to hope that such biases, even if frequent, would not exist everywhere , in which case some consolidation would be had in the fact that, for example, high returns to primary and secondary education might still exist in many countries. But it seems quite likely that the problems cited, if serious in a few countries, are likely to be serious in general. These biases probably flow from those systematic aspects of economic behavior and structure that make different economies so similar in many respects.

for primary than for higher educational levels because here differences in ability are not likely to be so important. 1/

Through all the above, it must be borne in mind that rate-of-return calculations systematically ignore the direct or consumption benefits of education, its effects on pleasure from work, the possible social externalities, and so forth. The policymaker must add his selective judgment of these benefits to the better quantified investment benefits. There is no necessary presumption that the later exceed the former. (Although quantification of the consumption benefits of education would obviously be difficult, there is no reason to believe that some feel for their magnitude could not be obtained. Unfortunately, research attention has not been directed at this issue.)

B. The Credentialist Contention: Earnings Differentials Do Not Reflect Productivity Differentials

In the framework of the human capital model, income is assumed to be a good proxy for productivity; in measuring the benefits of education the ambiguities that arise involve the question of the extent to which income differentials by level of education are really caused by variables such as ability, whose effects are difficult to separate from those of education. Under the credentialist argument, by contrast, high incomes are frequently associated not with high productivity but with superior credentials (for example, educational ones). This school of thought, most broadly defined, would include any model in which productivity is not the sole or nearly sole determinant of income; 2/ such phenomena as racial or sex discrimination would fall within its bounds. As a new interpretation of the high private benefits to education and a critique of the human capital model, the credentialist argument has two main variants, both of which propose that educational credentials help their holders to acquire better jobs even when the education has not made them more productive.

The "screening" variant accepts the assumption normally made in the human capital model -- that employers attempt to maximize profits -- but hypothesizes that educational credentials are viewed by employers as a good enough proxy for future productivity to warrant their use as a rule of thumb, either in the structuring of pay differentials among workers or in the selection of workers for given jobs. Alternative ways of assessing the relative productivity of different workers are viewed as either not much more efficient, or involving considerable extra costs, or both. Given that education presumably does contribute to skills and that the level reached is often correlated with important

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1/ The range of abilities is obviously greater at primary than at university levels, so a well constructed proxy for ability might pick up more income variance among persons with primary than among those with university schooling. However, it is less likely that years of schooling would itself be a proxy for ability at the primary level than at university.

2/ Note, however, that the human capital model should not be defined so narrowly as to require this condition to be met in the short run in cases in which worker-employer relationships are long run in nature.

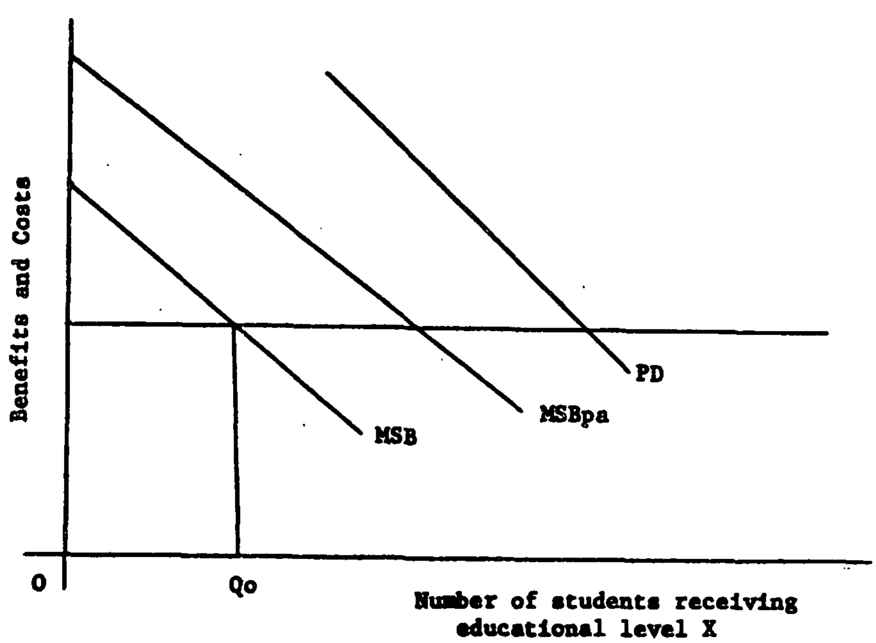
variables contributing to productivity such as ability and motivation, such a rule of thumb will frequently appear sensible. Whether such a behavioral pattern among employers causes large losses in social efficiency is not immediately obvious; the size of such losses would depend on whether the practice leads to too much education or makes the contents of education less useful. As long as the decision to screen by educational achievement is made by profit-maximizing firms in an economy with few other serious market imperfections, it seems unlikely that the loss in social efficiency would be large.

Where the number of persons with a given type of education is such that the social rate of return is low, (as it may be if private costs are well below social costs), screening will increase the demand for such education and increase the economic loss resulting from over investment. Where the opposite (too little education) is true, the practice could be beneficial on that count. The costs of alternative screening systems are also relevant; if they are low and, especially, if education is made more expensive 1/ by the fact that it does fulfill a screening function, there may be considerable inefficiency.

The efficiency of screening may be seen more clearly in a graph. The curve MSBpa indicates the marginal social benefits that an addition to the stock of persons at this educational level would provide if they were perfectly

Figure 4:

EFFICIENCY OF SCREENING AS INDICATOR
OF MARGINAL SOCIAL BENEFITS



1/ Or if its contribution to eventually productive learning is decreased because it fulfills a screening function, as in cases where students learn less (choose easy courses, memorize by rote) in order to achieve high grades.

and costlessly allocated among potential activities. The MSB curve is lower to indicate that on average there is loss vis-a-vis the perfect allocation standard when allocation is carried out by educational credentials. Assuming such allocation, nevertheless, to be the best alternative available, the socially optimal number of students to receive this education is 0Qo. The actual number receiving this level of education depends on a variety of factors, including the level of subsidization of education. The existence of screening is likely to increase that number; under perfect allocation and perfect information on the part of students, the private demand curve would be MSBpa, but with screening it would lie above MSB (definitely) -- by how much depending on how much inefficiency results from screening. If it is very little -- for example, if MSB(pa) and MSB are close together -- the private demand curve for education (assuming full information on the part of students) would also be close to the other two; the nature of the inefficiency attributable to selection by educational credentials -- choosing a <u>more educated person</u> for a job <u>requiring higher skills</u> than the <u>one for which a less educated person</u> is chosen, and winding up with <u>less total output</u> -- is that, if an individual is seriously misplaced, that is, put in a job that is much too hard for him, then both efficiency loss and his benefits from the screening process are large; but if he is slightly misplaced, both efficiency loss and his gain are small.

If the increase in private demand for education resulting from screening raises the demand curve to PD, it could engender a sizeable loss if it pushes the amount of education well above 0Qo. Note that whether PD is above MSB depends partly on whether or not the low-productivity individuals who attain high paying jobs because of their credentials would also be of below average productivity in the jobs they would have got without the education; in that case their benefits from education are greater than the typical productivity increase that the education could provide under perfect allocation of labor.

When screening is imposed on the employers (for example, by unions or government regulations), the presumption of fairly modest efficiency loss disappears, since it is no longer the case that large losses would trigger the search for a better selection procedure.

Screening is most likely to cause losses in social efficiency where labor markets are highly imperfect. In a seriously segmented labor market, for example, education becomes more attractive as a means of increasing one's chances of entering the high wage sector, and the possibility of social loss in the form of unemployment of persons trying to enter that sector also increases.

Where screening leads to a greater amount of education, and that amount exceeds the socially optimal level, there would be merit in public support for alternative selection procedures. But if the availability of education is fixed, there is no efficiency-related reason not to let employers use educational credentials as long as they find them more efficient indicators than alternatives. One could still argue for the encouragement of an alternative system on the grounds of income distribution, since screening according to education is likely to increase income inequality. Even when it has no efficiency cost, screening is also likely to lead to an upward bias in estimates of the social returns to education, by attributing too much of the income gains of educated people to assumed productivity gains from education.

Voluntary screening by profit-maximizing employers in developing countries seems unlikely to lead to serious losses in social efficiency because (a) if it were a very inefficient selection rule, firms would not use it; and (b) labor market imperfections, although serious enough, do not appear to be dramatic in most developing countries. By the same token, it seems unlikely that screening would typically lead to a large upward bias in estimated returns to education.

This cannot be said about the second variant of the credentialist argument, which focuses on the use of credentials to screen candidates for given jobs; or to set pay differences across job categories, by non-profit-maximizing employers 1/ (notably, the public sector). The full credentialist hypothesis involves not only the proposition that, where the skill requirements of a job are not clearly determined by the technology involved, persons with better "credentials" will be favored, but also the proposition that some occupation wage differentials reflect neither relative productivities nor supply-demand relationships. Rather, such factors as social beliefs with respect to the "approprite" relationship between different types of workers for example, workers with different educational levels -- may affect relative earnings, and therefore the calculated rate of return to education. Such beliefs can most easily affect relative earnings in non-competitive sectors but may play a role elsewhere as well. The resulting disequilibrium prices should normally lead to excess demand or supply in a given market even though they may not cuase open unemployment.

1. Qualitative Evidence of Credentialism

Evidence of credentialism (henceforth, we refer mainly to the second variant: that is, not to screening by profit-maximizing emmployers) can come either from information on the behavioral patterns of employers or from evidence of earnings differentials that are not fully explained by differences in productivity. As noted earlier, the defining characteristic of credentialism is simply that productivity is not the sole factor in hiring and wage decisions. One of the difficulties in assessing the credentialist view is that relative earnings, for example, may appear to conform to some concept of what is an appropriate pay structure, rather than to workers relative productivity but may be ultimately determined within fairly narrow bounds by relative productivity.

Concepts of the appropriate structure clearly do play a role in short term wage determination and, in certain contexts, in long-run determination as well. In a review of evidence, Phelps-Brown notes that the grouping of occupations by their average earnings forms much the same structure as the grading of occupations by status. Grading by status seems to be a basic human propensity; people in different times and places have little difficulty in ranking occupations by status or social standing, and the outcome is broadly similar even in very different societies (Phelps-Brown, 1977, p.105). This raises the question

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1/ One could include in this category firms that are prevented for example, by unions or social customs and pressures -- from maximizing fully.

of the nature of the link between pay and status. Any effects of status on incomes could affect relative incomes of persons by educational level through the occupation-education link or because education itself conferred status. In either case, there is little doubt that the upshot would be to strengthen the positive association between income and education.

Where status is simply a function of income institutionalized over time and fostered by the different life styles that accompany different income levels, its role as a determinant of wages at a point of itme is essentially to limit changes in relative incomes. When status is substantially independent of income, its effects could be more varied. It is, nevertheless, hard to distinguish cases in which high status really "leads to" high income through recognition of this being proper or right.

One would expect the role of status or credentials to be greater the less pervasive are market forces. Insulation from market forces is characteristic of situations in which there either is no direct market test of the value of the product (as in the public sector) or in which the market test is of the joint product of a heterogeneous group of people (as with a large private firm). Insulation is not likely when relative productivity is not strongly inconsistent with the existing pay structure, a fact responsible for the apparent tendency of relative wages to become altered under sudden changes in the economy but otherwise to remain rather constant.

Pay structures may be insulated from market pressures in many ways, and internal labor markets then take on added interest. 1/ Individuals or groups can be insulated from the labor market by specialization, costs of moving, loyalty and a host of other factors. Such insulation might even be as prevalent in informal markets as in the large firms with so-called internal labor markets. Domestic service workers are likely to be in a bilateral monopoly relationship with their employers. These workers' knowledge of the job gives an advantage; the costs of moving (especially against the employer's will if he or she must give a reference) constitute a disadvantage. In assessing the relevance of such imperfections for the returns to education, one must consider whether in these markets, too, there are advantages to education that are not related to productivity. The answer is almost certainly yes, but how large they are is uncertain.

Though there appears to have been little research directly on this question, one would expect that the influence of concepts of status and of what is appropriate in the determination of relative incomes would vary with the importance of class and status in a society with the extent of union bargaining over relative as well as absolute wages, with the size of the public sector, and with the economic importance of firms characterized by the

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1/ Such insulation is often in part a result of deliberate firm policy to reduce turnover and loss of key personnel. It is also provided by specialization of workers in the activities of their firm.

difficulty of distinguishing the contribution of different skill levels to the final product. 1/

The earnings of public sector employees are likely to be determined less by economic considerations -- for example, their productivity or the scarcity of acceptable candidates -- than by other factors, such as the prestige it is felt they should be endowed with, their position of political power, and the extent of nepotism. A clear demonstration of the role of tradition is provided by the relative earnings of high-level civil servants in former colonies where original pay scales reflected expatriate levels. To quote Phelps-Brown (1977, p.32):

> We can also see how, once set, they would be perpetuated by custom, even when political power and the channels of recruitment to high office had shifted. Thus ..... the relative pay of the civil servant in India and Pakistan stands out as far higher, in relation to the extent of higher education in the countries concerned, than is found anywhere else, and this can be explained by the civil servant of the 1950s in India and Pakistan having taken over the expatriate level of pay received by his British predecessor.

Many other observed differences in the earnings structures among countries are not obviously the result of Phenomena of demand and supply alone. One of the most interesting is the lower relative pay of white-collar workers in centrally planned countries than in Western economies (Table 8). This is in sharp contrast to the striking similarity of the rest of the two pay structures, including the differential between managers or higher professionals and manual workers and the differentials among skill categoreis of manual workers. In Phelps-Brown's judgment (1977, p. 46), the much lower relative pay assigned to white-collar occupations in the centrally planned economies was not instituted as part of a calculus of incentives but rather in accordance with doctrinal and political considerations:

1/ Whether these would tend to be the largest firms is unclear. It may be that, with large numbers of workers at all levels, such firms are freer to vary the number at each level and in so doing are better able to define the marginal productivity of each type of worker than firms with only one or two workers at the higher levels of the hierarchy.

2/ Phelps-Brown (1977, p. 41). The author also notes that "China probably resembles the USSR in paying the white-collar workers at a low rate, by western standards, in comparison with the skilled manual" (p.52).

Table 8:

EARNINGS OF NONMANUAL RELATIVE TO MANUAL WORKERS
IN CENTRALLY PLANNED ECONOMIES AND GREAT BRITAIN, 1964 AND 1970

NonManual Workers	Centrally Planned Economies				Soviet Union	Great Britain
	Czechoslovakia a/		Poland b/	Hungary c/		
	(1964)	(1970)	(1964)	(1970)	(1964)	(1970)
Managerial, engineering and technical	130	133	165	151	144	131
Administrative and clerical	84	84	105	97	84	106

a/ All industry.
b/ Socialist industry.
c/ State and cooperative industry.

Note: Average monthly earnings of two cleases of non-manual workers as percentage of those of manual workers in four centrally planned economies in 1964 or 1970; relative median weekly earnings of similar classes in Great Britain, 1970.

Source: Phelps-Brown (1977, p. 42) (Original sources are cited therein.)

> Can it be, then, that these influences prevailed to the neglect of incentives, and allowed differentials to come about that were incorrect by the planners' own usual standards? Or did these historically operative factors only serve to put the relative pay of the white-collared in its right place in contemporary economies? May it not be the place of white-collar pay in the Western structure that is anomalous, a relic of former days when the prerequisite level of education was so much rarer than it is now and have not the Soviet-type economies shown that in contemporary societies the supply of qualified white-collar workers and the willingness with which they apply themselves when in post, can alike be maintained by relative pay much lower than is usual in the West?

The way in which the relative earnings of groups of employees in the public sector are set suggests a strong credentialist element. The Malaysian case is described by Mazumdar (1975, pp. 28-29):

> In all these discussions of salary scales and recommendations made by the various commissions, the principle of relating the salary scale to the formal educational qualification was clearly established. Even the recent Cabinet Committee which rejected the recommendation of the so-called Ibrahim Commission on the grounds that "its wage structure is solely determined on the principle of qualification and training," went on to say that "qualificaitons can be accepted as a means of determining the various salaries and for the sake of convenience in classifying the various schemes of service and categories of employees to a particular scheme of service."

In this practice, of course, Malaysia is no different from any other country. The public sector, in attempting to provide uniform guidelines for wages in its different activities, has to use formal schooling as the major criterion for establishing scales of pay. It is, of course, possible for individuals to be paid differently on the established scales, but such flexibility is also sometimes undermined by generally accepted seniority rules. In Malaysia there is also some evidence that the recommended scales of pay in public services have been used to establish minimum wages above the levels prevailing in the private sector. In most recent recommendations by the Cabinet Committee, one of the objectives was to "reduce the differential between lower and higher categories of employees."

Such examples of wages that bear no direct relation to productivity are not hard to find. As distinct from the case of some weaknesses from which calculations or private rates of return may suffer, no conceptual arguments or empirical evidence put a ceiling on the potential bias which rate of return estimates by the human capital model might suffer because of credentialism. Although the arguments for expanded education, especially primary, based on efficiency are in many countries left reasonably intact after consideration of the other weaknesses of human capital estimates, serious credentialist arguments -- the differing strands must be borne in mind -- could be mounted against increasing the years of schooling or the quality of schooling (as measured by normal indicators of educational achievement).

2. Testing for the Significance of Credentialism

The magnitude of pay differentials through the job hierarchy from professionals, executives, high civil servants, and so on, through other white-collar workers to blue-collar workers is one issue the credentialist argument addresses. The other major issue is the extent to which, within these job categories, earnings differ by sector, type of worker, or other categories not related to productivity.

Individual examples of credentialism abound, and it is clear that it characterizes the public sector of any country to some degree. It is hard, however, to estimate the general prevalence of credentialism, its efficiency costs, or the extent to which it leads to upward biases in estimates of the rate of return to education -- the issue of greatest interest here To judge whether centrally planned or market economies give a more appropriate relative wage to white-collar workers would, for example, be quite difficult. To test for the presence of a generalized role of status in relative wage determination in an economy would similarly be complicated; a close look at employer behavior might help, but, if the evidence of possible disequilibria (such as an excess supply of workers in some better-paid jobs) is hard to establish 1/ the task becomes quite subtle. Where credentialism is hypothesized to characterize one branch of an economy but not the rest of it, there is a possibility of learning by comparison. It may also be possible to test whether income differences across individuals with similar jobs are related to productivity differences but not to determine whether such a relation exists among people with quite different jobs. These other tests of possible interest are reviewed below. There are many avenues whereby credentialist elements could make themsleves felt in an economy, and a correspondingly large number of aspects of an economy whose study might be expected to throw some light on the issue.

1/ For example, if persons trained for and looking for a certain job do not remain unemployed long when they do not get it, they may instead choose another job into which they become locked and thereby absent from the labor market in which they first sought employment.

3. Identification of a "Credentialist Sector" within which Pay is not Closely Related to Productivity: The Public Sector

The natural candicate for the characterization "credentialist" is the public sector, but it may be argued that elements of this could be present in any sector with enough excess profits so that competitive pressures do not weed out non-cost minimizers, where labor mmarket imperfections lead to isolation, or where beliefs about appropriate relative pay are so widely accepted that market pressures may never be strong enough to eradicate them.

The role of the public sector as an employer is substantial in many developing countries especially with respect to persons with secondary education or higher. To the extent that it sets wages either out of line with those in the private sector or out of line with productivity in the public sector, rate of return calculations are likely to exaggerate the social payoff to those levels of education. Several studies present relevant information on differences in the age-education earnings profiles between public and private sectors.

Mazumdar (1975, p. 5.13) finds that the human capital model (education and age) performs dramatically better in the Malaysian public sector than in the private sector ($\bar{R}^2$ of 67 percent versus 31 percent for principal male earners who are employees -- education alone explained 57 percent of income variance in the public sector but only 24 percent in the private sector, underlining "the importance of a formal system of the determination of earnings in the public sector which presumably emphasized formal schooling and seniority." The payoff to primary education is much greater in the private sector, whereas that to secondary and higher levels is greater in the public sector (Mazumdar 1975, p. 5.16). Malaysia would thus appear to be a case in which (a) the internal pay structure of the public sector <u>may</u> have little basis in relative social productivities; (b) the public sector employs a high enough share of the members of various high income occupations to be the main determinant of their average levels of pay; 1/ and, therefore, (c) it could be argued that overall figures on the rate of return would tell little about the relative social productivities of the educational levels. Mazumdar does not estimate social rates of return to education but he concludes that private rates are quite high (1975, p. 5.22-23). Income differentials by completed level of education are high over the whole of the educational range comparted with most countries for which reasonably reliable data are available. 2/

1/ The public sector employed 90 percent of professional, technical and related workers, 42 percent of administrative and managerial workers, and 51 percent of clerical workers. Mazumdar (1975) estimates that it accounts for about 40 percent of total urban employment (p. 11.23). A majority of persons with all levels from upper secondary on up work there (p. 11.24).

2/ Though some of the high differentials listed by Psacharopoulos (1973) in his review (here Table 5) are unlikely to be accurate.

It would not seem credible to argue that the dominant role of the public sector is the major cause of the much higher income differentials by educational level that are found in Malaysia than in developed countries. Too many other developing countries with smaller public sectors have comparable income differentials, at least from top to bottom. The composition of the differentials -- with secondary and higher paying off more in Malaysia than in Bogota, for example, and primary less -- might, however, be because of this factor. In most developed countries, there appears to be an earnings differential in favor of public sector employees when major personal income-generating characterisitics (education, age, and soforth) are held constant. For Canada, Gunderson (1979) reports a differential of 6.2 percent for males and 8.6 percent for females. The wage advantage of the public sector was larger for low-wage workers, creating a basic delemma that policies to curb the advantage might conflict with the desire to raise the wages of low-wage workers and achieve equal pay for equal work between males and females. 1/ In apparently stark contrast with Malaysia, the public sector in Canada tends to pay its surplus wage payment in the form of a constant wage advantage (Gunderson 1979, p. 239). This contrast between the tendency for the public sector to pay badly relative to the private sector for people with primary and well for the other levels in Malaysia and the opposite tendency in developed countries, such as the US and Canada, 2/ could be explained by different political inputs into the determination of public sector wage structures (in Malaysia the effect of these high wages is to raise incomes of Malays), by the effects of public sector unionization (Canada), or by other factors. 3/

1/ Gunderson's results (1979) are consistent with those reported by Smith (1977) for the US. With 1970 data for white,s the federal wage advantage was approximately 7 percent for males and 11 percent for females, and, based on 1975 data, the advantage for all levels of government (not wieghted by the number of employees) can be calculated as approximately 3 percent for males and 10 percent for females.

2/ One cannot judge on the basis of the evidence presented how the effect of the public sector on relative earnings by educational level differs between such countries, since the main determinant of that effect is likely to be the relative numbers persons at different educational levels hired by the sector. In all countries the tendency is to hire the more educated worker.

3/ In further confirmation of the nonmarket factors in public sector wage setting is a relative lack of responsiveness to labor market conditions in all countries whether developed or developing. For Canada, Cousineau and Lacroix (1977) have concluded on the basis of time series estimates of a 'Phillips curve' wage equation for each sector and on supplementary calculations, that labor market conditions have little effect on wages in the public sector.

Among developing countries, the Colombian public sector provides a substantial contrast to Malaysia. In a survey of cities above 30,000 people used by Kugler, Reyes and Gomez (1979, p. 23), 22 percent of the labor force worked in the public sector (versus 40 percent in the Malaysia survey by Mazumdar). The effect of education on incoems -- as defined by its coefficient in the human capital earnings function -- was virtually the same as in the modern private sector and only a shade higher than in the non-modern sector. More striking was the share of R^2 explained by the education and experience variables: only 27.4 percent in the public sector as compared with 36.4 percent in the modern private sector and 22.4 percent in the nonmodern sector (Kugler, Reyes, and Gomez, p. 26). Although the authors do not so indicate, it appears that, with education and age taken into account, earnings would not differ much between the two sectors. And the general impression of the public sector as neither a source of upward salary pressures nor of wide income differentials by education is consistent with this.

4. Credentialism and the Modern Sector

Considerable discussion in developing countries has focused on the formal-informal (or modern-traditional) sectoral division and the allegedly higher wages paid in the former for the same work. This distinction is usually based on some idea of technological complexity, with size of firm often adopted as a proxy for such complexity. A more directly relevant division for analysis of the credentialist argument may be that between permanent and casual work forces -- this distinction has been emphasized by Mazumdar (1979b) in the Indian context, and similar primary worker/secondary worker distinctions have been made by some U.S. authors. In some countries where the modern sector has difficulty in dismissing permanent workers and therefore employs few casual workers, the two approaches may virtually cointice. In any case, one possible result of the dualism in question, and the associated wage differential between sectors, is the application of screening by modern sector firms (including the government). As discussed earlier, such screening can, in the presence of a major labor market imperfection, lead to income differentials by education that exaggerate the inherent difference in productive capacity. A separate question is the existence of credentialist-institutional factors creating wage differentials larger than productivity differentials within the modern sector as a whole, 1/ not just within the public sector that forms only a part. One possible result would be a greater return to education in the modern sector than in the traditional one (though it remains to be demonstrated that credentialist factors are weak there), implying a greater income differential between the two sectors for higher than for lower levels of education. both screening by modern sector employers (given the presence of a large wage gap vis-a-vis the traditional sector and credentialism within the modern sector would tend to push up the private rates of return to education relative to the social rates.

1/ Or the hire of more of certain types of workers than are needed.

The extent of credentialism in the modern private sector cannot easily be assessed on the basis of an analysis of employer behavior because the evidence is too scanty. But if one accepts that there is little credentialism in the traditional sector, the education-income relationship there can be used as a point of comparison for the modern sector: if education has a much higher payoff in the modern sector, there should at least be reason to look deeper. In the study by Kugler, Reyes, and Gomez (1979) for urban Colombia, the income gains associated with higher levels of education in the modern sector were, however, only a little above those characterizing the nonmodern sector (p. 23). Comparable evidence from countries where credentialism seems to be stronger than in Colombia would be needed to provide a more relevant test.

More information is available on overall earnings differentials between modern and traditional sectors than is available on the returns to education within each sector. For Colombia, the studies by Kugler, Reyes, and Gomez (1979), and by Bourguignon (1979) both suggest typical income differentials between the modern and traditional sectors (somewhat differently defined as between the two studies) of less than 20 percent when age and education are taken into account. 1/ The study by Kugler and coworkers implies a greater intersectoral income differential for males who have some (2-3 years) or most (4-5 years) of secondary education than for those with primary or university schooling in neither of which cases is the differential of any size (Table 9). For women, the results are erratic, in part no doubt because of the small size of some of the cells.

Although comparisons are complicated by different methodologies, evidence from a number of other countries suggests greater earnings differentials between modern and traditional sectors than those in found in Colombia. In studies in San Salvador, Asuncion, and Santo Domingo (ILO 1978) Researchers of the Programa Regional del Empleo Para America Latina y el Caribe (PREALC) found large gross differentials (that is, before allowing for differences in the composition of the labor forces by education and experience) usually greater than 2:1. 2/ After allowance for age and education (not done in the studies), the differentials might be on the order of 30 percent or so, though perhaps grater in Asuncion. 3/ For males on fixed wage or salary, the traditional sector average in Santo Domingo was 70 percent of the modern sector

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1/ The share of variance explained does not reach 40 percent in either case, so the usual uncertainty remains with respect to the missing explanatory variables.

2/ In Colombia, Kugler and coworkers' (1979) gross differential was 46 percent for men and women together, and Bourguignon's (1979) was 88 percent.

3/ When domestic servants (for whom income data are unreliable) are excluded, the gross differentials are reduced and the traditional/modern income ratio ranges from 0.44 in Asuncion to 0.55 in Santo Domingo, the latter only a little below Bourguignon's (1979) 0.60 figure (the reason for the higher figure reported by Kugler and coworkers is not clear). A reduction, as in other cities, comparable to that from Bogota to allow for the effects of age and education, might produce a differential of 30 percent or so.

Table 9

MODERN SECTOR-NONMODERN SECTOR EARNINGS
DIFFERENTIALS IN URBAN COLOMBIA, 1975, BY SEX AND LEVEL OF EDUCATION

Years of education	Modern sector earnings/Nonmodern sector earnings	
	Men	Women
0-4	0.966 (0.953)	1.066 (1.107)
5-6	1.195 (120.6)	1.065 (0.951)
7-8	1.300 (126.3)	1.760 (1.376)
9-10	1.214 (123.0)	0.772 (0.806)
11+	1.050 (1.050)	1.031 (1.031)

Note: The earnings ratio presented is the geometric average of the observed differentials for different levels of experience: 1-4 years, 9-15 years, and 16 years and up, with the differential for 16 years and up given twice the weight of the other three. There is no conceptual base to this calculation. Parentheses indicate the simple ratio of income of all persons in the modern sector to income of all persons in the nonmodern sector, regardless of experience.

Source: Kugler, Reyes, and Gomez (1979, p. 21).

average, and for women it was 79 percent (ILO 1978, p. 51). In San Salvador, blue-collar males earned 73 percent as much in the traditional as in the modern sector, but females only 43 percent; in Asuncion these ratios were 62 percent and 73 percent respectively. For white-collar workers in both cities the differentials were much greater (ILO 1978, pp. 49-50) and, unlike those in Colombia, the differentials do not seem to be mainly the result of differences in the educational composition of this category in the two sectors. If, on normalizing for all relevant personal characteristics, the differentials did remain large (for example, above 30 percent or so), it would seem further evidence that institutional factors pushing earnings up in the modern sector have their greatest effects on white-collar workers. Such a conclusion must remain tentative however, both for statistical reasons (much of the data appear erratic), and substantive ones -- the modern sector could be more selective in its choice of white-collar workers than in its choice of blue-collar workers, for example.

Mazumdar's findings for Malaysia although not based on an explicit modern-traditional dichotomy, are also relevant in this connection. He tested various possible institutional determinants if the wages of male employees. 1/ When human capital variables were present, plant size was the only institutional variable remaining significant; its significance suggests that it may be a proxy for a variety of institutional determinants of income. The spread in earnings between plants of one to nine workers and those of a hundred workers and up is largest (about 60 percent for white-collar workers, though here the sample is small, and about 20-25 percent for the two categores of blue-collar workers. On the whole it is not much greater than the modern-traditional sector differentials estimated for Colombia.

5. Testing the Earnings-Productivity Link: Use of Direct Measures of Productivity

Much of the variation of average incoems across education levels is associated with differing occupational composition, but it is also true that, within a given occupation, persons with more education tend to earn more. Since, if the occupation is defined narrowly enough, the product becomes nearly homogeneous, it should be possible to compare the outputs of different individuals and ascertain whether or not differences in productiviy are closely correlated with differences in income. Such studies are few in number, recent, and, for the most part, vulnerable to (often unavoidable) methodological problems. The only conclusion that can be drawn to date is that they do not provide simple straight-forward support for the human-capital assumption, whether their indicator of productivity is a physical measure (feasible for

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1/ Type of employer (public, foreign, domestic, private), unionization, size of establishment, share of white-collar employees (Mazumdar 1979b, pp. 616-17).

some production workers) or supervisors' judgments. 1/ Further studies may change this picture, though it is possible that this sort of analysis will not provide many conclusions of general interest for some time to come. 2/

6. Higher Payoff to Completed Educational Levels than to Partial Completion as Evidence of Credentialism

A tendency for the last year of a given educational level for example, secondary) to be associated with a greater increase in income than completion of earlier years has been noted in a number of studies of earnings differential and rate of return. Such a case is the recent study by the International Labour Organization in the Philippines (1974, p. 635), where it appears that the last years of both secondary and university pay off substantially better than do the earlier years. In the case of Bogota, Colombia, Marcelo Selowsky's data for males (1963-66) do not suggest any general pattern of this sort, although the last years of both primary and secondary pay off well (Selowsky 1979). If the even higher payoff to the third and fourth years of secondary education is really a return to completion of the four-year basic secondary (or normal) cycle, then one could conclude that returns to completing secondary schooling (whether the basic or the full cycle) were indeed higher than those of completing earlier years. Perhaps credentialist influences are particularly strong at this level. Results from different countries do not fall into any

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1/ Exemplifying the former category is Fuller's (1975) study in an Indian factory. No productivity-education relation was apparent, though omitted variables and possible specification problems could have disguised it. Most analyses relying on supervisors' judgments have been carried out in developed countries. Medoff and Abraham (1979) studied managerial and professional employees of two major US corporations; they found a strong positive association between experience and and relative earnings within grade levels but either no association, or a negative one, between experience and relative performance. Because the fraction of the overall experience-earnings relationship occurring within grades was substantial, they concluded that a substantial portion of it could not be explained by the human capital model of productivity -- augmenting on-the-job training.

2/ One difficulty arises from the possibility that, within a given occupation or job category, such income-related characteristics as education and experience (related in the aggregate, that is) would be inversely related to other unmeasured income-related characteristics, especially ability and drive. In other cases -- for example, when pay structures are such that the main way in which productivity can be rewarded is by promotion -- there may be little pay range within a given occupational category but, at any given moment, considerable variance of productivity. Or, as in the firms analyzed by Medoff and Abraham, pay differentials for seniority may apply mainly within grade levels -- creating the income-experience association -- whereas selective promotion according to productivity may mean that in general, and especially when the incomes of individuals are averaged over periods of several years, the income-productivity relation is reasonably close.

simple pattern, however, so that this source of evidence is, at present, inconclusive.1/

To summarize this section, evidence of marked effects of credentialism varies from weak in some countries to strong in others; only when more intensive studies have been done will a persuasive, comprehensive assessment be possible. For the present, one cannot rule out the possibility that the true returns to education in most developing countries are rather little affected by such influences, nor dismiss the opposite contention that the true returns to many types of education are much lower than what calculations by the human capital model indicate. But the most telling evidence, on the substantial returns to education in the informal sector of several countries, would seem to favor the former point of view.

C. Positive Externalities from Education

Of the many possible benefits or costs of education that are not reflected in the incomes of the recipients, two warrant special attention -- education's possible contributions to lowering fertility and to raising the rate of technological change.

1. Education and Fertility

A negative association between educational level and family size has been observed in may developing countries. Given the general acceptance that some countries are seriously overpopulated and the possibility that fast population growth is a barrier to development in an even wider group of countries, this is an important relationship. Two questions arise: first, does the statistical association reflect an effect of education on fertility and, if so, how strong is this effect? Second, can the benefits of a dampening of population growth be translated into monetary terms?

Answering the first question involves sorting out the causation among a set of typically correlated variables, any or all of which could have an effect on fertility. These include education, income, health and nutrition, urban versus rural residence, and female participation in the labor force. In her review of multiple repression analysis of the detemrinants of fertility (age-adjusted), Cochrane (1979, p. 49) finds that the great majority (about 80 percent) of studies in areas where the illiteracy rate was under 40 percent found education to have a negative effect on fertility, but that this result was reversed in cases where the illiteracy rate was above 60 percent A negative effect was much more frequently observed for female than for male education and for urban than for rural areas (Cochrane 1979, p. 51). The frequently positive association between education and fertility across individuals when the overall level of education is quite low (that is, illiteracy quite high), coupled with the negative association when the overall level of education is higher suggests interaction between the aggregate level of education

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1/ Even were a more general pattern of high rates for completion years to emerge, it would remain to be analyzed whether this was due more to a not necessarily inefficient screening mechanism used voluntarily by profit maximizing employers or to a form of credentialism more likely to imply efficiency costs and overestimates of true social returns to education.

and the individual level of fertility. It is consistent with a pattern in which the biggest reduction in fertility, as average education (and income) rises, is in that of the more-educated groups. The multiple regression finding that fertility is negatively related to education are supported by analysis of some of the mechanisms that connect the two variables. Education tends to raise the age of marriage, decrease the desired family size, and improve fertility regulation. 1/

Although the evidence leaves little doubt that education typically lowers fertility in urban areas, there do appear to be exceptions, and there is no reason to believe the relation does not vary from one country to another. When there is no normalization for income or other family variables, the difference in fertility between persons with no education and those with some varies widely across studies (Cochrane 1979, pp. 36-38); the results would probably not differ so much had such normalization been undertaken. These figures, together with other evidence, 2/ suggest that a few years of education (especially of women) could lower fertility in some countries by 10-20 percent. 2/

Using this estimate as an illustration, one may ask how significant such an effect is; that is, if translated into value terms, would it be important relative to the benefits of education on which the human capital productivity model focuses? This question, unfortunately, involves making a kind of assumption from which economists, at any rate, tend to shy away. A reduction of population, which would be expected to increase per capita income but probably also to decrease total income, forces the question of whether it is better to have a group of people with a certain average income or a larger group with a lower average income. Although the philosophical (or psychological) nature of this question precludes basing an answer on economics, it is still possible to get some feel for the possible range of benefits (or losses) from such a reduction; such benefits or losses could be substantial under many reasonable assumptions, falling in the same range quantitatively

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1/ Cochrane (1979, p. 146). None of the relationships has the indicated sign in all of the studies reviewed, though each does in at least two-thirds of them.

2/ If, as may be the case, a woman's fertility is as much affected by the average level of education as by her own level, cross-family regression analyses may be misleading. Cross-country or over-time studies of aggregate fertility as a function of average education, average income, and so forth have their own methodological problems but it will be important in future to confront the results of the two types of studies. The simple correlation (negative) between fertility and education over time in most countries is at least consistent with the macro results.

3/ Though for some countries, especially those with high illiteracy rates, the figures indicate a positive effect.

as the effects of education on productivity and, conceivably, even substantially exceeding them.1/ These possibilities create a clear need for much more attention to the understanding of education's effects on fertility in general, which levels and types of education have the major effects, whether other processes (for example, family planning programs) can substitute partially or wholly for education in this role, and other issues.

1/ An extreme assumption, perhaps, is that persons not born because of fertility reduction should not be viewed as a loss at all. In this event one can simply estimate the benefits of fertility reduction as the increase in incomes for people already born or who will be born anyway. If the supply of nonlabor factors is taken as independent of the fertility reduction, and the society is fully egalitarian, then the gain in question, for each birth prevented, would be related to the difference between average and marginal labor productivity in the economy. To be more precise, we may compare the net benefits from education via its productivity-raising and its fertility-reducing effects as follows, taking, to illustrate the comparison, four years of primary education as an example. Suppose the internal rate of return from the productivity effect is 20 percent and the social discount rate is 10 percent. Then the net benefits (the "surplus") are about half of the gross benefits and about equal (in present value terms) to the costs. If the labor income of a person with no education is 50 percent of the average income of all earners, and education raises it by 10 percent per year, the income of a person with primary would be a 73 percent of average income. These benefits begin to accrue as soon as the individual gets a job and continue over the working career. Suppose also that the effect of the education in question is to lower fertility by 20 percent, or by one (1) child per family. Assume the marginal productivity of labor (an average across persons with different skills) is one half of average product (that is, the labor share is 50 percent, under neoclassical assumptions); then the prevention of one birth raises the income of the people who were born by 50 percent of average earner income for that period of time when the individual would have been in the labor force and, for earlier years, by the amount of consumption and investment expenditure that would have been made in that person. Under these assumptions the benefit stream from the prevention of the birth would in fact exceed the stream of gross benefits from raising producitivy (23 percent of average earner income), and far exceed the net benefit stream from that source. Thus the fertility reduction would be the major effect and the productivity-raising effect the secondary one. This illustrative exercise is designed only to make the point that this effect of education could be as important, or more so, than the effects that are conventionally included in the benefits calculus. Because of the incomplete understanding of the fertility effect, and of the sensitivity of these calculations to the social welfare function assumed, it is not possible to say more.

2. Education and Technological Change

A phenomenon of great importance in the process of development is technological change -- the raising of economic efficiency by improve ways of doing things. It is clear that various kinds of education underlie aspects of this proces; sophisticated scientific research, for example, usually requires a high level of education, whereas adoption of new seed varieties may be facilitated by literacy. Are the effects of education on the rate of technological improvements already reflected in the income differentials among individuals which form the chief block of the human capital model, or should they be considered as a separate contribution to be added to conventional income benefits? The answer is that there are likely to be benefits not captured in the traditional human capital calculus.

The basic distinction called for in dealing with this issue is between those positive effects of education on technological change which are reflected in a person's income and those which are not. When by his capacity to innovate or imitate a farmer or an entrepreneur raises his income, any contribution his education made to that capacity is appropriately registered in his income. When a paid researcher in a firm generates technological improvements whose present value is just equal to his salary, the same is true. But evidently, there are many cases in which an individual does not reap the full benefits of his innovation -- that is, cases in which his action has external effects. This contribution should, in principle, be evalutated and added to the other benefits of education.

As with the effects of education on fertility, there is no body of information on which to base an estimate of these unremunerated contributions to technological change. But it is possible to demonstrate that the effect could be quantitatively important and that it therefore warrants more serious attention. This possibility flows from the fact that technological improvements are a major source of economic growth in many developing countries, and, if even a modest share of such improvement were made possible by education and at the same time not fully remunerated in the market, then the absolute magnitude of such externalities would be substantial -- for example, 20-80 percent of the gross benefits from increased productivity that are demonstrated by the human capital model. 1/

Consideration of the possibly large contributions of education to the decline of fertility and to technological change highlights the weakness of our measures of the social returns to education. At the same time, since these are both positive externalities, such consideration weights rather heavily in the balance in support of expansion of education. Finally, however, especially in the case of technological change, it further confuses the matter of the relative payoff to different levels of education. Some studies do attempt to distinguish the effects of various levels of education on fertility, though no organized synthesis of the results has yet been presented. With respect to technological change, it is evident that much research is carried out by professionals; much less is known, however, about other kinds of

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1/ Again, an illustration may help to clarify this point. Consider a country in which total factor productivity is rising at 2 percent annually: that is, in which the "residual factor" often referred to as technological change contributes 2 percent to the control growth rate. Such a rate would not be far from the median of estimates made for a wide range of developing countries (see the synthesis by Nadiri, 1972). One can only speculate on what share of this growth might be based on improvements made possible by education and taking the form of externalities. Evidence on the process of technological change in agriculture suggests that for this sector the share would be high. Returns to public sector investment in agricultural research in both developed and developing countries have, according to the calculations, been quite high -- often 20 percent to 40 percent or even higher. Thus, most of the benefits are externalities (since the salaries of researchers are treated as a cost in the estimates). The processes in other sectors are less clear, but there seems no reason to doubt that externalities correspond to a significant share of technical change. Our illustrative calculations will use a lower limit for these externalities of one-eighth of all technological change, (that is, 0.25 percent of GNP yearly) and an upper limit of one half of all technological change (that is, 1 percent of GNP yearly). How do such contributions compare with the human capital estimates of gross benefits from education as a whole? To illustrate, consider a country in which total educational costs (including opportunity costs) add up to 6 percent rate of return by human capital model calculations (also on the high side), it would generate a flow of benefits whose present value would be equal to that of a permanent annual flow of 1.2 percent of this year's national income (call it Y). If the educational expenditure accounted for a permanent annaul flow into the future of somewhere between 0.25 percent and 1 percent of Y in benefits from the externalties of technological improvements, the latter category would be 20-80 percent of the former. Such benefits, like those of fertility reduction, could evidently be an important determinant of the optimal level of expenditures on education. Many of the assumptions used in the illustration could be off by a factor of 2 without reversing this conclusion.

inventors and innovators (for example, entrepreneurs) whose total contributions may be as great or greater. One might argue that innovative capacity is "freed" by literacy, and attribute much change to primary schooling. Or one might find something good to say about the more maligned secondary level. At present, one can only treat these externalities as a support for education in general.

D. The Possible Role of Education in the Alleviation of Urban Poverty

Most available studies of rates of return and information on age-earning profiles refer to urban areas; as discussed in Section IIA, is a clear relationship betwene education and income, whatever the mechanism underlying it. In assessing the potential of education as an antipoverty investment, it is necessary among other things to know what the education level the children of poorer families are now attaining, the private and social returns at that level, and the extent to which the returns for poor people diverge from the average.

1. Current Educational Achievement of the Urban Poor

There appear to be no organized data on age specific educational achievements of urgan populations (let alone of the poorer groups in thsoe populations). But some generalizations are fairly safe on the basis of the parital data at hand. Extending primary school coverage remains a significant task in many of the poorer developing countries. In Pakistan, for example (see Table 10), probably 25-30 percent of 15-19 year olds in urban areas are illiterate, and an additional 5 percent or so have not completed the 5-year primary cycle.1/ Despite the extremely low level of education in rural areas (70.7 percent illiterate in the 15-19-year-old group in 1973), the educational level of migrants (persons not enumerated at place of birth; some but not all would be rural-urban migrants) was above, though not dramatically different from, that of urban natives. 2/ Other very poor countries have more developed educational systems; in India, probably well below 20 percent of the group of 15-19 year olds is illiterate, whereas another 10-15 percent has not completed

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1/ These figures are guesses based on Table 10, which presents data as recent as 1974-75. For females the figure are much above those cited; for males they are considerably below.

2/ This fact is of more than passing importance. An alternative method of judging the share of a given age cohort reaching a certain educational level is to combine figures on school registration and on population by age. This approach is subject to serious error, since one or both sources frequently have serious errors. Use of some source is much superior, but it is usually not possible to distinguish between persons born in urban areas and those who are not, creating the possibility that the figures over- or underestimate the coverage of education among children raised in urban areas. This evidence from Pakistan, at least, suggests this problem may not be too severe.

Table 10

EDUCATIONAL LEVEL ACHIEVED IN URBAN AREAS OF PAKISTAN, EARLY 1970s

Source and Population Group	Illiterate	Less Than Primary a/	Primary but Less Than Matric b/	Matric and Above
Population Census (1973)				
15-19 year olds				
Male	30.80	<---------44.27--------->		24.94
Female	49.72	<---------31.90--------->		18.38
both	39.30	<---------38.71--------->		21.99
Enumerated at birthplace				
Male	31.39	<---------44.92--------->		23.69
Female	50.71	<---------32.00--------->		17.29
Both	40.09	<---------39.10--------->		20.81
Enumerted elsewhere				
Male	27.92	<---------41.07--------->		31.01
Female	44.79	<---------31.41--------->		23.80
Both	35.41	<---------36.79--------->		27.81
20-40 year olds				
Male	34.06	<---------28.44--------->		37.49
Female	60.07	<---------19.00--------->		20.93
Both	45.72	<---------24.21--------->		30.07
Enumerated at birthplace				
Male	33.89	<---------28.85--------->		37.26
Female	61.93	<---------18.41--------->		19.65
Both	46.28	<---------24.24--------->		29.48
Enumerated elsewhere				
Male	34.51	<---------27.28--------->		38.11
Female	55.62	<---------20.40--------->		23.97
Both	44.33	<---------24.14--------->		31.53
Labor Force Survey (1974/75) c/				
15-19 year olds				
Male	25.97	5.43	41.86	26.74
Female	43.67	4.82	30.27	21.08
Both	34.14	5.15	36.51	24.13
20-24 year olds				
Male	28.10	5.79	23.97	42.15
Female	56.65	5.28	14.39	23.68
Both	41.68	5.63	19.50	33.19

Source: Preliminary printouts of the 1973 Population Census and of the 1974-75 Labor Force Survey. Government of Pakistan, Islamabad.

a/ But literate. Primary is grades 1-5 and would include some people who had not attended school.

b/ Matriculation is completion of elementary school -- that is, eight grades.

c. Refers to population not labor force.

primary schooling.1/ In Khartoum, 19 percent of persons 15-19 years old had not completed primary in 1974; doubtless the percentage would be considerably higher in other urban areas.

Even among countries farther up the income scale, it is frequently still the case that 20 percent or so of the group of 15-19 year olds in urban areas has not finished primary school. This was the case for Colombia in 1978. In Kingston, Jamaica (which has a relatively high income among urban areas in developing countries, the figure is probably closer now to 10 percent. 2/ Meerman's (1979) sample-based enrollment ratios by income and level of education indicate that in Malaysia as of 1974, 95 percent of children of primary school age were enrolled. Probably less than 10 percent of students failed to compelte primary schooling, and perhaps 60-70 percent started secondary school. In short, as one moves from the countries with less coverage to those with more, the share of children not completing primary school falls from 30 percent to 40 percent or more in some cuntries to under 10 percent in others. The share of urban children attaining some secondary education probably reaches 30-40 percent in most developing countries and hits 70 percent to 80 percent in some.

If poverty were perfectly correlated with education, the figures just reviewed would give a good idea of the share of people at the bottom of the income scale who would be most helped by an improved quality of primary education. Since in few developing countries do more than half of urban youth get a significant amount of secondary schooling, primary school is clearly the main educational experience of the poor. To the extent, then, that a program includes both upgrading quality and expanding coverage among its objectives, it would be expected to benfit the great bulk of the urban poor whether they be defined as the bottom 20 percent (perhaps more logical in the richer developing countries) or the bottom 40-50 percent (more appropriate for the very poor countries). If expanded coverage is the only important mechanism at work, then the issue is less clear, and the precise correlation between poverty and educational level becomes important.

1/ Based on the 1971 Indian Population Census. Government of India, New Delhi.

2/ Judging by the data from the 1971 population census. Government of Jamaica, Kingston.

This mapping involves a number of complexities. First, the education-income relation among income earners is only reasonably close; further, not all members of a family have the same level of education; finally, the correlation across families between the income and education of one generation and those of the next is only reasonably high. In short, while correlated, low income and low education are not the same thing. Of the pertinent evidence available, some involves the relation between family income levels and current enrollment of children, some that between educational attainment (mainly of people whose schooling is completed) and family income levels, and some that between education and personal earnings (as opposed to family income).

Available data for Malaysia and Colombia on current enrollment of children by family income level provide an interesting contrast. Meerman's data for Malaysia (rural and urban; 1974) show a moderately positive relation between per capita household income and the enrollment rate of children of the appropriate age in assisted primary and secondary schools and a dramatically positive relation at the university level (Table 11) (Meerman 1979, p. 107). The coverage of primary was almost complete and that of secondary was also widespread -- 40 percent in assisted schools, about 44 percent in assisted schools in urban areas, 1/ and a little higher in all urban schools. 2/ The enrollment ratios would be higher for all quintiles of the urban population than shown in Table 11. The progression would probably be steeper if families were classified by some measure of permanent income and if private school students were included. Nevertheless, it seems that the access to secondary education is much less unequal than the distribution of income. 3/

1/ Based on the figures of Meerman's (1979) Tables 3.3 and 4.3 (pp.84 and 99 respectively).

2/ Of secondary students, 94 percent were in assisted (government or government aided) schools; the figure would probably be lower in urban areas.

3/ Per capita income was over 12.8 times as great for the top quintile as for the bottom one (Meerman 1979, p.81). Even were a permanent income measure used, this differential would surely be at least 5 or 6 to 1.

Table 11

ENROLLMENT RATIOS IN ASSISTED SCHOOLS BY EDUCATIONAL LEVEL AND BY QUINTILE OF HOUSEHOLD PER CAPITA INCOME

Quintile	Number of persons in cohort per household a/	Persons enrolled per household	Enrollment rate
	Primary level		
Quintile			
1 (poorest)	1.61	1.37	0.85
2	1.25	1.05	0.86
3	1.14	1.06	0.93
4	0.90	0.89	0.99
5 (richest)	0.51	0.46	0.90
Mean	1.04	0.94	0.00
	Secondary level		
Quintile			
1	1.14	0.38	0.33
2	1.20	0.40	0.33
3	1.19	0.48	0.40
4	0.87	0.38	0.44
5	0.75	0.36	0.48
Mean	1.00	0.40	0.40
	Postsecondary level		
Quintile			
1	0.438	0.003	0.007
2	0.500	0.006	0.012
3	0.775	0.018	0.023
4	0.700	0.018	0.026
5	0.875	0.048	0.055
Mean	0.675	0.021	0.631

Source: Meerman (1979, p. 107).

a/ For each level, the size of the age cohort was multiplied by the ratio of the total number of students at the level to the number of students who fell within the age cohort. Thus, it was corrected for underage and -- more importantly -- for overage students by making the average enrollment rate at each level equal to the enrollment rate at the level of students who fell within the age cohort. In effect, the cohort vectors were inflated 6 percent, 9 percent, and 25 percent respectively, in the primary, secondary, and postsecondary levels. Although the official age for beginning school is 6, 7 was used for the first year in the primary cohort. At the time the survey was carried out -- the last third of 1974, near the end of the school year -- fewer than 1.5 percent of primary students were less than 7 years old. The age cohorts are therefore 7-12 at the primary level, 13-18 at the secondary, and 19-22 at the postsecondary. Form VI and remove forms are included in the secondary level.

In Colombia, as in Malaysia, primary coverage is good (see Table 12) 1/, although the lowest quintile 2/ seems farther below the average than in Malaysia. But at the secondary level in Colombia, the enrollment ratio of the top quintile is well over twice that of the bottom one -- perhaps 2.5 times higher.3/ The differential is probably much smaller in Malaysia.4/

Contrast in the relative access to education (especially post-primary) by income level might be anticipated in light of the greater public sector involvement in secondary and higher education in the Malaysian case.5/ Whereas in Colombia just over half of secondary students were enrolled in public schools, in Malaysia the figure was 94 percent. Access to private schools in Colombia was very closely tied to income levels, with the private school enrollment rate over 7 times as high for the top quintile (of the total population -- rural and urban) as for the bottom quintile. In urban areas this differential was 4:1. The low resort to private schools in the bottom quintile was not because of high enrollment in public schools, since here, too, the enrollment ratio raises with income (except for the top quintile). Evidently, it was the combined result of inadequate supply of secondary schools and of economic conditions that did not permit the children to finish primary school or, if they do, to be long enrolled in secondary. One might guess that much of the difference between the two countries in the pattern of secondary enrollment by income is accounted for by the different relative supply of public secondary schools. Further, one might speculate that, among poorer countries, there are similarly significant differences in the relative primary enrollment of the poor as a result of differences in access to public schools. In short it seems reasonable

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1/ These figures overestimate enrollment ratios for some groups, probably for all, and are therefore not directly comparable with those of Meerman. But the differential misestimate across income quintiles may not be too serious, except for a relative understatement of the primary enrollment rate for the highest quintile probably attributable to less repeating by students in this group.

2/ As in the Malaysia study, families were ranked by per capita household income. The income was measured over the previous month.

3/ Relative enrollment of the top quintile is probably understated in secondary as well as in primary, for the reason cited in the previous footnote.

4/ When rural and urban families are lumped together, the differential in Malaysia is from 0.33 to 0.48 (Table 11) and in Colombia from 0.17 to 0.63 (Table 12).

5/ The countries have reasonably similar levels of income per capita, and both have quite unequal distributions of income.

Table 12

APPROXIMATE ENROLLMENT RATIOS BY LEVEL OF EDUCATION AND BY QUINTILES OF PER CAPITA HOUSEHOLD INCOME, COLOMBIA, 1974

Quintiles of households	All urban a/						Rural						Rural and urban					
	Primary			Secondary			Primary			Secondary			Primary			Secondary		
	Total	Public	Private b/	Total	Public	Private b/	Total	Public	Private b/	Total	Public	Private b/	Total	Public	Private b/	Total	Public	Private b/
1	0.866	.763	.103	.309	.173	.136	.598	.589	.009	.063	.049	.014	.722	.673	.049	.171	.107	.064
2	0.987	.869	.118	.356	.250	.106	.673	.667	.006	.081	.056	.025	.840	.767	.073	.219	.156	.063
3	0.992	.794	.198	.421	.228	.193	.714	.686	.029	.104	.094	.010	.866	.739	.126	.282	.173	.109
4	1.045	.818	.227	.515	.262	.253	.647	.603	.044	.173	.148	.025	.951	.765	.185	.438	.229	.208
5	0.891	.406	.485	.679	.155	.524	.857	.771	.086	.183	.150	.033	.898	.441	.458	.625	.163	.463
Total	1.009	.789	.220	.458	.211	.247	.772	.754	.018	.088	.066	.022	.829	.699	.130	.315	.162	.153

Source: Marcelo Selowsky (1979, pp. 54-57.

Note: For primary school, enrollment ratios are defined as enrolled students divided by children 6-12 years old; for secondary, as enrolled students divided by children 13-19 years old. Our concern is mainly with relative enrollment ratios, and it is reasonable to assume that the bias in this measure should be reasonably similar across quintiles.

a/ Rough estimates, since Selowsky did not present average number of children for all urban households by quintile; the figures used to effect these estimates were therefore based on rough averages of the figures for the three urban areas: large cities, intermediate cities, and small towns.

b/ Private schools with or without government subsidies (most do not have such subsidies).

to expect that the children of poor families can be significantly helped by increased access to public schools at the relevant level of education, and that the ultimate effects of such access on them and their families' incomes are positive.

This last proposition depends on the relation between the education of earners and present family incomes -- that is, rather than between family income and level of education currently received by children. There is, naturally, a positive correlation between education (whether of household heads, an average across employed persons, or whatever) and family income per capita. It remains to be seen how tight is the tie, since available evidence involves current rather than permanent income data and understates the correlation between education and a more valid income measure. 1/ In a detailed study of the anatomy of urban poverty in Bogota, (the poverty group being defined as the 30% of the population with the lowest per capita family income), Mohan and Hartline (1979) find its relative incidence for males 35-44 years old to be about 4 times as great for those with no education as for those with secondary. 2/ (See Table 13, which reports on the relative incidence of poverty age, sex, and education.) 3/ The use of income figures over a longer period or of consumption figures would probably magnify this differential by raising the incidence of poverty for persons with no education and lowering it for those with secondary education. It would not be surprising if lifetime relative incidence (retaining the definition of poor as the bottom 30 percent of population would be 5 or 6 times higher for those men without education as for those with secondary and more than twice as great for those with primary. The composition of poor men might then have persons with secondary and higher education constituting only 20 percent or less of the poor, instead of the nearly 40 percent they constitute in the Mohan-Hartline figures (see Table 14).

1/ That is, use of monthly (or more frequent) income is almost certain to generate a weaker association than would obtain if it were possible to use either average income over a longer period or consumption. Fluctuations around their typically low average income would more likely throw people with no education temporarily above the poverty cutoff than temporarily below it, with the opposite happening, for example, to persons with secondary and higher. The effects of temporary nonparticipation or unemployment in the income figures would tend to work this way, especially for the young with higher unemployment. Another factor in these data is the number of nonearners, especially the young, whose education exceeds that of the family income earners but has not yet been brought to bear as an income-earning asset.

2/ Poverty is defined by income (from all sources) per capita of the household (which excludes live-in maids -- p. 71), with income ususally reported on a montly basis (or less for employees paid more frequently -- p.68).

3/ Its relative incidence for males 15-24 years old with no education is only a little over double that for males with secondary schooling.

Table 13

THE POOR IN BOGOTA:
PROPORTION OF BOTTOM 30 PERCENT AMONG ALL INDIVIDUALS
BY AGE AND EDUCATION GROUPS
(in percentages)

Age/Education	None 1975	None 1977	Primary 1975	Primary 1977	Secondary 1975	Secondary 1977	Higher 1975	Higher 1977	All 1975	All 1977	Total 1975	Total 1977
Males												
12-14	73	66	46	44	30	30	-	-	40	39	116	132
15-24	54	53	33	34	24	23	18	14	26	24	301	406
25-34	66	46	35	33	14	15	5.6	11	22	22	182	241
35-44	77	72	46	44	20	15	3.5	5	33	29	148	173
45-54	52	48	31	31	23	11	8.3	7	27	21	104	119
55-64	43	40	31	26	22	17	4.5	12	27	22	52	69
65 and over	69	61	35	37	14	27	28	23	35	37	29	46
All	61	54	37	36	23	20	10	11	29	26		
Total (in thousands)	24	35	401	461	397	516	109	175	932	1187		
Females												
12-14	28	52	46	43	30	29	-	-	39	38	128	150
15-24	32	39	26	27	24	22	13	11	24	23	384	493
25-35	43	54	38	37	16	16	8.4	9	27	25	221	283
35-44	54	47	40	39	22	17	6.5	12	33	29	169	190
45-54	40	44	25	33	18	16	13	-	24	37	100	140
55-64	31	32	26	32	16	26	17	29	24	31	55	78
65 and over	51	53	25	41	26	25	-	53	32	41	40	55
All	42	45	34	35	22	21	11	11	28	28		
Total (in thousands)	60	80	513	596	453	616	70	97	1095	1389		

Source: Mohan and Hartline (1979, p. 13).

Table 14:

INCIDENCE OF POVERTY AND DISTRIBUTION OF THE POOR BY EDUCATIONAL LEVELS IN URBAN COLOMBIA, 1970, 1975 AND 1977
(in percentages)

Level of Education	Household heads, Urban Colombia a/ (1970) Share of poor	Household heads, Urban Colombia a/ (1970) Incidence of Poverty	Males, Bogota b/ 1975 Share of poor	Males, Bogota b/ 1975 Incidence of poverty	Males, Bogota b/ 1977 Share of poor	Males, Bogota b/ 1977 Incidence of poverty
None	28.9	35.9	5.6	61	6.1	54
Primary	63.3	18.2	56.6	37	54.4	36
Secondary	6.9	4.6	33.8	23	33.5	20
Higher	0.9	2.8	4.13	10	6.1	11
Total	100.0	16.4	100.0	29	100.0	26

Sources: For household heads (1970), DANE (1971, pp. 80-81, 84, 88); For the remaining colums (males in Bogota), Table 13 (originally from Mohan and Hartline 1979).

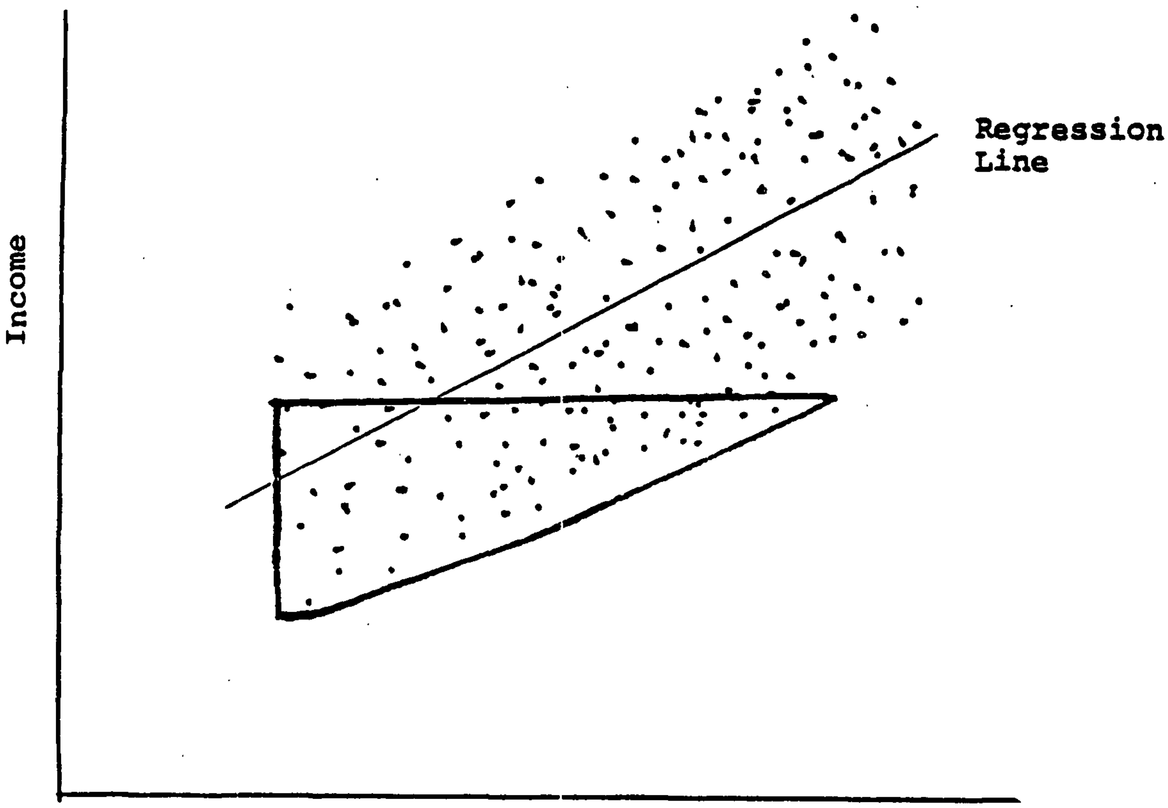
a/ Poverty defined as an income for the household head of less than 500 pesos per month, that is, roughly, in the previous month). The great majority of household heads are men.

b/ Poverty defined to include persons with a per capita household income placing them in the lowest 30 percent of all persons in populations.

they have. 1/ For Malaysia, Mazumdar has calculated the extent by which their age, their years of education, their race, and the size of establishment where they work (the major income determinants isolated in his study) overpredict the incomes of the poor, (defined as the bottom quintile of persons, ranked by the per adult equivalent incomes of the household: 22 percent for male principal earners, 61 percent for male secondary earners, and 33 percent for female secondary earners).(Mazumdar 1979b, p. 3.9). Although these gaps are substantial,

Figure 5

PREDICTED INCOME AS A FUNCTION OF EDUCATION



1/ The wide variance in Figure 5 around the regression line showing predicted income as a function of education reflects the empirical observation of wide income variance at given educational levels and the minority of total variance explained by the standard human capital variables (eduction and experience). Note that, if the poor category is so wide as to include nearly everyone with primary education, the rate of return calculated by the usual procedure is the relevant one in discussions of poverty alleviation.

2/ Mazumdar (1979a, p. 3.9).

Some support for this exception is provided by income data for household heads in urban Colombia (1970), which indicates that at that time only 8 percent of the poor (defined as the poorest 16.4 percent had secondary or higher education (see Table 14).1/

The Mohan-Hartline data are revealing in that they indicate the relation between female and male poverty. Apart from the substantially lower incidence of poverty for women with no education than that for men in the same circumstance, the education-poverty relation is very similar. Most women 12 years old and up) are not income earners -- around 70 percent in both 1975 and 1977 -- 2/ so that the per capita income of the household they are in depends mainly on the income of the male of that household and, in particular of the household head. If such women tended to marry men with quite different educational levels, the education-income relation would be much weaker for women than for men. This effect is not very marked except for the group with no education suggesting a quite limited frequency of marriage between persons with substantially different educatina levels.

Having ascertained that a significant share of the poor have less than complete primary schooling, and taking note of the generally high rates of return estimated for expenditures on primary school, one can be optimistic abot expansion of primary education as a poverty-alleviating tool. One possible qualification, however, must be borne in mind. Whereas such morphologies as that of Mohan-Hartline, along with the evidence on returns, are helpful insuggesting the potential poverty alleviation of an expansion of education at the different levels, they do not provide direct evidence of how successful such attempts could be. This requires, in principle, fuller understanding of the determinants of income. The rate of return to primary education over no education reflects (one would hope) the average effects of this schooling on the incomes of a group of persons, some of whom have below-average endowments. Thus, to simplify as in Figure 5, if the poor correspond to the persons represented by dots within the heavy triangle, it is important to know both their educational levels and the factors which, for a majority of them, make their income below average for the education

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1/ The two sources (DANE 1971 and Mohan and Hartline 1979) are different in many ways, but the use of information on household heads in this second study leads to exclusion of many younger persons providing, perhaps, a better idea of the normal relation between poverty indicence and education.

2/ See Mohan and Hartline (1979, pp. 80-81).

the one for principal male earners suggests that, after allowing for a part of it for short term income fluctuatons, not much would remain to be explained by below-normal benefits from such education, experience, and so forth as these workers have. 1/

Apart from the general relevance of knowing why many of the poor tend to lie below the regression line 2/ of Figure 5, such knowledge is also important from the point of view of educational policy, since the benefits to education may vary across groups defined by high or low amounts of level of ability, sex, race and other determinants of income; in an analysis of variance these would be the interactive effects.) The interpretation of earnings functions within groups (defined by unalterable personal characteristics) is in general the same as for the universe of groups; it is instructive, for example, to look therefore at returns to education within a low-income group defined by race or by status of parents. I have not seen any such studies for developing countries, however.3/ Within groups defined by alterable characteristics (for example, sector or occupation) the interpretation of such analysis becomes hazier, though still of interest. As we have seen above, there is evidence from Colombia, among other countries, that the rate of return calculated within the informal sector is substantial. Even more direct evidence or the effect of education on the incomes of the poor comes from Jallade's (1977) study of Brazil. A category "Low socio-economic background" was defined to include "all persons having a head of

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1/ This may be in part because of their having very little education or experience, a matter worth investigating.

2/ So that other policy tools can be put to work -- for example, anti-discrimination legislation.

3/ A large share of income variance goes unexplained in most studies, so that intragroup data on the benefits of education are of less value than they might be since it is not clear that the major determinants of income variance apart from education and age-experience have been identified. Accordingly it also is not clear that the groups identified (or the interactive effects studied) are the interesting ones. This matter turns importantly on how much of observed variance in current income does not reflect differences in permanent income. If that share is high enough, for example, over 25 percent or so) and if the analytically uninteresting fluctuations are not correlated with the explanatory variables already introduced in analyses, then the share of the interesting variance explained is high.

household earning less than 200 cruzeiros per month." 1/ For males the figures indicate comparable rates of return to primary education for this group as for other groups -- for females, higher rates (Table 15).2/ Estimated returns for secondary education are somewhat, but but not dramatically, lower for males of low socioeconomic background.

2. Improvements in Quality as an Aspect of Educational Policy in General and Poverty Alleviation in Particular

Almost all of the available statistics on the relation between education and income refer to the amount of education -- for example, years in school or, usually, grade level attained; the effects of quality have not yet received much attention in this connection. Yet it appears that quality does vary widely within some developing countries and that average levels may be low relative to those of developed countries. Inkeles (1974, pp. 139-200) has pointed out in his review of the massive, 21-country study of educational achievement of 10 and 14 year olds by the International Association for the Evaluation of Educational Achievements (IEA) that educational achievement scores on a variety of tests of cognitive skill were far lower in the developing countries (Chile, India, Iran, and Thailand were included) than in developed countries. Inkeles feels that a lack of familiarity with the testing procedure, curriculum deficiency, and poverty-caused deprivation of school resources were responsible for some of this strikingly poor performance (Inkeles 1974, pp. 162-68), although no single fact would seem to explain all, or perhaps the bulk, of the differences observed. But he notes that the schools in developing countries did seem to produce comparable proportionate gains in the scores of their students between the age groups tested, suggesting that the basic factor may be social deprivation -- a low cultural level when beginning school and little support from the home and outside environments. 1/

1/ Jallarde (1977). This category presumably includes the head himself/herself, in which case one would expect to be characterized by low rates of return (since the sample would be more selective of the bottom of the existing income range at each successively higher level of education). Even if household heads were not included, and especially if they were, the results are consistent with education's begin quite productive for persons of low socioeconomic background.

2/ The methodology of these calculations is not clear but appears to be based on an equation using education and age. A combination of ambiguities and dubious aspects of the methodology imply a need to review the results.

3/ This conclusion should be treated as tentative because developing countries have high rates of attrition even for 10 year olds, and those those still in the system at age 14 may have been retained on the basis of ability.

In the analysis of the variance in student scores within countries, age, sex, and home circumstances (they were lumped together) tended to explain rather little of total variance -- in the range of 8 to 17 percent, according to Inkeles' tabulation for all countries (1974, p. 185), even when other variables were not included (and therefore less when they were). Home circumstances alone explained only a median of 10 percent of the variance of student scores within countries on the science test, including about 10 percent in Chile and Thailand but almost nothing (2-3 percent in India and Iran. Although one would need to check the results of the other tests, this fact would suggest that, if general cultural background plays a big role in determining the low scores in developing countries, it is not so much through the cultural poverty of the poorer families (vis-a-vis the rich ones) but through the general cultural milieu, which in turn is substantially determined by the subsistence levels of living. The IEA's study design was not such as to provide any test of the social deprivation hypothesis on a cross-country basis. The IEA studies do, however, provide some general support for the function of quality of schooling ("type of school" and "learning conditions") as a predictor of test scores, the scores in developing countries included.

Although no firm conclusions on the sources of low student performance in developing countries can be reached on the basis of the IEA studies, the low performance itself suggests that quality of education should receive mush more attention as a policy variable.1/ If low-quality schooling is the cause of low performance, the payoff to a greater investment in teaching resources should be substantial. Even if general social deprivation is the more important causal factor, improving the quality of schooling may be the right antidote -- that is, it may be a partial substitute for a strong cultural context.

In the case of children from poorer families, these arguments would appear to take on additional strength. Such children doubtless suffer greater social deprivation, and they usually have lower-quality schooling. An additional advantage to a focus on quality in the schooling of the poor involves their relatively higher opportunity costs of spending a long time in school as compared with better-off children. 2/ For some of the poor, more "total education" is feasible only when it does not call for more years in school.

1/ Assuming that the low performance on the kinds of cognitive materials tested in the IEA studies could indeed the matched by a low performance on the abilities most relevant in income earning, whichever they are. This link needs more attention.

2/ A high cost reflected in their high desertion rates.

Table 15

RATES OF RETURN TO PRIMARY EDUCATION FOR PERSONS OF LOW SOCIOECONOMIC BACKGROUND, COMPARED WITH OTHER GROUPS, BRAZIL, SAO PAULO STATE AND PERNAMBUCO STATE, 1974

	Rates of return (percent)					
	Private			social		
Population category	Sao Paulo	Brazil	Pernam-buco	Sao Paulo	Brazil	Pernam-buco
Males (Nonfarm)	15.1	24.7	10.0	14.3	23.5	18.2
Migrants from urban areas	13.8	21.9	19.6	13.2	21.2	18.8
Migrants from rural areas	12.9	20.9	17.1	12.4	20.3	16.7
Low socioeconomic background	14.9	24.2	18.9	13.8	22.7	17.5
Females (nonfarm)	13.8	22.7	19.3	12.8	21.2	17.0
Migrants from urban areas	11.1	17.0	14.4	10.4	16.5	13.3
Migrants from rural areas	17.7	23.1	23.5	16.4	21.9	20.9
Low socioeconomic background	15.7	35.2	42.1	14.0	30.6	32.3

Source: Jallade (1977, Tables 4-6).

One final, important reason for a quality-oriented approach to education argues the merits of increased educational spending on the urban poor, whether at primary or at other levels. Although the argument that education-related differences in income do not reflect nearly comparable differences in productivity would, if sustained, seriously weaken the logic of broad educational expansion, it would not detract seriously from the merits of a program to decrease inequality in education across groups by raising the levels of the poor. In cases in which the target groups of poor people is small, say 20 percent of urban population, its income is likely to be only 5 percent or so of total urban income. A doubling of its share at the expense of the rest of the urban population, 1/ by a little over 5 percent. In such cases, if it can be shown that more education is very likely to raise substantially the incomes of the urban poor, a good case can be made for proceeding even if it cannot be clearly ascertained whether the income increases are paralleled by productivity increases. If the urban poor are the bulk of the urban population, greater assurance that productivity would be increased by additions to their education would be necessary.

In the context of income distribution, it is important to remember that lack of education (illiteracy) contributes directly to feelings of inferiority, entirely apart from its negative effects on income. It puts the illiterate at the mercy of the more educated in some business dealings. As a "consumption item," in the parlance of human capital analysis, there is a great case to be made for universal primary education, at least to the point of providing universal literacy.

Though as an economic proposition it remains a speculation, there is the possibility that literacy or some other relatively low level of education may have threshold effects in unlocking innovative human skills by opening the door to the future growth of the individual. Especially in highly decentralized informal economies, technological progress may come from many sources, including people with only a few years of schooling.

3. The Case for Primary Education: Summary

As noted above, substantial shares of urban youth in developing countries are not currently finishing primary school many more are not beginning secondary school. And the relation between low levels of education to cover more of the urban population, or improvement in its quality, is thus a promising policy to help the poor. The relatively high social rates of return calculated for the primary educational level in most developing countries

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1/ Which would happen if the income claims of the target group rose because of more education but its productivity, and therefore total output of the urban economy, did not.

further augment the case, especially because, as indicated above, the evidence lending support to the credentialist argument that earnings differentials do not reflect productivity differentials seem more prevalent at the secondary than the primary level.. More generally, those arguments are not at present persuasive in the context of the urban poor, a high share of whom work in the information sector, where the role of credentialist institutions is not obvious. In a different vein, some of the benefits infertility reduction benfits from education come from the primary educational level.

The statistical evidence on the private benfits from education leaves no doubt that, for the average recipient of primary or secondary education, the gains are substantial. In assessing the relevance of this evidence for the urban poor, it is necessary to consider whether the poor are "typical" in this sense: are they mainly people with below-average education, or are they mainly people whose income is less than average for their level of education? Evidence is scanty and mixed on this issue, and it deserves servious attention; at present, however, there are no serioius grounds for pessimism. It seems less likely in LDCs than in some developed countries that the poor will benefit much less from primary education than will the average recipient since poverty, being much more widespread, is probably less the result of personal characteristics than of externally determined factors.

Recent international comparisons of school achievement, based on tests applied to students in a variety of subject areas, have indicated very low performance in the developing countries sampled as compared with their developed-country counterparts, suggesting that considerable benefits might flow from an improvement in the quality of education in the developing countries. Applied to the context of the urban poor, this might be particularly advantageous in providing a partial substitute for the sort of home environment (books, discussion, and so forth) likely to promote effective learning. For the poor, too, it is important to achieve as much education in as short a time as possible, since the opportunity cost of their time is often so high that it forces them out of school.

III. GENERAL CONCLUSIONS AND PRIORITIES FOR RESEARCH

While both the true extent and the mechanisms of education's effects on income and welfare remain to be ascertained in developing countries, both in general and for poorer people, there are reasonable grounds for optimism that increased investment in education can be beneficial both to the poor and to the society as a whole. Calculations of rates of returns suggest that private benefits from education are generally high. But there are many ambiguities still to be probed, especially with respect to the social benefits. There is no doubt that institutional (that is, nonmarket) factors can play an important role in the determination of income differentials in the short or medium run (for example, wage differentials may not respond quickly to labor market imbalances) and, in some sectors, in the long run as well. But evidence on education-related income differences in the more informal part of the urban economy, which is less affected (at least directly) by those institutional factors most commonly cited, casts doubt on the general importance of these pnphenomena even though they may be quite significant in some countries. In many poor countries the relatively informal sector, (for example, the self-employed and those in establishments with less than five workers, excluding professionals and other highly trained people) constitutes the majority of the urban economy; relative incomes by education would therefore not be expected simply to reflect incomes of the modern sector, even if the latter sector established its wage differentials by legislative fiat, union pressure, tradition, or similar means.

Evidence which does support the proposition that certain wage levels are above their normal market-determined levels because of institutional factors suggests that such factors are most prominent for secondary school leavers. The same may be said for another concern, that overeducation is leading to high and rising rates of unemployment. In most developing countries the unemployment rate for recent secondary school leavers is high, but there is no evidence of general increases in that rate. Further, employment rates spanning careers may be little, if any higher for persons with secondary school than for persons with primary so that this problem does not, by itself, warrant a change of policy.

Two indirect benefits (externalities) from education -- fertility reduction and technological improvement -- may be of definite quantitative importance, but are understood too little at present to permit much more than this to be said. 1/ It is very important that they be proved further in the future.

1/ The evidence of the effects of education on fertility, is in fact, ambiguous in that the effect may sometimes (especially at very low levels of education) raise fertility.

Although there is considerable uncertainty, for reasons mentioned above, about the benefits to society of expanding education in the ways it has been expanding in developing countries, for example, with dramatic growth at the secondary and higher levels there is much less reason to question the merits of the sort of educational program that would be most likely to benefit the urban poor. For this group the estimated social returns to the primary level of education are high, credentialism appears to be less relevant, and, perhaps most important of all, the argument for income distribution is powerful.

Similarly though some of the current ambiguities in our understanding of the role of education in developing countries will be difficult to clarify, there are a number of areas within which, it is reasonable to expect, efforts will bear important fruit. These should, therefore receive priority; among them are the following:

- A detailed, systematic and critical review of studies of rates of return to see whether these studies suggest patterns (for example, in the relation of rates of return to level of development). Such a study would update Psacharopoulos' (1973) analysis of a decade ago, but also would attempt an assessment of the primary studies and focus on their methodological differences and implications.

- Country studies of the interaction over time of educational, levels labor market, income distribution, and overall economic development. At present, there appear to be no such studies, at least not of a serious and detailed nature. This lack is related to the extreme scarcity of detailed studies of the evolution of labor market in developing countries.

- Much more attention, within rates of return studies, to the ways in which the education-income link works itself out. Distinction of the public and private sectors, the formal and informal sectors, and so on, are examples. At preseent the research which can be drawn on is very limited.

- Detailed direct analysis of how education affects the careers of poorer groups, defined both by start in life (parents' situation) and their later status. At present it is necessary to guess at these effects since they are seldom if ever addressed directly in available studies.

- Additional primary studies and synthesis of existing studies on the effects of education on population growth. Cochrane's (1979) study is a valuable synthesis of existing information. The situation in this area, however, is similar to that of the rate of return studies in that the primary research has been carried out with a wide variety of methodologies and data bases, making both interpretation and generalization difficult.

- Attempts to assess the effects of education on innovation.

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PART V

EDUCATION AND INCOME DISTRIBUTION IN DEVELOPING COUNTRIES: A REVIEW OF THE LITERATURE

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I. INTRODUCTION

Education in developing countries is highly sought after. Part of its value is as a consumption good: education is valued in its own right and is seen as a basic human need. But education also has more materialistic value: it is a means to higher income, more stable employment, and better working conditions.

This paper is a survey of the available literature on education and income distribution in developing countries. Education may affect the distribution of income in a variety of ways: by raising the level of income; by changing, for better or worse, the dispersion of income; by opening up new opportunities for the children of the poor and thereby serving as a vehicle for social mobility and/or, by limiting participation to the children of the well-to-do, transmitting intergenerational inequality; by offering greater access to favored segments of the population (boys, city-dwellers, certain racial groups); by rewarding differently the education received by these groups; through public financing, by taxing some more heavily to subsidize the education of others; and by interacting with fertility, mortality, health, and other aspects of development.

The paper is divided into five sections. Section II-IV address the private benefits of education. Section II is concerned with the private benefits of education which accrue as better employment opportunities and higher labor incomes. Section III offers a critical review of the literature on differing benefits from education for different subgroups in the population, with particular attention to the econometric methods used. Section IV looks at who (by income class, parental background, region or tribe, sex, and other relevant distinctions) receives these private benefits from education and why some groups receive more education than others. Section V turns to social benefits and examines the relation between education and the incidence of poverty, the evidence on social rates of return to education and a critique of that evidence, and the association between the distribution of education and the inequality of income. Section VI considers the educational system as a fiscal program, combines data on the distribution of benefits with data on the distribution of costs, and examines the benefits each population group receives relative to the costs they pay. Conclusions appear at the end of each section.

This paper is one in a series of studies commissioned by the World Bank which evaluate various aspects of the role of education in economic development. Any review paper must be selective in the topics covered. In striking a balance between depth of coverage of some areas and breadth of coverage of all, some relevant areas have of necessity been shortchanged. Among the topics not treated in any substantial way here are: direct measures of education's role in augmenting the productivity of labor; distributional aspects of preschool education: the role of alternative forms of education such as adult education and radio; interrelations between the distribution of income and the distribution of health and nutrition; the multidirectional linkages between education, fertility, and income distribution; the determinants of school achievement; and examination of the content of education. Several of these issues have been recently surveyed elsewhere and the small attention given to them in the present paper reflects the division of labor among researchers, not the inherent unimportance of these matters.

II. THE PRIVATE BENEFITS OF EDUCATION

Any examination of education and income distribution rests on the premise that education confers economic benefits on its recipients. This section examines the size of the private economic benefits of education. Two kinds of private benefits are treated in turn: employment benefits and income benefits. The question is then asked in Section III: do the benefits of education differ for different groups?

A. Private Employment Benefits

In the 1950s and the 1960s it was thought that education clearly improved the employment prospects of the people who received it. That perception changed in the late 1960s and early 1970s, partly as a result of the study by Blaug, Layard, and Woodhall (1969) detailing the dimensions of the problem of educated unemployment in India. Further evidence compiled by Turnham (1971) suggested that the relationship is not a simple monotonic one. Rather, what he reported was that the highest levels of open unemployment are found among people with intermediate education levels in Bogota, Colombia, Buenos Aires, Argentina; Caracas, Venezuela; urban India; urban Ceylon; urban Malaysia; and Syria. Evidence from other countries is mixed. Some subsequent studies (for example, for Colombia and Sudan) tend to support the pattern of highest unemployment in the intermediate educational categories, whereas others (for Kenya, Iran, Chile, the Dominican Republic, and Nicaragua) show the rate of unemployment falling with education. The relevant data are summarized in Table 1. Note that these data are not standardized by age.

The causes of unemployment and underemployment among the educated have been extensively debated. Among the arguments are: inappropriateness of the type of education received; the creation of false hopes by the educational system; low quality of education; inability of the economy and the labor market to create enough jobs that require the skills of the educated; and unemployment as part of a process of rational search by the educated for the best jobs. I personally am persuaded by the job search position, though not to the exclusion of other views; see Fields (1975a) for an elaboration on this theme.

Economists are now well aware of the limitations of unemployment measures in developing countries. 1/ Very simply, most people are employed according to the standard definition -- working at least one hour a week

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1/ For a penetrating examination of measurement issues on employment and unemployment, see Bruton (forthcoming).

Table 1:

UNEMPLOYMENT RATES BY LEVEL OF EDUCATION,
SELECTED DEVELOPING COUNTRIES
(in percentages)

Country	Educational level: Illiterates	Primary	Secondary	Higher
Argentina	3.8	4.3	5.7	3.3
Ceylon	7.1	n.a.	11.8	2.3
Chile	12.1	4.6	1.3	0
Colombia	11.5	15.3	14.9	13.2
Dominican Republic	22.4	17.9	9.2	n.a.
India	1.2	2.7	7.0	2.8
Iran	10.0	8.1	13.0	2.6
Kenya	21.0	21.0	13.0	17.0
Malaysia	10.4	19.5	30.9	15.5
Nicaragua	23.8	14.0	12.2	n.a.
Sudan	2.0	2.5	5.5	5.0
Syria	4.3	n.a.	11.7	4.4
Venezuela	4.3	7.0	10.2	2.3

n.a.: Not available.

Note: Comparability between countries and educational levels is limited because of different definitions and sample populations.

Source: Psacharopoulos (1978, Table 15).

for pay, or fifteen or more hours a week not for pay in a family farm or business -- and very few are unemployed by the standard definition -- actively seeking a job but not working in the survey period. The reason why is clear: poor people cannot afford to be openly unemployed for very long. The International Labour Organisation mission to Colombia (ILO, 1970) redirected our attention from the <u>fact</u> of employment to the <u>kind</u> of employment, to which we now turn.

It is clear that education raises one's chances of working in a superior job. Data on the occupational distribution of the labor force broken down by educational attainment are usually found in national population censuses. Table 2 gives illustrative data for Peru. It is evident that the educated, on average, have better jobs. But we also find much diversity within occupations. In other words, a better education is neither necessary nor sufficient for entry into the better occupations, but more education does help.

B. <u>Private Income Benefits</u>

In every country where studies have been done, the evidence is that additional education raises income and reduces poverty, often by very substantial amounts. Micro-level breakdowns within developing countries show an inverse relation between education and poverty. National evidence for Brazil, Malaysia, Taiwan, Thailand, and India is presented in Table 3. Additional evidence for specific cities or regions is widely available elsewhere: for ten Latin American cities in the work of Musgrove (1978); for Lima, Peru, in Webb (1974); for Jakarta, Indonesia, in Papanek (1975); for Bogota and Cali, Colombia, in Mohan (1979); and in other studies too numerous to mention.

Looking at incomes more generally, rather than just at poverty, education appears as a key variable in earnings function studies throughout the world. Table 4 shows that the percentage gains in income associated with an additional year of education are estimated to range between 3.6 percent and 17.2 percent, with an average of 11.2.

The importance of education is also revealed in decomposition studies, which are surveyed in Fields (1979b). Education is the single most important determinant of income. That is, if you sought to determine an individual's income and could ask only one question, you would do best to ascertain how much education the individual in question had received.

One thing worth noting is that these are average figures. Some groups in these countries may benefit more than others from education. In particular, it is thought that the children of the well-to-do may benefit more from education than do the children of the poor. The evidence on this point is reviewed below in Section III.

Why education results in higher income is a matter of some debate. 1/ The dominant school of thought, and one which clearly contains a strong element of truth, is the human capital view, which holds that education creates additional productive skills and knowledge embodied in people. The higher income received by better-educated workers is seen as a payment to the superior productivity they have gained through education. But though the evidence from

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1/ Blaugh (1973) terms this the "puzzling economic value of education."

Table 2:

EMPLOYED POPULATION BY OCCUPATIONAL GROUP AND
BY EDUCATIONAL LEVEL ATTAINED, PERU, 1972
(in percentages)

Occupation	Without Schooling	Educational level attained: Some or completed: Primary	Secondary	Higher	All educational levels
Professional, technical, executive, and managerial	0.4	2.1	16.9	63.7	8.2
Clerical	0.3	1.9	20.0	14.5	6.0
Sales	4.5	8.8	13.3	6.2	8.7
Service	6.0	9.8	8.6	4.3	8.5
Agricultural	74.5	47.3	8.7	3.2	42.3
Other nonagricultural	11.8	27.2	28.2	5.0	23.2
Not specified	2.5	2.9	4.3	3.1	3.1
Total	100.0	100.0	100.0	100.0	100.0

Source: Oficina Nacional de Estadisticas y Censos, VII Censo Nacional de Poblacion, 1972 (Lima, Peru, 1974).

Table 3:

INCIDENCE OF POVERTY AMONG HOUSEHOLDS AT DIFFERENT EDUCATIONAL LEVELS, SELECTED DEVELOPING COUNTRIES

Country and Source	Education of head of household	Poor Families (percent)	All Other (percent)
Brazil, 1960			
(Source: Fishlow 1972)	None	64	35
	Primary	35	55
	Lower secondary	1	5
	Upper secondary	0	2
	University	0	2
	Education of head of household	**Incidence of poverty (percent)**	
Malaysia, 1970			
(Source: Anand 1977)	None	49.0	
	Some primary	39.1	
	Completed primary	32.8	
	Lower secondary	11.7	
	Some upper secondary	5.2	
	Certificate V or higher	2.1	
	Education of head of household	**Poor groups (percent)**	**All groups (percent)**
Taiwan, 1972			
(Source: Kuo 1975)	Illiterate	81.0	12.3
	Primary	14.1	51.4
	Secondary	0	29.1
	College	4.9	7.2
	Education of head of household	**Incidence of poverty (percent)**	
Thailand, 1968-69			
(Source: Meesook 1975)	None	21.4	
	P1-MS2	26.1	
	MS3-MS4	1.1	
	MS5+	1.8	
	Education of head of household	**Average disposable income per household (Rs.)**	
India, 1964-65			
(Sources: Bardhan 1974	Illiterate	1,186	
Da Costa 1971)	Primary	1,489	
	Above primary, below matriculation	2,358	
	Matriculation and intermediate	2,803	
	Prof./tech. certificate	2,630	
	College graduate, arts and sciences	5,432	
	Prof./Tech. degree	6,776	
	Postgraduate	12,015	

Source: Fields (1980, Table V.2)

Table 4:

INCOME AND SCHOOLING IN SELECTED DEVELOPING COUNTRIES

Country	Percentage change in income associated with an additional year of schooling	Proportion of variance in income explained by included variables	Source
Brazil	17.2	.50	Velloso (1975)
Colombia	16.1	.57	Fields (1976)
Colombia	16.9	.32	Fields and Schultz (1977)
Colombia	11.4	.32	Kugler et al. (1977)
Cyprus	12.5	.44	Demetriades and Psacharopoulos (1979)
Iran	5.7	.81 a/	Psacharopoulos and Williams (1973)
Kenya	4.8	.42	Thais and Carnoy (1972)
Malaysia	5.3	.80 a/	Hoerr (1973)
Mexico	15.0	.73	Carnoy (1967)
Morocco	15.8	.44	Psacharopoulos (1977)
Taiwan	6.0	.55	Gannicott (1972)
Thailand	3.6	.51	Blaug (1974)
Vietnam	16.8	.16	Stroup and Hargrove (1969)

a/ Used grouped data, hence the high R^2.

Note: The table shows the coeffficient of earnings on years of schooling, in semi-logarithmic earnings functions. The coefficients are not strictly comparable because of the different independent variables used in each study.

Source: Psacharopoulos (1978, Table 12).

literally hundreds of earnings function studies in dozens of countries is consistent with the human capital interpretation (Blaug 1978), that same evidence is also consistent with other explanations. Blaug (1973) calls these the "sociological" and "psychological" explanations, by which he means that education inculcates students with certain socially acceptable values (the "sociological" explanation), and that education acts as a screening device to select the best qualified workers for the job (the "psychological" explanation). Although each of these explanations is undoubtedly accurate to some degree, their relative explanatory value has not been determined and is even thought by some to be undeterminable.

One should note that the evidence reviewed above refers to the private benefits of education. Coefficients of education in earnings functions are sometimes interpreted as private rates of return, that is, a coefficient of X percent is taken to mean that "education raises the present value of expected lifetime income by X percent. This will only be correct if there are no precisely accurate (private) costs of education other than economies forgone while in school or if direct costs and unmeasured earnings while in school cancel each other out.

Data on the earnings received by individuals with different levels of educational attainment frequently are used to compute not private but social rates of return. This literature is reviewed in Section V.

C. Conclusions on the Private Benefits of Education

By now, it has been thoroughly documented that in some but not all developing countries better-educated workers have lower unemployment rates than do less-educated workers; that the better-educated tend to be employed more frequently in the superior occupations; and that they tend to earn higher incomes while working. Subsequent sections address whether the benefits differ for various population groups and identify who the beneficiaries are.

III. DIFFERENT BENEFITS OF EDUCATION FOR DIFFERENT GROUPS

Not everyone in developing countries benefits equally from education. At any given educational level, some individuals receive larger incomes and other benefits than do others. The empirical evidence is presented and examined critically below.

A. Empirical Evidence

Differences in returns to education are thought to arise in many dimensions: by sex, race or tribe, region, rural or urban location, stratum of the labor market in which the individual is employed, occupation, industry, socioeconomic background, and whether or not the individual is poor. Different incomes received by workers grouped according to any or all of these dimensions would constitute "labor market segmentation" according to most definitions, none of which I find particularly satisfactory. 1/

The literature offers many studies of whether different groups in the labor force receive different rewards from education. The methodologies followed in these studies are of two general types, corresponding to two related but distinct questions. The first of these is: are some individuals paid more in the labor market than would be predicted from their education and skills, depending on their sex, race, or occupation? The second is: do the earnings functions (in general) and the estimated gains from more education (in particular differ for various groups depending on their sex or race or occupation? Research into the first question looks for income differences in the earnings (or income-generating) functions themselves. In research into the second question the labor force is stratified into segments separate earnings-function regressions are new within each stratum, and the regression coefficients in each stratum are then compared.

1. Shift Variables in a Single-Equation Earnings Function

In the first approach, the supposed segmentation variable is included in a multiple regression as a shift variable in an earnings function. An example is the work of Bourguignon (1979). He uses the following variables:

Y = income,

EDUC = years of schooling,

EXP = labor market experience,

EXPSQ = labor market experience squared,

WORKTIME = hours per week,

M = dummy variable for modern sector employment.

1/ In a recent paper (Fields 1979a), I considered a number of alternative definitions of labor market segmentation. A commonly-used conceptualization is that stated by Selowsky (1979a, p. 22): "wage differences (for labor of equal skill or education) associated to particular occupation or sector of employment." Virtually the same definitions have been used in studies of developing countries by Mazumdar and Ahmed (1977), Souza and Tokman (1977), Altimir and Pinera (1977), and Bourguignon (1979), among others. I have problems with these definitions because they fail to consider why the worker is in one group rather than another. Others criticize these definitions for their failure to consider compensating (or equalizing) differences in unmeasured job attributes. As anyone familiar with utility theory knows, appeals to unmeasured variables explain everything, and hence nothing.

His regression evidence (p. 66, reg. 1. a) for males in Bogota is:

$$Y = 5.266 + \underset{(.004)}{.145}\ EDUC + \underset{(.003)}{.074}\ EXP - \underset{(.000)}{.001}\ EXPSQ + \underset{(.040)}{.196}\ WORKTIME$$

$$+ \underset{(.021)}{.123}\ M,\ R^2 = .316,\ n = 3,713.$$

All regression coefficients are statistically significant at the 1 percent level. Bourguignon interprets the significance of the modern-traditional sector employment variable as evidence of a degree of dualism in the Bogota labor market.

This kind of approach -- introducing shift variables into single-equation multiple regression models and observing whether people with the same measured education, experience, and other characteristics receive different incomes in the labor market depending upon their own characteristics or upon characteristics of their employment -- has been used in many studies of developing countries. Most shift variables have proven to be statistically significant. The results of some of the studies using this approach are presented in Table 5.

Two classes of variables have generally been found not to be significant in shifting the earnings function. One kind of variable pertains to the worker's socioeconomic background. We have studies by Kugler (1975) and Fields (1976) for Colombia, by Pang and Liu (1975) for Singapore, Carnoy (1967) for Mexico, Blaug (1974) for Thailand, and Mazumdar (1979) for Malaysia -- most of which show the unimportance of parents' income, occupation, or education in determining the incomes of their sons or daughters in the labor market (see Table 6). We should note, however, that it is only the <u>direct</u> effect of parental background that is shown to be insignificant. In nearly all studies that have allowed for <u>indirect</u> effects of parental background on the socioeconomic status of the children, a clear linkage is shown between the socioeconomic status of the parents, the educational attainment of their children, and the children's subsequent economic position. (See Section IV.) This evidence should be interpreted as a hopeful sign that, in many societies, the children of the poor -- if they do receive education -- will apparently <u>not</u> be discriminated against in the labor market when it comes time for them to seek jobs commensurate with the educational levels they have reached.

Another variable that usually is found to be insignificant in the studies of incomes and earnings in developing countries is the individual's <u>migrant status</u>. The relevant literature is reviewed in Yap (1977) and Todaro (1976); a more recent examination, perhaps the most thorough for a developing country, is the work of Ribe (1979) for Colombia. These studies report that migrants' earnings are virtually identical with those of natives at destination. Put differently, the evidence is that migrants quickly acquire economic comparability with lifelong residents. The implication for educational planning is that if a person is educated in one area and then moves elsewhere, that person is apt to find the labor market receptive to him and will therefore be able to put his education to effective use.

Table 5:

VARIABLES EXPLAINING DIFFERENCES IN EARNINGS,
SELECTED DEVELOPING COUNTRIES

Source	Country	Shift variables	Higher coefficient for:
Many studies too numerous to list		Sex	Males
Langoni (1975)	Brazil	Status, sector	Employers, manufacturing
Bourguignon (1979)	Colombia	Modern-traditional sector	Modern sector
Fields (1978a)	Colombia	Industry	Tobacco, rubber
Musgrove (1978)	Colombia	Occupation	Managerial
Musgrove (1978)	Ecuador	Occupation	Professional
Mazumdar and Ahmed (1977)	Malaysia	Firm size, sector	100+ employees, foreign sector
Musgrove (1978)	Peru	Occupation	Professional
Knight and Sabot (1977)	Tanzania	Occupation	Supervisory employees
Blaug (1974)	Thailand	Firm size, occupation	Large firms, executives
Stroup and Hargrove (1969)	Vietnam	Occupation	Professional and clerical
Thomas (1976)	Yugoslavia	Industry, occupation	Medium capital intensity, general management

Note: The table shows shift variables in single-equation earnings functions.

Table 6:

EFFECTS OF FAMILY BACKGROUND VARIABLES ON EARNINGS, SELECTED DEVELOPING COUNTRIES

Source	Country	Statistically significant variables	Nonsignificant variables	Reasons for overall unimportance a/
Kugler (1975)	Colombia	Logarithm of father's income	Parents' occupation and education	Low explanatory power as compared with other personal characteristics
Fields (1976)	Colombia	Mother's education	Father's occupation and education	As above
Mazumdar (1979)	Malaysia	None	Father's occupation and education	Statistically insignificant
Carnoy (1967)	Mexico	Father's occupation	--	b/
Pang and Liu (1975)	Singapore	Proxy for parents' income, mother's education	Father's occupation and education	c/
Blaug (1974)	Thailand	Parents' education, father's occupation (sales or executive)	Other father's occupations	Small coefficients and low explanatory power compared with other personal characteristics

a/ The reasons given for overall unimportance of the socioeconomic variables are those expressed by the authors themselves in their studies.

b/ Carnoy (1967) computed private rates of return to education. The magnitude of these rates is not associated in any direction with the occupation of the fathers.

c/ Pang Liu (1975) find that the proxy variable for parents' income accounts for more than 11 percent of the observed variance in earnings.

2. Earnings Functions on Stratified Subsamples

The second methodological approach to determining if "comparable" workers receive different rewards from the labor market is to run earnings functions on stratified subsamples of the labor force; sometimes, in place of multiple regression, these returns to education are estimated using simple cross-tabulations. These are several examples of such studies; their results are summarized in Table 7. Despite the seeming sophistication of many of these studies (in that they look for a variety of effects of education and other variables on the incomes of different population subgroups, and test for these effects using the Chow test or other sophisticated econometric methods), it nonetheless turns out that many of them are methodologically deficient. These methodological issues are discussed in the following subsection.

B. Methodological Issues

As a whole, the empirical studies have taken little care with the nature of the segmenting variables and the structure of the labor market that produces differences between groups. Most researchers have not concerned themselves with whether the groups are defined according to unalterable personal characteristics such as sex; choice variables such as place of residence; limited opportunity sets (for example, work in modern vs. traditional sector employment); or income itself. Yet, as I shall now show, how the segmenting groups are defined crucially affects the interpretation of both dummy variable and segmented earnings function regressions. 1/

1. A Simple Structural Model of Income Determination

In the pursuit of higher income, there are some exogenous factor that an individual has no power to change. Without question, these include sex, age, race, and family background; somewhat less certainly, but usually treated as unalterable, are an individual's education, migrant status, and religion. Other income-determining factors are endogenous to the income-determination process. These include occupation; industry of employment; characteristics of the occupation, industry or firm; and place of work. What these have in common is that workers presumably maximize over these variables by choosing subject to constraints, that occupation, industry, firm or workplace which pays best.

1/ For further details of these arguments, see Fields (1979a).

Table 7:

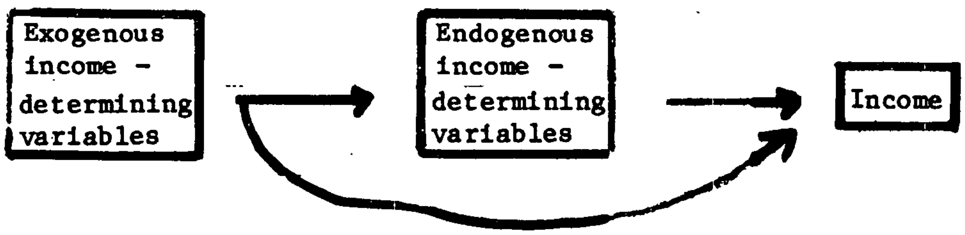
VARIABLES EXPLAINING DIFFERENCES IN EARNINGS IN SELECTED DEVELOPING COUNTRIES

Author	Country	"Segmentation" is reported according to:	Higher earnings for:
Many studies too numerous to list		Sex	Males
Langoni (1975)	Brazil	Occupation, sector	Employers, tertiary sector workers
Jallade (1977)	Brazil	Socioeconomic group	Males, non-farm activity
Corbo (1974)	Chile	Industry-firm size	Chemical and pharmaceutical industry, 100 or more employees
Kugler (1977)	Colombia	Poor vs. non-poor	Nonpoor
Kugler et al. (1979)	Colombia	Modern vs. nonmodern, traditional vs. marginal sector	Modern, marginal
Musgrove (1978)	Colombia	City of residence	Bogota workers
Fields (1978a)	Colombia	Urban vs. rural, employer vs. employee	Urban workers, employers
Bourguignon (1979)	Colombia	Modern vs. traditional sector	Modern sector workers
Mohan (1979)	Colombia	Neighborhood within Bogota	Workers in higher income neighborhoods
Mazumdar (1978)	India (Bombay)	Three sectors: casual, small-scale, factory	Noncasual sector workers
Psacharopoulos and Williams (1973)	Iran	Three employee categories: permanent, contract, and new	Contract employees
Mazumdar (1979)	Malaysia	Public vs. private, white-collar vs. blue-collar, plant size, race (2 groups)	Public employees, white-collar, larger firm size, Malays
Webb (1974)	Peru	Self-employed vs. factory workers	Self-employed
Pang and Liu (1975)	Singapore	Primary vs. secondary sector	Primary sector workers
Knight and Sabot (1977)	Tanzania	Racial groups	Non-African Workers
Chiswick (1977)	Thailand	Employees vs. self-employed	Employees
Stroup and Hargrove (1969)	Vietnam	Farmers vs. non-farmers, occupation	Nonfarmers, sales and service workers
Thomas (1976)	Yugoslavia	Region	Slovenia

A simple structural model of the relationship between these sets of variables appears in the following figure:

Figure 1:

A SIMPLE STRUCTURAL MODEL OF INCOME DETERMINATION



In this model, the exogenous variables affect income both directly, by influencing one's income within occupational or industrial groupings, and indirectly by influencing which occupation or industry one is in.

We may now ask: having recognized this economic structure, what difference does it make to the econometric testing of the questions posed above? We consider first the use of shift variables in a single-equation earnings function and then earnings functions run on stratified subsamples.

2. Shift Variables in a Single-Equation Earnings Function

When one introduces shift variables into earnings functions, the issue is whether some individuals are paid more (or less) in the labor market than would be predicted from their education and skills alone, and whether these differencs are associated with sex, race, or occupation. The econometric procedure used to address these issues is to introduce potential explanatory variables as additional regressors and estimate models of the form:

$$Y = \alpha + \beta \text{ EXOG} + \gamma \text{ ENDOG} + \varepsilon ,$$

where

Y = income (or its logarithm),

EXOG = exogenous income-determining factor(s),

ENDOG = endogenous income-determining factor(s),

α , β , γ = parameters, and

ε = error term.

How good is the estimated earnings function? Econometric theory offers a clear answer: all regression coefficients -- not only those of the endogenous factors such as occupation but also those of exogenous factors such as education -- are biased, because of the correlation between the endogenous variables and the error term. 1/

What is the direction of the bias? Suppose there were three income-determining factors: education (exogenous), sex (exogenous), and occupation (endogenous). The effect of ignoring the endogeneity of occupation is to attribute mistakenly to occupation a larger independent effect on income than is justified, for some part of the apparent effect is really derived from the intercorrelation among the explanatory variables and the error term. That is, if OLS (ordinary least squares) is used to estimate an earnings function like that given above, simultaneous equations bias causes one to overstate the independent contributions of occupation in explaining income and understate the independent contributions of education and sex. Nearly all investigators, myself included, have at one time or another failed to consider these biases in empirical work.

The usual remedy is to estimate a reduced form of the model illustrated in Figure 1. Reduced-form estimation is helpful up to a point. It is formally correct and yields unbiased estimates of the total effects of education, sex, and other exogenous income-determining factors on income. In particular, if we wish to know whether some individuals are paid more (or less) in the labor market than would be predicted from their education and skills, depending on their sex, race, or family background, reduced-form estimation is an appropriate method. 2/

These reduced-form estimates may be compared with those obtained when occupation and other endogenous income-determining factors are included in the usual way using OLS. Estimates derived in these two ways differ in empirical studies, but not by much. This means that the effects of education and other exogenous income-determining factors are measured reasonably well by established methods.

What about the effects of occupation and other endogenous income-determining factors? Reduced form estimation, by definition, does not even try to estimate the effects of these endogenous factors. It therefore offers no information on the extent to which different occupational or industrial groups in the population receive different benefits from education. Thus, the importance of the biases in the estimated effects of endogenous income-determining factors remains unknown.

In summary, those earnings functions estimated by OLS which include shift variables to allow for different rewards from education for workers who differ in sex, race or other exogenous factors are suitable provided the earnings function model is otherwise well specified. However, those which include shift variables to allow for different rewards from education

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1/ I shall spare the reader the details of the argument; see Fields (1979a) for more on this.

2/ Provided, of course, that the income-determination model is otherwise well specified.

for workers in different occupations or industries suffer from simultaneous equations bias, which affects the estimates of <u>all</u> included variables. The size of the biases affecting the estimated effects of exogenous income-determining factors is unknown, but inferences from such estimates ought to be drawn with care. Because the available reviews in the literature fail to distinguish between relatively appropriate and relatively inappropriate studies, they cannot be relied on to resolve these issues.

We turn now to the question of separate earnings functions for different groups.

3. Earnings Functions on Stratified Subsamples

Earnings functions have been run separately for different groups in many developing countries (see Table 7). When is it valid to infer that some groups benefit more than others from education, or to conclude more generally that some groups' earnings functions differ significantly and meaningfully from those of others? The structural model of income determination shown in Figure 1 suggests that we can distinguish three kinds of groupings: according to exogenous income-determining variables, endogenous income-determining variables, or income itself. The validity of earnings function estimates for stratified subsamples depends on which kind of grouping is used. They are presented in turn.

<u>Stratification by Exogenous Income-Determining Factors</u>. When a sample of workers is stratified according to sex, race, or other exogenous characteristics, the question is: <u>What function determines the income expected by a representative worker of sex or race</u>? The principal conclusion about stratified earnings functions when workers are grouped by exogenous income-determining factors is that valid results <u>are</u> obtained when the labor force is segmented in this way. An undistorted estimate of the returns to education is obtained for members of each group.

Actually, a regression fitted to the whole sample may result in a biased estimate of the effect of an extra year of education on income <u>for all strata</u>. For example, if men and women each earn 10 percent higher incomes for each extra year of education, but men with any given level of education are paid more than women, then the effect of education on income estimated for a sample of both men and women might <u>appear</u> to be 20 percent or 5 percent when in fact everybody gets 10 percent. 1/ (See Figure 2.)

To sum up, when (i) different groups in the labor force receive different incomes, and (ii) these incomes are generated by different underlying earnings functions, and (iii) these groupings are based on an exogenous characteristic, then the sample <u>should</u> be stratified and separate earnings functions run for each segment, since not segmenting will typically produce a <u>biased</u> estimate of the effect of education on income.

1/ The magnitude and sign of such bias depends on how the different groups are distributed with respect to the explanatory variable (education in the example). The bias will be positive whenever the higher-paid group (males) also has, on average, a higher level of educational attainment, and negative otherwise, as shown in Cases A and B of Figure 2, respectively.

Stratification by Endogenous Income-Determining Factors. In several of the studies of developing countries cited in Table 7, earnings functions have been run and the structures compared for workers in various groupings by endogenous factors such as occupation, industry, firm size, and work place. How meaningful are within-group regressions like these? Before answering, we must establish carefully the objective of the exercise, since ambiguity abounds.

The purpose of stratifying a sample of workers according to occupation, industry, or other characteristics, is to establish what function determines the income expected by a worker with characteristics. This question in this particular form is too vague to be useful and has led to much confusion in the literature. Problems arise in two respects. For one thing, the question fails to specify when the worker is in group i. Is he/she in that group at the beginning of working life, at the time of the survey, or throughout? And second, once we recognize that workers are heterogeneous, we must ask: to which worker is the earnings function supposed to apply? To the representative worker in that group? To the representative worker in the population as a whole? Or to somebody else? More specificity is needed.

I suggest the following as an interesting question, perhaps the most interesting one, pertaining to intergroup differences in earnings functions: what function determines the income expected by a representative worker entering the labor force in group i? The standard method of answering this question is to divide the sample according to current occupation or industry and to run separate earnings functions within each such representative group.

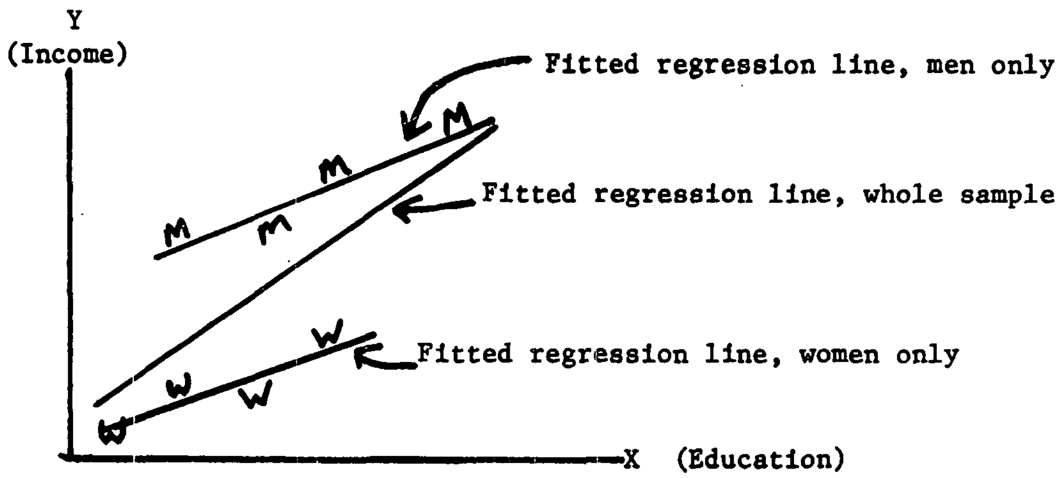
How valid is this procedure? The answer has three parts. First, when the labor force is grouped according to endogenous income-determining factors, if there is no mobility between groups, and if the labor force is homogeneous with respect to omitted variables, then intragroup regressions provide valid estimates of the effect of education on income in each occupation. The reason why intragroup estimates are valid under the stated assumptions is that the labor market is completely segmented, so that otherwise identical workers receive different wages depending solely upon the segment of the labor market in which they are first employed, with no opportunity to move from the poorer to the better segment. If the stated assumptions do not hold, however, the intragroup regressions are not valid.

Hence, and second, when the labor force is grouped according to endogenous income-determining factors, if workers move within groups, then intragroup regressions provide invalid estimates of the effect of education on income in each occupation. The simple intuitive explanation is that any degree of mobility between the segments means that some of those who start in group i move up to group j, and this mobility is ignored in within-group regressions. The result is sample selectivity bias: looking only at the incomes of those individuals who end up in group i underestimates the income expected by individuals who started out in that group.

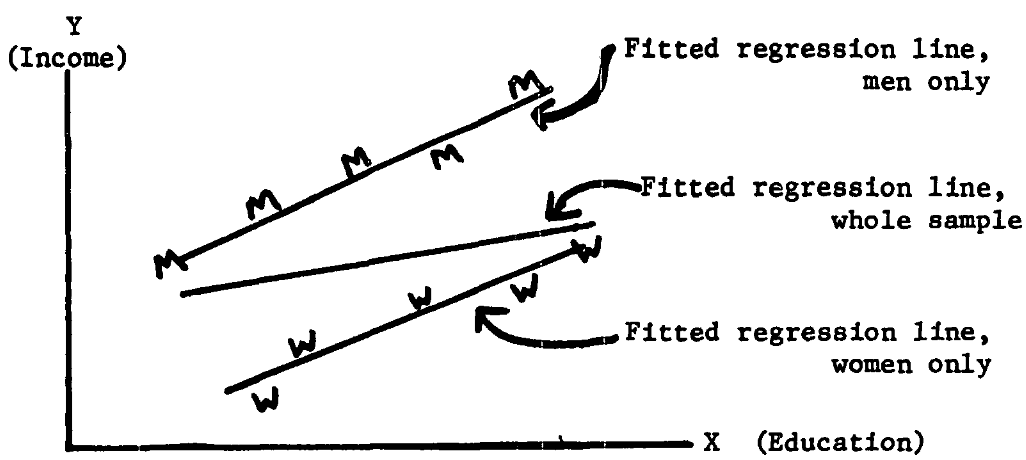
Figure 2:

BIAS FROM OMITTING OR FAILING TO STRATIFY BY AN EXOGENOUS INCOME-DETERMINING VARIABLE

Case A: Higher-paid group has higher average education



Case B: Higher-paid group has lower average education



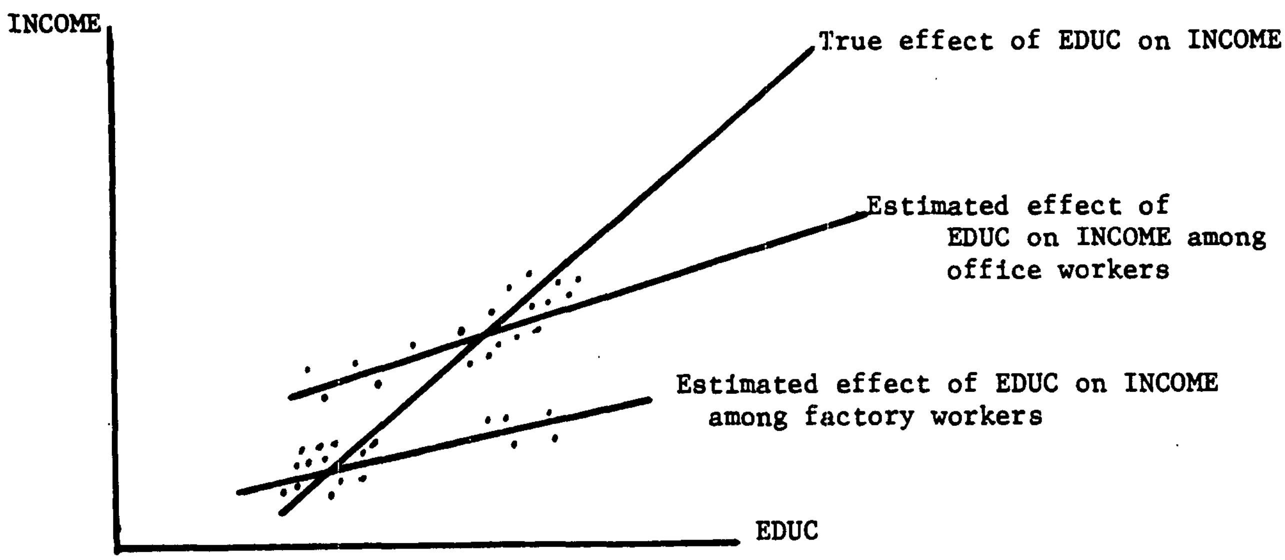
Third, when the labor force is grouped according to endogenous income-determining factors, if the labor force is heterogeneous with respect to omitted variables, and if the effects of these unmeasured variables are ignored, then intragroup regressions provide <u>invalid</u> estimates of the effect of education on income. Take ability as an unmeasured variable. It is well-known that to ignore ability in earnings functions, in the absence of ability measures, imparts an upward bias to the estimated coefficients of variables such as education, which are correlated with ability. This is because part of the estimated return attributed to education is in fact a return to superior ability. What happens if we stratify the sample and run separate earnings functions within each stratum, ignoring the unmeasured ability? The likely effect is to <u>reduce</u> the apparent contribution of education in determining earnings in the lower strata, even, in extreme cases, producing a seeming <u>negative</u> relation between education and earnings. One might tend to conclude from such evidence that education fails to raise income for workers in the lower earnings strata. This inference may be unfounded: those individuals still in the lower strata, despite a high level of education, are likely to have low ability -- otherwise, they would probably have been able to move to higher strata. Incomes are low among highly educated people working in the lower labor-force strata because their low (unmeasured) ability offsets their high (measured) education. Since this unmeasured variable, ability, remains unmeasured, however, we cannot detect the cause of the low income and so erroneously conclude that education does not pay off among this group of workers. 1/

To sum up the discussion on stratification by endogenous income-determining factors, these procedures yield valid results only under strong assumptions that do not hold. In each case, the problem is a form of selectivity bias brought about by truncation the sample: education tends to raise people's incomes by allowing them to move out of lower occupational or industrial categories into higher ones, and this effect is missed when income functions are estimated within an occupation. The result is that the effect of education on income may be substantially <u>understated</u> in the segmented earnings functions. Figure 3 illustrates this for a situation in which the better-educated individuals tend to be employed as highly paid office workers and the more poorly educated individuals tend to be lower-paid factory workers:

1/ For example, among traditional sector workers, the low incomes received by college graduates working as street vendors more probably reflect the peculiar (unmeasured) physical and mental limitations of those particular indiviuals, who are working in that occupation despite a lot of education, more than it reflects the lack of skills that could be acquired during sixteen years of schooling.

Figure 3:

BIAS FROM STRATIFICATION OF LABOR FORCE BY ENDOGENOUS INCOME-DETERMINING VARIABLE



Stratification by the Dependent Variable (Income). Stratifying the labor force by the dependent variable entails running separate regressions for workers with incomes above and below a predetermined amount. This kind of segmentation produces estimates of the effect of education on income that are invalid. The estimates are biased downward for low-income workers for the reasons given in the preceding discussion of endogenous income-determining factors: one of the effects of education is to raise people's incomes and hence move them from the low-income sample to the high-income sample, and this effect is ignored when samples are stratified by the dependent variables. Figure 4 illustrates this problem.

The same problem arises if samples are stratified by income-determined variables, such as neighborhood. A correlation between benefits from education and neighborhood of residence is both expected and spurious.

In actual empirical research, the dangers of segmentation by the dependent variable are particularly acute. Figure 5 illustrates, for Bogota, how incorrect inferences might be drawn. We see that the benefits of education for low-income workers would be misstated if separate earnings functions were run within poverty and nonpoverty groups: in the sample as a whole, each year of education raises incomes by about 15 percent; yet, within the higher-income sample, the income gain is attenuated because low-income workers are systematically excluded; and, in the low income sample, the apparent effect of education on income is negative! Segmenting by the dependent variable understates the effect of education on income for every segment and ought not to be done.

Figure 4:

ILLUSTRATION OF TRUNCATION BIAS:
STRATIFICATION OF LABOR FORCE BY DEPENDENT VARIABLE (INCOME)

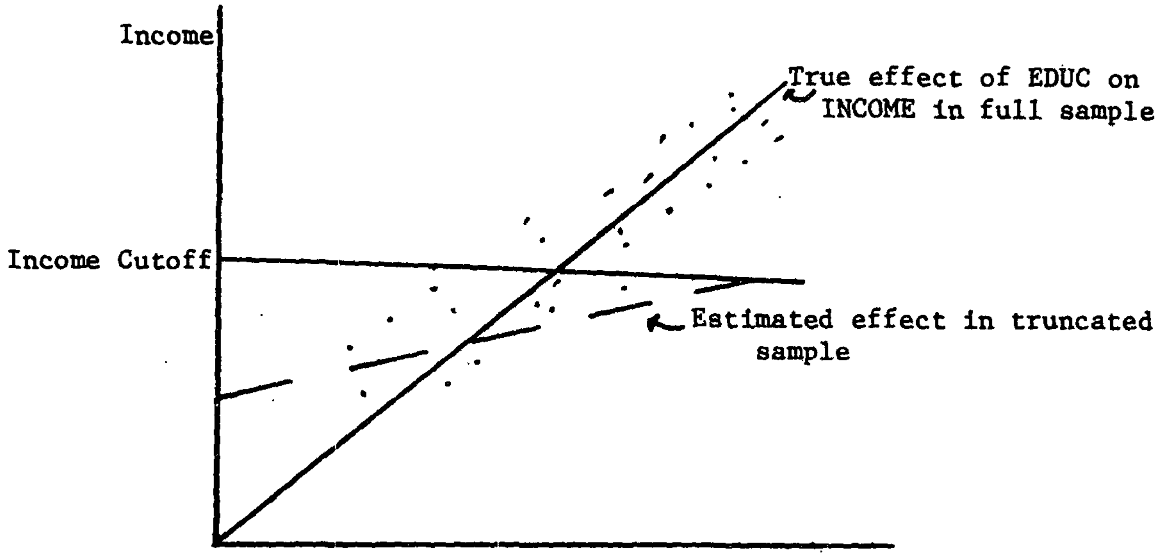
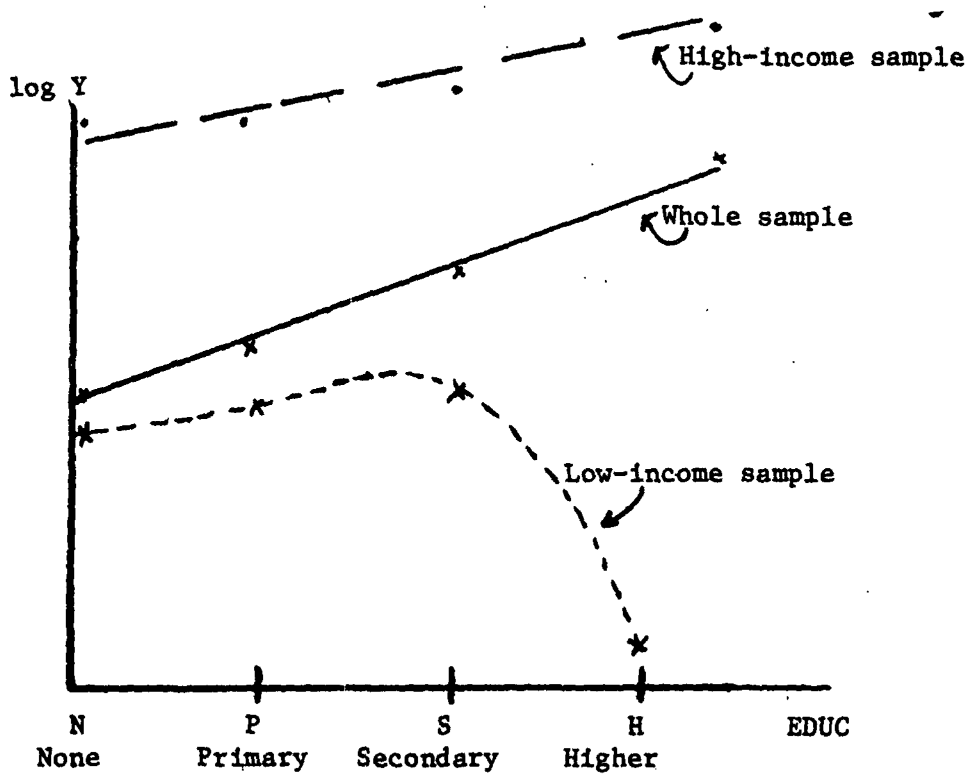


Figure 5:

ESTIMATED EDUCATION-INCOME RELATIONSHIPS
FOR WHOLE SAMPLE AND TRUNCATED SAMPLES IN BOGOTA



C. Conclusions on Different Benefits of Education for Different Groups

In light of the interpretative issues raised in section B, what lessons are we to draw from the empirical evidence in section A? We may legitimately conclude from the available evidence that the benefits of education _are_ greater for some groups than for others. The evidence may properly be interpreted as showing that, given the same measured education and skills, men earn more than women in most if not developing countries; some racial groups in some countries do better than others; in-migrants in several countries fare as well as comparable lifelong residents at destination; and workers from poor socioeconomic backgrounds in several countries do as well as workers with the same education and experience who come from more advantaged backgrounds. These conclusions are derived from single-equation earnings functions which contain shift variables for exogenous income-determining variables.

When samples are stratified by these exogenous variables (see Table 7), it may legitimately be inferred that the benefits from education are greater for men than for women in many countries, for Malays as compared with non-Malays in Malaysia, and for non-African workers in Tanzania.

There are indications of other earnings differences among groups defined according to endogenous income-determining variables, which include occupation, industry, firm size, and region. Although biased to a certain degree, the estimated coefficients on these variables in single-equation earnings functions, and the estimated earnings functions themselves, differ so markedly as to suggest that education indeed receives more rewards in certain sectors of employment or regions than in others. Among the apparent findings of the studies noted in Table 7 are larger returns to education among modern sector workers versus traditional sector workers in Colombia and Singapore; among white-collar versus blue-collar workers in Malaysia; among urban versus rural workers in Colombia; for various occupational groups in Brazil, Colombia, Iran, Malaysia, Peru, Thailand, and Vietnam; for workers in various industries in Brazil, Chile, India, and Malaysia; and for persons in various regions of Colombia and Yugoslavia.

The relationship between returns to education and income itself also demands attention. It may correctly be said from the available evidence that, given the same education, the children of the poor generally do as well in the labor market as the children of the nonpoor. Moreover, despite some authors' claims to the contrary, existing studies have not established that the poor themselves have less to gain from further education than have others.

IV. WHO RECEIVES HOW MUCH EDUCATION AND WHY?

A. Differential Participation in Education

Education in developing countries is highly valued for the income and nonincome benefits it brings. Still, very many children receive little or no education. One reason for this is the favored access to education enjoyed by some individuals and the lack of school spaces for others. Another reason is that, even if school spaces are available, parents may choose not to send their children to school. This may be because of the need for their children's labor in family farms or businesses, inability to pay school fees, or lack of conviction that expenditures on education will prove to be worthwhile (for example, because the family is part of a group that is discriminated against). Research studies have demonstrated that all these factors contribute to explaining patterns of school attendance and absence. 1/ However, the relative strength of supply-side and demand-side factors has not yet been analyzed definitively.

From the point of view of income distribution, given that only some people get educated, an important aspect is which people get educated how much. Unesco publications and other data sources document that educational systems in developing countries cater more to some groups than to others.

1. Males and Females

Table 8 shows that in developing countries, parents tend to favor the education of their sons over their daughters. For developing countries as a group, the probability of a male in the school age group (6-23 years old) being enrolled is about 40 percent higher than that of a female. Wider differences also exist in some regions; for example, in the Arab states this figure reaches 70 percent.

The table also shows that educational opportunities by sex are even more pronounced at older ages, which correspond to the higher educational levels. Again for developing countries as a group, the probability of a male being enrolled is higher than that of a female, by 30 percent for the first age group (6-11 years), 48 percent for the second (12-17 years), and 84 percent for the last (17-23 years).

The evidence in Table 8 also shows that, with the expansion of the educational systems in the last fifteen years, these differentials have been reduced noticeably. Nonetheless, the gaps that remain are large and unfortunate.

1/ A review of this literature is now being prepared by Mary Jean Bowman and C. Arnold Anderson.

Table 8

ENROLLMENT RATIOS BY AGE GROUPS AND SEX, DEVELOPING COUNTRIES, 1960 & 1975

		Age Groups											
		6-11			12-17			18-23			6-23		
	Year	MF	M	F	MF	M	F	MF	M	F	MF	M	F
Developing countries	1960	46.8	56.1	37.2	21.6	28.3	14.9	3.6	5.2	1.9	26.6	32.9	20.1
	1975	61.8	69.8	53.5	35.3	42.0	28.3	9.0	11.6	6.3	38.7	44.8	32.3
Africa (excluding Arab states)	1960	30.1	37.1	23.1	17.4	23.0	11.9	1.4	2.2	0.6	18.0	22.9	13.2
	1975	48.9	55.4	42.5	30.7	37.7	23.7	3.9	5.8	1.9	30.7	36.1	25.3
Latin America	1960	58.5	59.0	58.0	36.2	38.7	33.5	6.3	7.8	4.9	37.3	38.8	35.8
	1975	77.9	77.7	78.2	56.5	58.4	54.4	19.7	22.0	17.5	54.7	55.9	53.4
Asia (excluding Arab states)	1960	53.9	64.8	42.6	25.8	32.9	18.5	3.9	6.0	1.8	30.5	37.7	23.1
	1975	63.6	72.8	53.8	35.0	42.0	27.6	8.1	11.1	4.9	38.9	45.7	31.6
Arab states	1960	39.1	49.9	27.9	18.0	25.7	10.0	3.9	6.4	1.3	22.6	30.2	14.8
	1975	59.1	71.8	46.0	34.6	44.6	24.2	12.3	17.1	7.2	38.5	48.2	28.5

Source: Unesco Statistical Yearbook, 1976.

2. Ethnic and Religious Groups

Table 9 shows that some ethnic or religious groups within developing countries have less access to education. Contrast, for example, the distribution by educational levels of the white and the nonwhite population in Mozambique, or in Peru, that of Spanish-speaking people and those whose maternal language is indigenous. These are also some wide educational differences among ethnic groups in Sri Lanka. Less clear are the differences in educational attainment between Malay and Chinese employees in Malaysia. Although idiomatic and cultural differences probably account for a significant part of the inequality in educational attainments, unequal opportunities and discrimination against certain groups probably hold the key to understanding the observed patterns.

3. Urban and Rural Areas

In most developing countries, urban children have many more opportunities to attend school than rural children. Some regions have virtually no upper-level schools or persons educated up to the secondary level or beyond. Although rural parents may express less demand for education than urban parents, the main reason for the disparity in rates of education between urban and rural children appears to be that more resources for education are provided in urban areas - hence, more schools are built and more school spaces are available.

These differences are reflected in the educational composition of the urban and rural labor forces, for which evidence is presented in Table 10. For the fourteen developing countries covered, we can clearly see that wide disparities exist between urban and rural areas. The proportion of people in the rural areas with no schooling is always higher than that of the urban areas, whereas the opposite is true for secondary and postsecondary levels. Clearly, the lack of rural educational opportunities and selective rural-urban migration of the highly educated combine to leave the rural areas with only limited human resources.

4. Socioeconomic Status

There exists substantial evidence that poorer families are unable to enroll as large a proportion of their children in school as are the more advantaged groups. Moreover, children coming from well-to-do families are significantly overrepresented at the higher educational levels. The reasons for these disparities are addressed in Section IV.B.

Table 11 presents, for four developing countries, the proportions of children enrolled broken down by parents' socioeconomic status. In all cases it is evident that enrollment rates are higher the better the position of the parents. In Colombia, for example, the lowest 60 percent of the families (with annual per capita income less than 36,000 pesos) enroll fewer than 50 percent of their children in education, whereas the enrollment rates among the top 7 percent (more than 120,000 pesos annually) rise to more than 60 percent.

Table 9:

EDUCATIONAL ATTAINMENT BY RACE, TRIBE OR RELIGIOUS GROUPS, SELECTED DEVELOPING COUNTRIES

Country and source	Group	Educational attainment (percent)				
		No schooling	First level	Second level	Post-secondary	
Algeria, 1954 (Source: UNESCO Statistical Yearbook, 1976)	Total population a/	79.8	18.1	1.7	0.4	
	Moslem population a/	92.7	7.2	0.2	0.0	
		No formal schooling	Primary school	Some or completed secondary	Post-secondary	
Malaysia, 1974 b/ (Source: Mazumdar 1979)	Males, Kuala Lumpur					
	Malay	2.0	42.7	48.7	6.6	
	Chinese	3.5	43.5	47.9	5.2	
	Males, East Coast towns					
	Malay	9.4	55.2	33.4	2.0	
	Chinese	4.1	40.0	52.4	3.8	
	Females, Kuala Lumpur					
	Malay	1.5	25.7	66.2	6.6	
	Chinese	7.1	39.0	51.6	2.3	
	Females, East Coast towns					
	Malay Chinese	14.8	10.9	50.6	3.7	
	Chinese	7.7	30.9	57.7	1.9	
		Illiterate	Literate	Primary	Secondary	Higher
Mozambique, 1955 (Source: Population Census, 1955)	Total population c/	26.8	27.7	32.8	11.0	1.7
	White	16.7	27.7	36.5	16.3	2.8
	Yellow	38.5	27.0	28.7	5.5	0.2
	Indians	36.7	30.7	25.1	7.1	0.4
	Mixed	41.7	26.4	28.6	3.2	0.1
	Blacks	35.2	28.4	34.2	2.2	0.0
Peru, 1972 (Source: Oficina Nacional de Estadisticas y Censos, 1974)	Maternal language	Without schooling	Primary	Secondary	Higher	Not specified
	Total d/	30.2	51.2	14.8	3.0	0.9
	Spanish	21.6	54.5	19.1	3.9	1.0
	Quechua	50.3	43.7	4.8	0.7	0.5
	Aymará	42.2	51.7	5.0	0.6	0.4
	Other autochthonous	56.9	35.7	3.1	0.6	3.7
	Foreign	6.2	27.8	37.5	20.9	7.6
Sri Lanka, 1967 (Source: cited in Leonor 1977)	Ethnic group	Population e/	University admission			
	Sinhalese	71.0	84.1			
	Ceylon Tamil	11.1	14.1			
	Muslim	6.7	1.4			
	Burgher	0.4	0.1			
	Indian Tamil	10.6	0.1			
	Other	0.2	0.2			
	Total	100.0	100.0			
	Religion					
	Buddhist	66.3	79.2			
	Hindu	18.4	10.9			
	Muslim	6.9	1.4			
	Christian	8.3	7.8			
	Other	0.1	0.7			
	Total	100.0	100.0			

a/ Refers to population 25 years or older.
b/ Information is on employees only.
c/ All civilized popualtion.
d/ Includes population 5 years or older.
e/ Distribution of population by ethnic group corresponds to 1963.

TABLE 10

Distribution of Population by Educational Attainment in Urban and Rural Areas Selected Developing Countries Highest Educational level attained

Country	Year	Area	No schooling	First level	Secondary level	Post-secondary
Algeria	1971	Total	84.4	13.0	2.2	0.3
		Urban	73.5	20.5	5.2	0.8
		Rural	89.9	9.2	0.6	0.1
Kenya	1969	Total	75.9	20.5	2.8 a/	0.8 a/
		Urban	46.9	37.0	5.3 a/	10.7 a/
		Rural	79.5	18.5	1.1 a/	0.9 a/
Tunisia	1966	Total	89.1	7.1	3.0	0.7
		Urban	78.4	13.7	6.3	1.7
		Rural	96.4	2.7	0.8	0.1
Dominican Republic	1970	Total	40.1	45.9	12.1	1.9
		Urban	22.9	49.5	23.5	4.1
		Rural	52.8	43.2	3.7	0.3
Guatemala	1973	Total	93.9		4.9	1.2
		Urban	85.2		11.8	2.9
		Rural	98.7		1.1	0.2
Chile	1970	Total	13.1	61.0	22.2	3.8
		Urban	8.3	60.1	27.0	4.8
		Rural	29.8	64.2	5.4	0.6
Colombia	1973	Total b/	22.4	55.9	18.4	3.3
		Urban b/	14.2	54.8	26.1	4.9
		Rural b/	38.4	58.0	3.5	0.2
Paraguay	1972	Total	19.6	68.0	10.3	2.1
		Urban	11.2	63.6	20.4	4.8
		Rural	25.5	71.1	3.1	0.2
India	1971	Total	72.2	22.7	3.9	1.1
		Urban	46.6	36.8	12.3	4.2
		Rural	78.6	19.2	1.8	0.3
Indonesia	1971	Total	55.3	39.1	5.1	0.5
		Urban c/	22.0	56.9	14.1	7.0
		Rural c/	45.2	51.4	2.1	1.3
Korea	1970	Total	72.6		21.8	5.6
		Urban	53.0		36.0	11.0
		Rural	86.2		12.0	1.8
Malaysia (West Malaysia)	1970	Total d/	40.6	44.6	9.3 a/	5.5 a/
		Urban d/	32.2	42.7	14.0 a/	11.1 a/
		Rural d/	43.9	45.4	7.4 a/	3.2 a/
Sri Lanka	1971	Total	29.5	58.9	9.4	2.3
		Urban	20.6	58.8	16.8	3.9
		Rural	32.3	58.9	7.1	1.7
Yemen, Democratic Republic	1973	Total c/	72.9	22.1 e/	5.1 e/	
		Urban c/	59.1	30.2 e/	10.7 e/	
		Rural c/	80.0	17.9 e/	2.1 e/	

Source: UNESCO Statistical Yearbook, 1976

Note:
a/ Those persons with completed secondary education are also included in the post-secondary figures.
b/ Considers population of more than 20 years old.
c/ Considers population of more than 10 years old.
d/ Considers all population.
e/ Those persons with completed primary education are also included in the post primary figures.

Table 11:

ENROLLMENT RATIOS BY PARENTS' SOCIOECONOMIC POSITION, SELECTED DEVELOPING COUNTRIES

Country and Source	Socioeconomic indicator	Enrollment (percent)	
Brazil, 1970 (Source: Jallade 1977)	Socioeconomic group of head of household	Average monthly earnings (cruzeiros)	Enrollment ratios in basic education a/
	Total males (nonfarm)	873	77.5
	Migrants from urban areas	688	79.9
	Migrants from rural areas	691	69.1
	Low socioeconomic background	247	63.1
	Total males (farm)	252	45.0
	Migrants from rural areas	316	45.8
	Low socioeconomic background	91	37.2
	Total females (nonfarm)	380	76.8
	Migrants from urban areas	520	77.5
	Migrants from rural areas	247	66.7
	Low socioeconomic background	187	64.4
	Total females (farm)	112	44.5
	Migrants from rural areas	96	43.2
	Low socioeconomic background	64	37.2
Colombia, 1970 (Urban) (Source: Jallade 1974)	Income bracket (pesos yearly)		Enrollment ratios in all levels b/
	0 - 6,000		48.5
	6,000 - 12,000		43.1
	12,000 - 18,000		45.4
	18,000 - 24,000		48.2
	24,000 - 30,000		48.7
	30,000 - 36,000		47.6
	36,000 - 48,000		52.0
	48,000 - 60,000		54.4
	60,000 - 72,000		52.9
	72,000 - 84,000		56.8
	84,000 - 120,000		58.3
	120,000 - 180,000		64.9
	180,000 - 240,000		66.2
	Over 240,000		61.9
	Total		50.8
Colombia, 1974 (Source: Selowsky 1979b)	Quintiles of household per capita income (poorest to richest)	Enrollment ratios in primary education c/	Enrollment ratios in secondary education c/
	1	72.2	17.1
	2	84.0	21.9
	3	86.6	28.2
	4	95.1	43.8
	5	89.8	62.5
	Average	82.9	31.5
India, 1962 (Rural)	Occupation (Cultivators)		Enrollment Ratios in all levels d/
	Big		61.0
	Medium		48.8
	Small		41.5
	Landless		34.9
	All groups		48.9
Malaysia, 1974 (Source: Datta and Meerman 1979)	Quintiles of household per capita income		Enrollment ratios in primary education e/
	1		.85
	2		.86
	3		.93
	4		.99
	5		.90
	Mean		.90

a/ Enrollment ratios are for children 6-14 years old, apparently classified by socioeconomic group of head of household; basic education includes primary and lower secondary levels.

b/ Enrollment rates are for children 5-25 years old, classified by family income.

c/ Enrollment rates are for children 6-12 years old for primary level and 13-19 years old for secondary level; in both cases children are classified by family per capita income.

d/ Enrollment rates are for children 5-15 years old, classified by family landholding status.

e/ Enrollment rates are for children of primary school age, classified by family per capita income.

Disparities among socioeconomic groups are even greater at the higher educational levels. As Table 12 shows, higher-level students are disproportionately from better-off families, whatever the measure of status.

It is noteworthy that participation in education thus appears to be more equally distributed than income. Differences in enrollment rates between socioeconomic groups are never larger than a factor of 2, whereas the incomes of the groups concerned vary by a factor of 10 or more.

It is also true that the educational systems in developing countries are not completely closed to children from a poorer socioeconomic background. If we look at the composition of the student body, we see that significant numbers of students from low socioeconomic backgrounds are enrolled in the higher levels of education. Note, for example, that in Colombia in 1967, 23 percent of the university students had parents with primary education or less; in Kenya in 1970, about 50 percent of students in the teaching training colleges had parents with no education (Table 12).

The distribution of education among a sample of 331 urban workers in Colombia and of those workers' parents is presented in Table 13. This data set shows that, although there is a pronounced relation between parents' and children's education, the correlation is far from perfect. There are large numbers of workers in the younger generation whose education greatly exceeds their parents', even after allowing for the general expansion of Colombia's educational system in the last generation; and at every educational level, considerable numbers of younger workers have attained less education than their parents.

Those who argue that educational systems are stratified and closed to the children of the poor see the facts in one way, and those who characterize developing countries' educational systems as vehicles for social mobility see the facts otherwise. There is truth in both perceptions.

5. Influence of Family Background on Achievement

In the earlier parts of this section, the emphasis was on quantity of education. If we look instead at the cumulative effects of quality, as measured by students' test scores, there seems to be a consensus that family background is a statistically significant determinant of students' measured achievement in school (Bhagwati 1973; Bowles 1971; Psacharopoulos 1978). The empirical evidence is less clear on the extent of this influence, not only in absolute terms but also as compared with other variables affecting achievement, such as student characteristics or school inputs.

An example of this evidence is reported by Leonar (1977) and is reproduced in Table 14. Students in four developing countries were given a common reading comprehension test. Students with more-advantaged socioeconomic backgrounds achieved higher scores in some of the learning categories, but in many more cases the differences in achievement were not significant. The evidence does not allow us to assess the importance of socioeconomic background in explaining the observed differences in scores.

Table 12:

DISTRIBUTION OF HIGHER EDUCATION STUDENTS BY PARENTS' SOCIOECONOMIC BACKGROUND, SELECTED DEVELOPING COUNTRIES

Country and Source	Socioeconomic indicator	Distribution of education among students' parents (percent)	
	Level of instruction of fathers	University students	Men, 40-59 years old
Colombia, 1967 (Source: Rama 1969)	Primary or less	23.0	89.4
	Secondary	42.0	9.0
	University, incomplete	8.0	0.3
	University, complete	24.0	1.4

Country and Source	Average monthly income of family (Rs.)	College graduates	Income distribution of all families: Urban	Income distribution of all families: Rural
India, 1954 (Source: cited in Bhagwati 1973)	Below 200	29.1	80.3	90.6
	200-499	45.7	15.7	8.5
	500 and above	23.3	4.0	0.9
	Not known	1.9		

Country and Source	Occupational category	Primary TTCs a/	Secondary TTCs a/	University of Nairobi	Reference group
(Source: Fields 1975b)	High and middle level manpower	23	19	35	3 b/
	Entrepreneurs, traders and businessmen	9	9	20	--
	Small-scale farmers	54	60	44	66 b/
	Unskilled and traditional	14	12	1	31 b/
	Educational attainment				
	None	49	48	21	80 c/
	At least some primary	44	48	56	18 c/
	Secondary or beyond	7	5	22	2 c/
	Percentage landowners	87	87	73	72
	Acreage if landowners				
	0.1 - 4.9	34	32	15	52 d/
	5.0 - 24.9	56	56	50	41 d/
	25 and over	10	12	38	7 d/

Country and Source	Occupational group of students/household heads	University students	Male labor force
Korea, 1970 (Source: Snodgrass 1977)	Professional, technical and related	6.5	6.1
	Administrative and related	5.9	---
	Clerical and related	10.7	8.1
	Sales	14.9	11.1
	Service	4.4	4.4
	Agricultural, fishermen, and the like	12.7	45.8
	Production, transport, laborers	10.7	24.5
	Others	34.0	---

--- Not available

a/ TTC = Teacher Training Colleges.
b/ Reference group: all adult males.
c/ Reference group: all African males 40 years old and over.
d/ Reference group: percentage of number of landholdings.

Table 13:

EDUCATION OF PARENTS AND OF THEIR CHILDREN, FOUR COLOMBIAN CITIES, 1967

Education of younger generation (years)	Mean education of parents (years) 0	1-3	3-5	5-8	8-11	11 or more	Average (total)
0	3.6% (12)	0.9% (3)	0.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	4.8% (16)
1-3	7.5% (25)	10.0% (33)	4.5% (15)	0.9% (3)	0.0% (0)	0.0% (0)	23.0% (76)
3-5	3.6% (12)	11.5% (38)	13.0% (43)	1.5% (5)	0.6% (2)	0.0% (0)	30.2% (100)
5-8	0.9% (3)	4.5% (15)	8.2% (27)	3.0% (10)	0.9% (3)	0.0% (0)	17.5% (58)
8-11	0.3% (1)	2.7% (9)	5.4% (18)	3.9% (13)	2.4% (8)	0.6% (2)	15.4% (51)
11 or more	0.0% (0)	0.3% (1)	2.1% (7)	2.7% (9)	2.7% (9)	1.2% (4)	9.1% (30)
Average (Total)	16.0% (53)	29.9% (99)	33.5% (111)	12.1% (40)	6.6% (22)	1.8% (6)	100.0% (331)

Note: Numbers in parentheses are numbers of individuals in that cell.

Source: Fields (1976, Table 7).

Table 14:

STANDARDIZED MEAN SCORE DIFFERENCES IN READING COMPREHENSION TEST BY SOCIOECONOMIC GROUP, SELECTED DEVELOPING COUNTRIES

Item tested	Children of professionals or executives vs. children of laborers				Children of professionals or executives vs. children of farmers or rural workers		
	Chile	India	Iran a/	Thailand b/	Chile	India c/	Iran
Functional information	.031	.407 d/	.108	.012	.607 d/	.393	.071
Comprehension	.725 d/	.211	.090	.162	.574 d/	.940	.163
Application	.656 d/	.146	.015	.115	.607 d/	.653	.495
Higher mental processes	.262	.104	.374 d/	.025	.561	.063	.204

Note: The data represent the results from a common test applied by the International Association for the Evaluation of Educational Achievement in 21 countries. The population considered in the table are students in the last secondary grade.

Source: Leonor (1977).

a/ Laborers are semiskilled workers.
b/ Laborers are craftsmen and skilled farmers.
c/ Rural workers are large-scale farmers.
d/ Coefficients represent differences between the means (for the two classes being compared) divided by the standard deviation for the population. Significant at 5 percent level or better.

A different line of research on school achievement takes as its starting point the educational production function. These studies regress some indicator or indicators of educational performance against a set of variables which usually includes the student's personal and family characteristics, school inputs, peer or fellow student characteristics, and other relevant external influences.

The evidence from educational production functions in developing countries has been surveyed recently by Schiefelbein and Simmons (1979). On the basis of twenty-six studies from more than twenty developing countries, they find that the socioeconomic status of the students' parents is a statistically significant predictor of school achievement in ten out of thirteen studies in which it is included. Moreover, many of these studies find that family background is the single most important determinant of school achievement. No indication is given, however, of how important the socioeconomic variable is, for example, in explaining differences in achievement among students, or in relation to other explanatory variables. Less clear is how these differences in school achievement affect future earnings. Empirical evidence in this respect does not exist for developing countries.

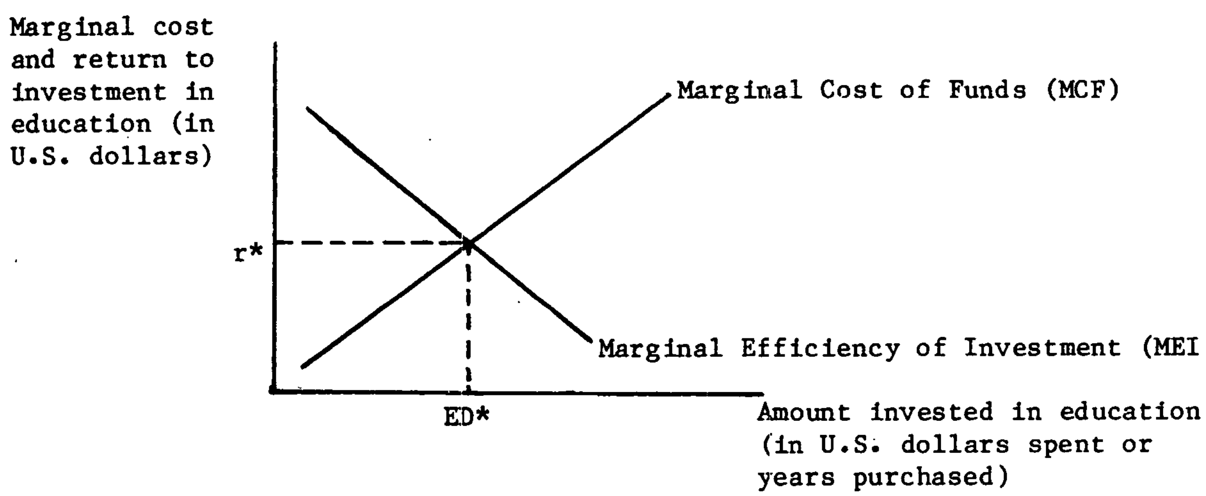
B. On the Intergenerational Correlation of Education and Income

The association between parents' and children's educations across generations is well established from evidence such as that given in the foregoing section. Nobody questions that the children of the poor get less education on average than the children of the well-to-do. The question is why.

The literature offers varying interpretations for the intergenerational correlation of educational attainments and for education's role in transmitting economic status across generations. These fall into two general classes: human capital theories and social stratification theories.

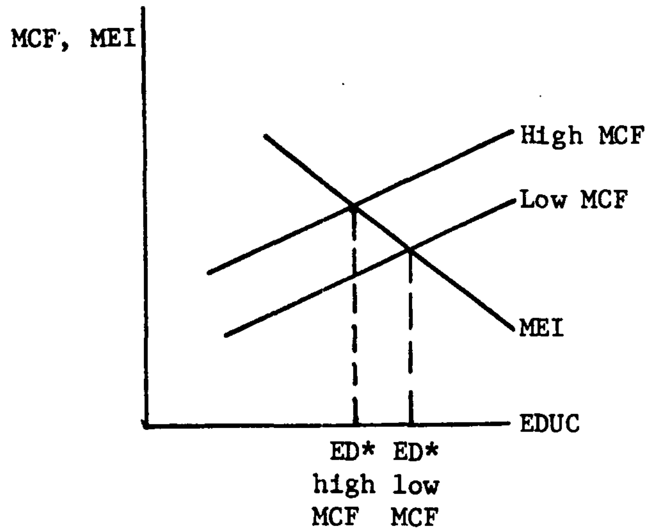
The human capital theories emphasize the private benefits and costs associated with personal investments in education as the cause for intergenerational correlation of educational attainments and incomes. Individuals (or families acting on behalf of their children) are thought to choose that level of education for which the present value of expected future income (or utility) is maximized. The reason why some individuals get more education than others in human capital theory is that persons differ in their ability to benefit from education or in the costs they must pay to acquire the education, or in both. Imperfections in capital markets, lack of schools in a particular locale, or other barriers to investment in human capital - if they are considered at all in human capital theory - are typically considered as of secondary importance.

As formulated by Becker (1964 and second edition 1975; 1967) and amplified by Becker and Chiswick (1966), the human capital model closely parallels basic investment theory. The functions describing the private benefits and costs from investment in education correspond to the marginal efficiency of investment and marginal cost of funds schedules in the standard theory of investment. The marginal efficiency of investment function (MEI) gives the return on the marginal dollar spent on the last year of education. This function is thought to slope downward because of diminishing returns. The marginal cost of funds (MCF) function represents the cost of the funds needed to pay for the education. This function increases with the amoung of education, reflecting both increasing opportunity costs (because the better-educated forgo more income during the marginal year of school than do those with less education) and increasing direct costs (moving from the range where educational fees are paid for by the state, then to forgone consumption, then to withdrawals from savings, and then to increasingly expensive sources of borrowing). The downward-sloping MEI schedule and upward-sloping MCF schedule confronting a particular individual are illustrated in the following figure:



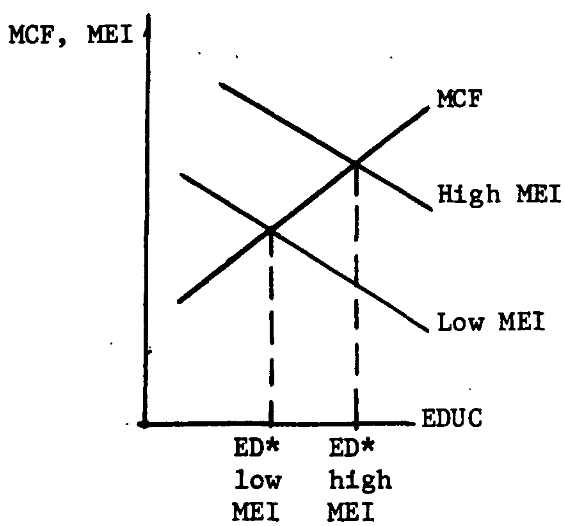
According to human capital theory, the individual in question would choose a quantity of education (ED*) and earn a marginal rate of return (r*) on his investment, because that is the level at which the marginal benefits and marginal costs of educational investment are equalized.

Intergenerational aspects enter in by considering how the MCF and MEI functions are linked with parents' education and other aspects of the person's socioeconomic background. Well-to-do parents are apt to be better educated. These well-to-do parents presumably face lower costs than do poor parents, probably in absolute terms and certainly in relation to their income. They are much less dependent on their children's labor; they can reduce consumption while the poor must reduce savings; draw on savings while the poor must borrow at high rates of interest; or borrow at whatever rate while the poor cannot borrow at all. Thus, the marginal cost functions are likely to be systematically higher for the children of the poor than for children from more favorable socioeconomic backgrounds. Individuals with high marginal cost functions, who must pay more to finance their education, would be expected to invest less in it than individuals with low marginal cost functions, as shown in the following figure:



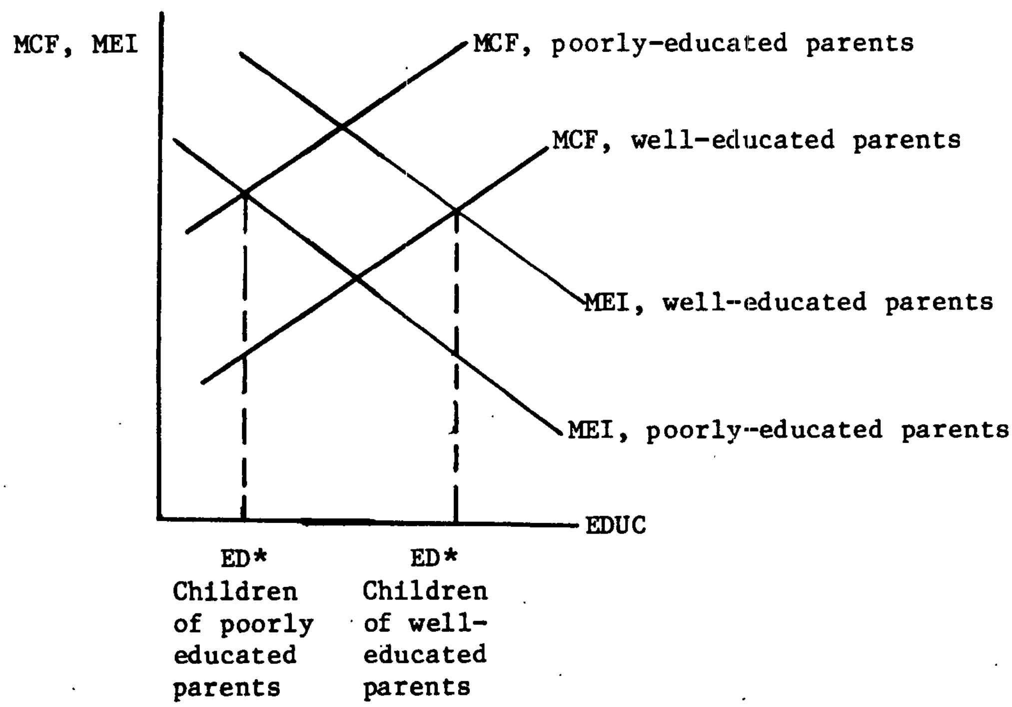
This is one reason why, in human capital theory, a correlation in educational attainments across generations would arise: poor parents must pay more and so they invest less; the less-educated are more apt to be poor, hence the less-educated parents have less-educated children.

The other set of explanations offered by human capital theory for the perpetuation of relative educational positions across generations is on the benefit side. Some individuals earn more than others in the labor market because of superior intelligence, greater socialization toward acceptance of traditional lines of authority, better contacts with potential employers, or by discrimination against others unlike themselves. Such individuals gain more from the same education than do others, and so presumably invest more in education, as the following figure illustrates:



These same well-to-do individuals are able to transmit these advantages to their children in a variety of ways -- including genetic inheritance, type of upbringing, resources available in the home, favoritism in the job market. Hence it is reasoned that children from advantaged backgrounds benefit more from education and so invest more; better-educated parents are more apt to be well-to-do, therefore better-educated parents have better-educated children.

The arguments from the two preceding paragraphs are combined in the following figure:



This summarizes how human capital theorists explain inequality in educational attainments, the correlation between parental and child education, and the perpetuation of such patterns over time. According to human capital theorists, differences in education within a generation are explained by market opportunities; across generations, market forces explain why the children of highly educated parents are themselves more likely to be highly educated.

In each generation, people with more education earn higher incomes. Better-educated parents are apt to have both higher incomes and better-educated children. These better-educated children, in turn, are more likely themselves to have higher incomes. Consequently, a high correlation between parents' incomes and children's incomes is expected. Hence, human capital theory offers strong market-based explanations of why education transmits economic status across generations. If the cycle is to be broken, there is a need for market intervention on behalf of the children of poorly-educated parents, at a minimum by lowering the marginal cost of funds (MCF) they must pay, if not also by reducing differences in the marginal efficiency of investment (MEI) by breaking down discrimination and other barriers to their opportunities in the labor market.

Social stratification theories emphasize other aspects of the intergenerational transmission of economic position and the role of education in that process. Social inequality theorists place heavy weight on the role of intergenerational transmission of values: well-to-do parents inculcate their children with initiative, perseverance, appreciation of education, and acceptance of the existing socioeconomic order. Analysts of class structure, many of them radical in their orientation, note that individuals often agree, tacitly if not formally, to band together to advance their own group's interest. Examples are the exclusive job networks in which nepotism and favoritism are central in determining access to employment opportunities. Theorists who argue that the labor market is segmented focus on the barriers faced by the poor, who for example lack access to schools and therefore are not free to choose their level of education.

Together, these alternative theories challenge the human capital theorist's premise that educational outcomes reflect different individuals' assessments of the marginal costs and marginal benefits of further educational investments. Human capital theorists would respond by observing that even the least advantaged members of society usually could choose to invest in the education of their children <u>at some price</u>, though the price might be many times larger than the family's resources and thus would be prohibitive.

From my reading of the various literatures on the causes of inequality, I conclude that the various approaches are rather similar in their accounts of the <u>proximate</u> reasons for inequality and education's role in it. Analysts of various persuasions generally agree that the monetary costs and benefits of education are central to determining which parents spend how much on the education of their children; and education is usually seen as the most important determinant of a person's economic position (whether gauged by income, occupation, or some other measure).

The human capital and social stratification theories appear to differ in two important dimensions: stratification theorists go further than human capital theorists by looking to the functioning of the economic system and the social and historical context in which it operates to understand the <u>root</u> causes of inequality, and stratification theorists are less willing than human capital theorists to regard the resulting pattern of income distribution as <u>just</u> simply because market forces provide powerful explanations for the observed outcomes.

These various approaches have led to different hypotheses about the relationship between distribution of education and distribution of income. In the human capital tradition, Mincer (1970) and Chiswick (1971) reasoned that the degree of income inequality in a country should be related positively to at least four factors: (1) the level of education in the population, (2) the dispersion of education in the population, (3) the rate of return to educational investments, and (4) the dispersion in rates of return to educational investments. 1/ I shall not try to develop these models here; the interested reader is referred to Mincer's (1976) and Rosen's (1977) survey papers for reviews of the relevant literatures.

An alternative is the so-called job competition model (see Thurow 1975), by which an expansion of the educational system only affects the distribution of workers within the queue for jobs. Thus, if the distribution of job opportunities does not change, the overall income distribution does not change if more people are educated. All that happens is that the newly educated workers get jobs at the expense of those persons who do not get additional education. Moreover, Thurow's specific version of the model predicts that more people being educated would widen the wage differentials between the more educated and less educated, though other models similar to the job competition model suggest otherwise. 2/

A more radical approach associated with the names of Bowles, Gintis, and Carnoy has also been propounded. 3/ The essence of these views is a theory of class: the educational system helps to legitimize the positions of the elite at the top of the social structure and to perpetuate the existing social hierarchy and modes of production. The author say the educational system does this by establishing a meritocracy, by inculcating pupils with attitudes of acceptance toward the prevailing socioeconomic order, and by providing greater access to education for the children of more favored parents. Thus, in the radicals' conception, schooling (and its expansion) perpetuate income and class differences across generations. 4/

1/ The specific equation (from Chiswick, 1971) is:

$$\mathrm{Var}(\ln Y) = k^2 \, [N'^2 \, \mathrm{Var}(r) + r'^2 \, \mathrm{Var}(N) + \mathrm{Var}(N)\,\mathrm{Var}(r)]$$

where Y is individual earnings, k is the rate of human capital investment, N' is the average number of years of training in the population, and r' is the average rate of return to investment in training.

2/ Cf. the "bumping model" in Fields (1974).

3/ Early statements of these views may be found in Carnoy (1971) and Bowles (1971). More full developed treatments are the books by Carnoy (1972) and Bowles and Gintis (1975). Among their most recent works are Carnoy (1977) and Bowles (1978).

4/ In Bowles' words (1978, p. 784): "In this interpretation, the state serves to reproduce the social relations which define the position of the capitalist class and other dominant groups of the society... The educational system, as an important influence on political life, ideology, and the development of labor power as an input into the production process, is one of the main instruments of the state. The 'output' of school is the reproduction or transformation of social relations...."

To validate any of these alternative hypotheses, information is required on changes in income inequality in relation to changes in the distribution of education. So far, the data available are too scanty to permit systematic analysis.

C. Conclusions on Who Receives How Much Education and Why

It is clear from the evidence presented in this section that educational opportunities differ among different groups in developig countries. Whether stratified by sex, racial or tribal group, geographic location, or parents' socioeconomic status, differential participation in the educational system is a very important cause of income inequality and of its perpetuation over time. It has also been recognized that the children of the poor learn comparatively less well according to various measures of learning achievement. No direct evidence exists, however, on how such differentials affect income inequality in developing countries.

This section has considered alternative theories of the intergenerational correlation of educational attainments and of education's role in transmitting economic status across generations. Among the reasons why the least-advantaged groups invest less in the education of their children are market conditions that work against the poor and limitations on opportunities imposed by the class structures of stratified societies. Alternative theoretical paradigms lead to different predictions about whether income inequality will rise, fall, or remain unchanged as educational opportunities expand. Empirical testing , however, awaits better data.

V. THE SOCIAL BENEFITS OF EDUCATION

Given the evidence on the large private returns to education in developing countries, it would seem at first that the social benefits of education ought also to be considerable. The private benefits are frequently used with modification to approximate the social benefits of devoting further resources to education. This section reviews estimates of social returns to education in developing countries, summarizes the disagreement in the literature over the usefulness of the standard calculations, and considers another kind of social benefit -- reduced income inequality.

A. Education and the Incidence of Poverty

The evidence linking increased education with higher income and lower incidence of poverty is considerable. For 41 developing countries, Table 15 shows a clear correlation between the proportion of poor in a country (defined as persons with annual incomes below US$50 per capita) and the educational attainment of its citizenry (as measured by the proportion of adults with no schooling). For the countries in the table, the correlation coefficient between the percentage poor and the percentage unschooled is +0.45. But it is also evident that both measures are highly correlated with the level of gross national product (GNP) per capita; the respective correlation coefficients are -0.67 between the proportion of poor and GNP, and -0.51 between the proportion of adults with no schooling and GNP.

Table 15:

EDUCATION AND THE INCIDENCE OF POVERTY, SELECTED DEVELOPING COUNTRIES

	1969 GNP per capita (U.S. dollars)	Percentage of total population with annual incomes per capita below US$50	Percentage of adult population with no schooling a/
Latin America			
Argentina	1,054	...	8.3
Brazil	347	14.0	42.6
Chile	751	...	13.1
Colombia	347	15.4	22.4 c/
Costa Rica	512	2.3	20.6
Dominican Republic	323	11.0	40.1
Ecuador	264	37.0	32.9
El Salvador	295	13.5	54.7
Guyana	390	9.0	12.9 b/ d/
Honduras	265	28.0	65.9 b/
Jamaica	640	10.0	18.8 b/
Mexico	645	7.8	89.8 c/
Panama	692	3.5	24.9
Peru	480	18.9	35.0
Puerto Rico	1,600	...	14.4
Uruguay	649	2.5	14.1 b/
Venezuela	974	...	49.1 b/
Asia			
Burma	72	53.6	67.0 e/
India	100	44.5	72.2
Iran	350	8.5	88.5 f/
Iraq	316	24.0	94.9 f/
Korea	224	5.5	72.6
Malaysia	323	11.0	40.6 g/
Pakistan (East and West)	100	32.5	85.6 b/
Philippines	233	13.0	19.8
Sri Lanka	95	33.0	29.5
Thailand	173	26.8	34.1
Turkey	290	12.0	58.0 f/
Africa			
Chad	75	43.1	94.4 b/ h/
Gabon	547	15.7	87.6 b/ h/
Ivory Coast	237	7.0	95.0 b/ h/
Madagascar	119	53.8	66.5 h/
Niger	94	33.0	98.6 b/ h/
Rhodesia	274	17.4	43.0
Senegal	229	22.3	94.4 b/ h/
Sierra Leone	165	43.5	94.4 b/ h/
South Africa	729	12.0	49.5 b/
Tanzania	92	57.9	71.9 h/
Tunisia	241	22.5	89.1 f/
Uganda	128	21.3	71.8
Zambia	340	6.3	63.9

... Negligible.

Sources: For data on 1969 GNP and percentage of population with low annual income per capita, Ahluwalia (1974, p. 12); for percentage of population with no schooling, UNESCO Statistical Yearbook, 1976.

a/ Adult population refers to persons of 25 or more years old; information is for circa 1970.
b/ Circa 1960.
c/ Population 20 or more years old.
d/ Population 15 or more years old.
e/ Only urban areas, 1953.
f/ For 1965 or 1966.
g/ Includes all ages.
h/ Illiterates in the population 15 or more years old.

At the regional level within countries, Table 16 shows for nine Latin American countries that differences in poverty rates between urban and rural areas are associated with rural-urban education differences. Notably more poverty and greater illiteracy were observed in rural areas.

The whole literature on the relationship between education and poverty at the aggregate level is plagued by a persistent difficulty: the problem of two-way causation. One possibility is that the negative correlation between education and poverty arises primarily because a better-educated populace contributes to economic growth. This would be the position of human resource optimists. But there is another possibility. Undoubtedly, some poor countries spend little on education because they cannot afford to spend more. With economic growth comes the ability to spend more on both investment and consumption goods; education fits into both categories. Assuredly, educational growth causes economic growth and economic growth permits educational growth, but the relative importance of these two simultaneous effects has not yet been demonstrated satisfactorily.

In short, with more education comes less poverty, whether at the level of the nation, the region within a country, the family, or the individual. But, to repeat an earlier observation, the existing literature has not established to what extent education is the <u>cause</u> of poverty reduction and to what extent the <u>result</u>.

B. Social Rates of Return: The Evidence

Social rates of return are the standard approach in the economics of education for evaluating countries' past educational performance and in planning education for the future. I should say at the outset that I have serious conceptual reservations about the validity of these calculations for developing countries. But before I go into the reasons, let us look at the numbers.

Social rates of return have been calculated for many countries, both developed and developing. The available evidence has been synthesized by Psacharopoulos (1973) and is reported in Table 17.

Three findings of Table 17 are of interest. One is that, for nearly all countries at all educational levels, the private rate of return exceeds the social rate. For higher education, the difference is 6.2 percentage points (between an average private rate of return of 17.5 percent and an average social rate of 11.3 percent. For secondary education, the difference is smaller but still noticeable: 2.8 percentage points (the private return averages 16.3 percent, while the social return is 13.5 percent). That private returns are larger than social returns reflects society's subsidization of education, so that costs are borne partly by taxpayers and not fully by the students themselves. This is often thought necessary because individuals would otherwise invest too little in education compared with the true social payoff. Reasons for this claim are listed in Thurow (1970, Chapter 7).

Table 16:

EDUCATION AND THE INCIDENCE OF POVERTY: REGIONAL COMPARISONS WITHIN NINE LATIN AMERICAN COUNTRIES

	Percentage of households below the poverty line a/			Percentage of pop population that is illiterate b/		
	Urban	Rural	National	Urban	Rural	National
Argentina	5	19	8	5.8 c/	18.1 c/	8.6 c/
Brazil	35	73	49	20.0	53.6	33.8
Colombia	38	54	45	11.2	34.7	19.2
Costa Rica	15	30	24	4.9	17.0	11.6
Chile	12	25	17	7.6	27.2	11.9
Honduras	40	75	65	26.1 c/	64.6 c/	55.0 c/
Mexico	20	49	34	21.3 c/	48.9 c/	34.6 c/
Peru	28	68	50	12.6	51.9	27.6
Venezuela	20	36	25	20.9 c/	62.7 c/	36.7 c/

Sources: Altimir (1978) and UNESCO, Statistical Yearbook, 1976.

a/ 1970 estimates.
b/ The reference group is population 15 years or older; estimates are for the early 1970s except when noted.
c/ Circa 1960.

Table 17:

SOCIAL AND PRIVATE RATES OF RETURN BY EDUCATIONAL LEVEL AND COUNTRY, SELECTED DEVELOPING AND DEVELOPED COUNTRIES
(Percentages)

		Rate of return by educational level					
		Social			Private		
		Primary	Secondary	Higher	Primary	Secondary	Higher
United States	1959	17.8	14.0	9.7	155.1	19.5	13.6
Canada	1961	...	11.7	14.0	...	16.3	19.7
Puerto Rico	1959	17.1	21.7	16.5	> 100.0	23.4	27.9
Mexico	1963	25.0	17.0	23.0	32.0	23.0	29.0
Venezuela	1957	82.0	17.0	23.0	...	18.0	27.0
Colombia	1966	40.0	24.0	8.0	> 50.0	32.0	15.5
Chile	1959	24.0	16.9	12.2	...	...	...
Brazil	1962	10.7	17.2	14.5	11.3	21.4	38.1
Great Britain	1966	...	3.6	8.2	...	6.2	12.0
Norway	1966	...	7.2	7.5	...	7.4	7.7
Sweden	1967	...	10.5	9.2	...	...	10.3
Denmark	1964	...	...	7.8	...	...	10.0
The Netherlands	1965	...	5.2	5.5	...	8.5	10.4
Belgium	1967	...	...	9.3	...	...	17.0
Germany	1964	...	...	...	...	...	4.6
Greece	1964	...	3.0	8.0	...	5.0	14.0
Turkey	1968	...	...	8.5	...	24.0	26.0
Israel	1958	16.5	6.9	6.6	27.0	6.9	8.0
India	1960	20.2	16.8	12.7	24.7	19.2	14.3
Malaysia	1967	9.3	12.3	10.7	...	...	...
Singapore	1966	6.6	17.6	14.6	...	20.0	25.4
The Philippines	1966	7.0	21.0	11.0	7.5	28.0	12.5
Japan	1961	...	5.0	6.0	...	6.0	9.0
S. Korea	1967	12.0	9.0	5.0	...	...	...
Thailand	1970	30.5	13.0	11.0	56.0	14.5	14.0
Hawaii	1959	24.1	4.4	9.2	> 100.0	5.1	11.0
Nigeria	1966	23.0	12.8	17.0	30.0	14.0	34.0
Ghana	1967	18.0	13.0	16.5	24.5	17.0	37.0
Kenya	1968	21.7	19.2	8.8	32.7	30.0	27.4
Uganda	1963	66.0	28.6	12.0	...	...	...
N. Rhodesia	1960	12.4	...	...	...	...	...
New Zealand	1966	...	19.4	13.2	...	20.0	14.7

... Negligible

Source: Psacharopoulos (1973, p. 62).

Table 18:

DIFFERENCES BETWEEN PRIVATE AND SOCIAL RATES OF RETURN TO EDUCATION IN DEVELOPED AND DEVELOPING COUNTRIES
(Percentages)

Country type	Educational level					
	Secondary			Higher		
	Private	Social	Difference	Private	Social	Difference
Developed	11.9 (7)	9.5 (8)	2.4	11.9 (11)	9.4 (10)	2.5
Developing	18.5 (14)	15.2 (18)	3.3	22.0 (14)	12.3 (8)	9.6
All	16.3	13.5	2.8	17.5	11.3	6.2

Note: Numbers of countries are in parentheses.

Source: Psacharopoulos (1973, p. 67).

A second finding is that developing countries have higher rates of return on average than developed countries, as can be seen from Table 18. This finding is offered by some as evidence for the proposition that poor countries are underinvesting in education compared with richer countries (and, for that matter, compared with the opportunity cost of capital). One policy implication of this view might be to direct a large fraction of the world's resources toward education in low-income countries.

A third general pattern in Psacharopoulos' data is that primary education generally has a higher social rate of return than secondary and higher education, as Table 19 indicates.

Table 19:

RELATIVE RANKING OF SOCIAL RATES OF RETURN BY EDUCATIONAL LEVEL

Educational level	Number of developing countries by rank of social rate of return 1st	2nd	3rd
Primary	14	1	3
Secondary	4	9	5
Higher	--	8	10

Source: Psacharopoulos (1973, P. 66).

This is often taken to imply that these countries should invest a larger proportion of their educational budgets in lower levels of education. Some would even go so far as to say that the education sector is misallocating its resources if it puts money into higher education when the highest rate of return is elsewhere.

I agree with the practical conclusions of the preceding paragraphs but not for the reasons given. My reasons are given in the following section.

C. Critique of Social Rate of Return Analysis

Social rate of return analysis is predicated on the assumption that differences in incomes among individuals with different educational attainments reflect differences in their social marginal productivity, and that those differences are because of the education they have received. This assumption is indefensible, I submit, in the circumstances of substantial unemployment and underemployment that characterize most developing countries' labor markets. It is a matter of some debate whether social rates of return are even approximately valid under the conditions prevailing in the developing countries' labor markets. I think not, for reasons given below. Mine is, however, an unusually critical position. The mainstream view is more positive--see, for example, the survey paper by Berry and Sabot (1979) and the other papers in this volume.

A thorough social rate of return analysis would contain at least the following features:

- Identifying the Beneficiaries. Educational programs are usually justified on the basis of the number of beneficiaries. But also important here is a characterization of the beneficiaries by socioeconomic status. It should be shown that the beneficiaries are drawn from the selected group; fears that educational expansion caters mainly to the elite should be allayed.

- Measuring Size of Benefits. To assess the economic benefits, information is needed on what the newly educated persons are doing. What kind of work do they find and how much do they earn from it? How much more productive are they in that work after education than before? Are others without education being displaced, and, if so, what are they doing instead?

- Quantifying magnitude of costs. Account must be taken of both the direct costs of education and the opportunity costs. Often, for an educational program, the relevant comparison is with the costs of some other educational program. For example, the opportunity cost of educating one additional student for one year at a university is that of X fewer elementary school pupils.

- Estimating incidence of costs. School fees are typically a fraction of the total cost. The incidence of fees and forgone earnings parallels the incidence of benefits. But the incidence of other direct costs must also be estimated. This is where such features of the tax structure as its progressivity or regressivity, and overall budget surplus or deficit, enter in. It is probably the case in many developing countries that taxpayers as a group, including many poor families, help to subsidize the education of the few, who are drawn disproportionately from the middle and upper classes.

- Consideration of other social benefits. In concentrating here on the economic benefits, other social benefits should not be disregarded. These benefits should be considered, even though they probably cannot be precisely quantified.

Compared with this list, cost-benefit analysis of education as actually practiced (see Table 20) is strikingly deficient. It should be evident from Table 20 that the so-called "social rates or return" to investments in education leave a great deal to be desired. As conventionally computed, the average social rates of return neither indicate all the right questions nor measure all the right phenomena. A detailed critique of the usual methods appears in the appendix to this paper.

Table 20:

COST-BENEFIT ANALYSIS OF EDUCATION IN PRACTICE

Aspect of cost-benefit analysis	Treatment in literature
Identifying the beneficiaries	Number of beneficiaries usually is taken into account; composition of beneficiaries is usually ignored
Measuring size of benefits	Usually assumes that marginal benefits = average benefit; this is unjustifiable in cases of labor surplus (see appendix)
Quantifying magnitude of costs	Usually done well
Estimating incidence of costs	Sometimes included as an afterthought; most frequently is ignored
Consideration of other social benefits	Sometimes is done; may be used to override cost-benefit calculations

D. Distribution of Education and Inequality of Income

An important social benefit of education may be to affect the income distribution in such a way as to reduce income inequality. The available evidence is of two kinds: international cross-section at a single point in time, and intertemporal comparisons within countries. 1/

1. Cross-Sectional Studies

The earlier empirical studies, some in the human capital tradition and some not, performed cross-sectional analyses relating education variables to different countries' income inequality at a single point in time. One set of studies examined educational levels (as measured by school enrollment ratios, literacy rates, or average educational attainment) and consistently reported a negative relation between educational level and income inequality. 2/ Adelman and Morris (1973), using a sample of forty-three developing countries, concluded that the "rate of improvement of human

1/ In presenting this evidence, I pass over the question of how inequality is best measured. The inequality indices in common use are satisfactory for the purposes at hand.

2/ The reader may have noticed that the Mincer-Chiswick model leads to the prediction that level of education is positively related to income inequality, whereas the empirical evidence shows a negative relation. These are not necessarily inconsistent findings, since Mincer and Chiswick's predictions relate to *ceteris paribus* effects and the empirical evidence reflects the effects of everything, including changes in the education level.

resources" (as measured by the school enrollment rate) was a significant negative determinant of income inequality. A similar negative relation between school enrollment and income inequality was found in subsequent research by Chenery and Syrquin (1975), who used a somewhat larger sample of developing countries. Consistent with these results are the findings of Ahluwalia (1974, 1976a, 1976b), based on a sample of sixty-two developing countries, that higher levels of literacy are associated with lower relative income inequality in the cross section.

I am aware of three studies that have looked at the <u>dispersion</u> of education and its relation to income inequality. One is that of Chiswick (1971). Because of data limitations at the time, he was restricted to a cross section of just nine countries, four of them developing. Using three different inequality measures, he found a statistically significant relation between income inequality and the variable measuring inequality of educational attainments, with the anticipated positive sign in two out of three cases. The other study is that of Psacharopoulos (1978) - which for forty-nine countries (eleven of them developed), showed that educational inequality, was positively and significantly associated with the Gini coefficient of income inequality, even after controlling for the level of per capita income.

Further evidence on the relations between the level and dispersion of schooling and income distribution has been presented recently by Winegarden (1979). Using data from thirty-two countries (eighteen of them developing), he regressed the share of income of the bottom four-fifths of households in each country against the mean and variance of educational attainment of their population. His results were consistent with those of previous studies. Both the level <u>and</u> the dispersion of education are significant in explaining income inequality: the mean educational attainment is <u>negatively</u> related to income inequality, and greater inequality in educational attainment is associated with <u>higher</u> income inequality.

To summarize the cross-sectional evidence, studies to date suggest that those developing countries with higher <u>levels</u> of education exhibit <u>less</u> income inequality. With respect to the <u>dispersion</u> of education, the three studies reviewed above report that greater inequality of educational attainments is associated with <u>greater</u> income inequality.

2. <u>Intertemporal Studies</u>

Turning to intertemporal comparisons within countries, one finds that the evidence is limited. A number of observers (e.g., Jallade 1979; Carnoy 1977) have called attention to a seeming paradox: despite the rapid growth of educational systems in developing countries, there has been at best little reduction in income inequality in those countries. An analysis (Fields 1978b) for five developing countries (Brazil, Costa Rica, India, Philippines and Sri Lanka) concluded that there is "... a closer relationship between educational performance and <u>aggregate</u> economic growth than between educational performance and <u>distribution</u> (in terms either of relative inequality or of absolute poverty)."

These facts should not be regarded as anomalous, since it is the distribution of education, much more than the level of education, that we would expect to be associated with income inequality.

A more systematic method for investigating the relationship between education and income inequality has been applied by Langoni (1972) and Fishlow (1973) for Brazil. In trying to explain the increased inequality in incomes in Brazil over the 1960s, both studies decompose the change in income inequality, as measured by the log variance indicator, into three components: changes in the educational composition of the labor force, changes in the average incomes received by each educational group, and changes in income inequality within each educational group. 1/ According to Langoni and Fishlow, the changes in each of these components led to greater income inequality in Brazil. However, both authors strongly differ in how they interpret these changes. On the one hand, Langoni (1972) argues that increased inequality is a natural, but temporary, result of the speed at which the Brazilian economy grew, especially at the end of the 1960s. By this reasoning, increased income inequality should not be considered an undesirable aspect of economic growth over the period. On the other hand, Fislow (1973) emphasizes the role of governmental policies, which favored a select few, as the main cause of the increase in income inequality. In his view, rising inequality offsets the welfare gains associated with income growth, so that it is even questionable whether welfare increased at all.

What this debate points out, for our purposes, is that it is of primary importance to understand the causal mechanisms by which education and income distribution are related. Only with this understanding can the contribution of education to income equality (or inequality) be fully assessed.

1/ Chiswick and Mincer (1972) developed a different framework to explain changes in income inequality over time while working with a dynamic version of the basic human capital equation. The four human capital variables in their analysis are the level and dispersion of education and the level and dispersion of rates of return to education. If those four factors enter into the determination of income inequality at a single point in time, then, by first differencing, it follows that changes in income inequality over time can be explained in part by changes in those four factors, by the levels of those factors, and by the correlations among them. Chiswick and Mincer used this framework to analyze changes over time in income distribution in the United States. These authors are strong advocates of the human capital approach to income distribution analysis, which many students of developing countries find to be of positive but limited value. Logically, one need not adhere to all the premises of human capital analysis--in particular the strong market orientation and marginal productivity assumptions--to accept the Chiswick-Mincer formulas as a point of departure for empirical research.

E. Conclusions on the Social Benefits of Education

One social benefit of education is higher national income. Another is a lower incidence of poverty. The associations between the amount of education (as measured by school enrollment ratios, literacy rates, or average educational attainment), the level of national income, and the incidence of poverty are well documented. At the national, regional, or even micro level, when education goes up, aggregate income goes up and poverty goes down. But association is no proof of causation, since it is true both that a high level of education causes higher national income and reduced poverty and that higher national income and reduced poverty permit a high level of education. Researchers have not yet resolved which of these two simultaneous effects is relatively more important. But even if it were demonsrated that the principal reason for the observed correlations is that educational growth causes higher national income and reduced poverty, this would be presumptive but insufficient grounds for deciding to expand education, since the costs of further education have yet to be entered into the calculation.

The private benefits and costs of education are sometimes used with modification to approximate the social returns to devoting further resources to education. The consensus in the literature is that private rates of return to education appear to exceed social rates, that developing countries have higher rates of return on average than developed countries, and that primary education generally has a higher social rate of return than secondary or higher education. Though these conclusions may be right, they are based on what I consider to be a weak methodological foundation. There is some disagreement in the literature on the usefulness of standard social rate of return calculations under the labor market conditions that prevail in developing countries. I personally regard the estimates as so distorted that they greatly overstate the true social returns to higher levels of education, but my position is not generally shared. Although social cost-benefit analyses indicate the right questions, they must do a better job of answering them.

Another possible social benefit of education is diminishing income inequality. For evidence on the relations between education and income inequality, we must rely primarily on cross-sectional patterns. These patterns, though only suggestive, are consistent on two points: those countries with higher levels of education exhibit less income inequality on average; and, on balance, greater disparities in educational attainments among the population are associated with greater income inequality. Little evidence on intertemporal change is available, and what evidence there is is inconclusive. Systematic procedures have still to be applied to analyze the growth of education and changing income inequality in developing countries.

VI. EDUCATIONAL FINANCE AND INCOME DISTRIBUTION

Another way in which educational systems may affect the distribution of income is by charging some income groups a larger share of the costs of education than their children receive in benefits and by using the proceeds to subsidize the education of others. This chapter discusses how educational systems in developing countries are financed and how the costs and benefits of education are distributed across income groups.

A. Educational Finance

Are the costs of education in developing countries distributed equally? Or do some groups pay more than others? The answer may be found by estimating the social costs borne by different socioeconomic groups or income classes at different levels of education.

A first point is how much the educational system is financed directly by the students and their parents and how much it is supported publicly. Of course, in any given country, the answer depends on the extent of private vis-a-vis public education and on the amount of subsidization the government provides to each. A piece of evidence in this respect is presented in Table 21 for three Eastern African countries: Ethiopia, Kenya, and Tanzania. Some of the conclusions that can be drawn from these data are:

(1) In the three countries large proportions (90 percent or more) of the expenditures on education are directed to the public educational systems.

(2) The public educational systems are financed mainly by the government. In Ethiopia and Kenya public financing by the national government provides 70 percent of the total resources of the system. In the case of Tanzania the corresponding figure exceeds 90 percent.

(3) Household resources supply a relatively small proportion of the financing of public educational systems. Household resources are most important in Kenya, where they make up 17 percent of the financing of public education; in Ethiopia and Tanzania they provide only 1 percent of the total.

(4) Private educational systems are financed predominantly or exclusively by households' direct contributions. The respective proportions are 50 percent in Ethiopia, 90 percent in Kenya, and 100 percent in Tanzania. In all cases public financing of private educational systems is negligible.

(5) From (1) and (4) above, since most educational resources in these countries are spent on public education and since public education is funded predominantly by public financing, it follows that public taxes are the main source of educational finance in these countries.

Table 21

DISTRIBUTION OF TOTAL EXPENDITURES ON PUBLIC AND PRIVATE EDUCATION
BY SOURCES OF FUNDS, THREE EAST AFRICAN COUNTRIES

	Ethiopia 1970-71 (millions Ethiopian dollars				Kenya 1970-71 (millions Kenyan pounds)				Tanzania 1970-71 (millions Tanzanian shillings)			
Sources of financing	Public educational system	Private educational system	Total	%	Public educational system	Private educational system	Total	%	Public educational system	Private educational system	Total	%
National resources	93.2	8.9	102.1	72.4	37.9	5.8	43.7	89.7	548.3	16.8	565.1	97.3
Public financing	91.7	0.4	92.1	65.1	30.0	0.0	30.0	61.6	541.8	0.0	541.8	93.3
Household resources	1.3	8.2	9.5	6.7	7.1	5.5	12.7	26.1	6.1	16.8	22.9	3.9
Other private resources	0.2	0.3	0.6	0.4	0.8	0.3	1.0	2.0	0.4	0.0	0.4	0.1
Foreign Resources	31.4	7.7	39.0	27.6	4.7	0.3	5.0	10.3	15.6	0.0	15.6	2.7
External Loans	4.0	0.0	4.0	2.8	0.1	0.0	0.1	0.2	2.2	0.0	2.2	0.4
External assistance	27.4	7.7	35.0	24.8	4.6	0.3	4.9	10.1	13.4	0.0	13.4	2.3
Total	124.5	16.6	141.1	100.0	42.4	6.1	48.7	100.0	563.9	16.8	580.7	100.0

Source: ter Weele (1975): Tables 2-8, 3-9, 4-9.

These conclusions hold qualitatively for most developing countries. This being the case, it is important to determine who pays the taxes and who pays the fees that finance the private educational systems.

Studies of the incidence of taxes in developing countries have been synthesized in a review paper by de Wulf (1975), to which the interested reader is referred. It is beyond the scope of this paper to analyze in detail the methodology underlying the conclusions obtained. For our purposes it will suffice to extract the main conclusions, which are based on forty-four studies covering twenty-two less developed countries:

> For twelve of these studies, owing to their specific approach or their limited coverage, no general impression of suggested rate progression could be obtained. Of the remaining thirty-two studies, twenty-two suggested some progressivity in the effective tax rate schedule. This progressivity pattern was often an uneven one and frequently did not extend up to the highest income or expenditure brackets or started only from the second or third income class. The degree of progressivity of the tax rates also varied from steep (however defined) to moderate. The results of eight other studies could be characterized as suggesting some wandering proportionality in the rate pattern. These countries are mainly in Latin America... The taxes of only two countries (Greece and the Philippines) could be characterized as regressive.
>
> The general impression left by the studies surveyed here is that the tax system in developing countries tends to burden the incomes of rich families relatively more than the incomes of poor.

These studies are not without their limitations, as de Wulf himself points out. Despite the tentative nature of their results, however, it is fair to conclude that the higher income groups pay more absolutely, and an equal or higher proportion of their incomes relatively, to finance school costs as compared with the lower income groups.

A second issue is whose children attend private schools. A detailed study of Colombia by Jallade (1974) (see Table 22) clearly shows that, at all levels of education, those families in the higher income brackets are more apt to enroll their children in private schools. For example, in the top 20 percent of the families (annual incomes 60,000 pesos or more) 50-90 percent of the children at primary and secondary levels are in private schools, whereas in the lower 60 percent of the families (annual incomes less than 36,000 pesos) the comparable figure never exceeds 20 percent and is much lower in most cases. Moreover, if we consider that school fees vary widely from one private school to another and that families from the highest income brackets tend to send their children to the most expensive schools, we may infer that the distribution of fee payments in private schools is much more concentrated at the top of the income scale than the enrollment rates show.

Table 22:

DISTRIBUTION OF ENROLLMENT IN PUBLIC AND

PRIVATE SCHOOLS BY FAMILY INCOME LEVEL, URBAN COLOMBIA

(in Percentages)

	Educational level					
	Primary		Secondary		Higher	
Annual income bracket (pesos)	Public	Private	Public	Private	Public	Private
0- 6,000	95.0	5.0	95.0	5.0	--	--
6,000- 12,000	90.0	10.0	90.0	10.0	100.0	--
12,000- 18,000	85.0	15.0	85.0	15.0	100.0	--
18,000- 24,000	89.1	10.9	79.9	20.1	100.0	--
24,000- 30,000	89.1	10.9	81.0	19.0	95.0	5.0
30,000- 36,000	89.5	10.5	81.0	19.0	90.0	10.0
36,000- 48,000	64.8	35.2	58.9	41.1	85.7	14.3
48,000- 60,000	54.6	45.4	49.7	50.3	86.3	13.7
60,000- 72,000	42.5	57.5	38.7	61.3	67.1	32.9
72,000- 84,000	34.5	65.5	31.3	68.7	54.3	45.7
84,000- 120,000	22.4	77.6	20.3	79.7	35.2	64.8
120,000- 180,000	20.3	79.7	18.4	81.6	32.0	68.0
180,000- 240,000	11.9	88.1	11.1	88.9	19.2	80.8
Over 240,000	12.0	88.0	11.0	89.0	19.3	80.7
Total Enrollment	72.5	27.5	49.0	51.0	54.8	45.2
Number (thousands)	1,316	500	341	355	46	38

Source: Jallade (1974, Table 3.11).

To sum up, the evidence presented thus far shows that the financing of the educational systems in less developed countries is borne more than proportionally by the higher income groups. This is for two reasons.

Public Education. Public educational systems are heavily subsidized by governments. Thus, who bears the financing of public education depends mainly on the tax structure, which in turn seems to be proportional or even progressive to some degree in most less developed countries.

Private Education. Private educational systems draw students disproportionately from the upper income groups. Because private educational systems are in general financed through direct fees paid by the students (or their parents), and because the children of the higher-income families tend to enroll more frequently in private schools, it follows that the higher-income groups pay a disproportionately large share of the costs of private education.

The above conclusions pertain only to the incidence of the direct costs of financing the educational systems. There exist, however, opportunity costs borne by the students, or their parents, that are also relevant. These opportunity costs consist of the income the students could earn if they were working instead of being enrolled in schools. The richer families bear a more than proportional share of these opportunity costs, since a disproportionate number of students are from richer families because of the higher enrollment rates among the well-to-do. This is strengthened by the fact that opportunity costs increase with the level of education, and disparities among enrollment rates tend to be greatest at higher educational levels.

We may therefore conclude that both direct and indirect costs of education in developing countries are borne more than proportionally by upper-income families.

B. Distribution of Costs and Benefits of Education

In this part, the question under investigation is: how do the costs of education borne by parents in various income groups compare with the benefits received by their children? This requires us to compute the distribution of costs according to parents' income, the distribution of benefits according to parents' income, and then to compare the two. The studies reported below share this methodology.

The studies differ, however, in what specifically is included under costs and benefits. Some view the educational system primarily as a fiscal program that grants subsidies (benefits) to pupils and pays for these subsidies (costs) out of current tax revenues. Others also consider additional costs and benefits -- in particular, future income gains and opportunity costs that come from attending school. The inclusion of these other items in the comparison leads to a more comprehensive research approach.

The remainder of this section reviews studies of the distribution of educational costs and benefits in three countries: Kenya (Fields 1975b), Colombia (Jallade 1974), and Chile (Foxley et al. 1976, 1977a, 1977b). 1/

1. In Kenya

My study of the higher educational system in Kenya (Fields 1975b) was done at the same time as Jallade's work on Colombia (see the next subsection). Some methodological differences bear highlighting. I attempted to estimate broadly the social costs and benefits of education received by different income classes, where Jallade (and most authors after him) have limited attention to public sector subsidies and taxes. Because of data limitations, however, my work was restricted to higher education, whereas Jallade and others have been able to study primary and secondary education also.

Table 23 presents the estimated values of direct costs and benefits of investing in the three levels of higher education in Kenya (primary and secondary teacher training colleges, and university). Earnings data were based on public service salary scales. The system is fully subsidized, so no direct private costs need be imputed. The remaining cost items consist of the implicit subsidy given by the government (rows 1 and 4) and the direct opportunity costs borne by the students. Both figures are large relative to family income. Forgone earnings are at least Shs. 9,000 annually (the entrance salary for public service), which corresponds to the top 2 percent of the distribution of income (see Table 24). Still, these costs are small when compared with the benefits of attaining a high educational level. The additional income obtained by those who continue their education after secondary school is so large that it yields a rate of return of about 30 percent annually. Thus, higher education in Kenya is a lucrative investment that yields large benefits and places an individual at the very top of the income distribution. 2/

1/ Two other studies dealing with the comparison of costs and benefits of education across income groups are not reviewed here. One of them is Jallade's (1977) work on Brazil. His study has a fundamental methodological problem: conclusions about different benefits for different groups are based on the individual's own household's characteristics, rather than those of his parents' household. The second study is that by Szal (1979) on rural Botswana. This work has not been included because of doubts regarding the quality of the underlying data expressed by those in the World Bank familiar with it. Two studies dealing with the distribution of benefits (subsidies) from education have been published recently: Selowsky (1979b) for Colombia and Meerman (1979) for Malaysia. Neither addressed the distribution of the costs of education, therefore they are not included here. Finally, all the studies that are presented below deal only with the redistributive effect of the financing of public educational systems. I am not aware of any study that tries to assess the costs and benefits accruing to different income groups whose children are enrolled in the private educational systems.

2/ Benefits here are defined as the net present value of attaining the higher educational level -- that is, present value of increased income less direct costs (only forgone earnings in the case of Kenya).

Table 23:

COSTS, BENEFITS, AND PRIVATE RETURNS TO DIFFERENT

EDUCATIONAL INVESTMENTS IN KENYA, 1971

(Kenya Shillings)

Item	Educational attainment: Primary TTCs	Secondary TTCs	University of Nairobi
Average annual social cost a/	3,140	5,600	17,740
Direct private cost	0	0	0
Total forgone earnings (undiscounted)	18,160	27,600	47,100
Total direct subsidy after Form 4 b/	6,280	16,800	55,600
Present value of private benefits compared with Form 4: c/			
r = 0%	302,820	549,660	771,880
r = 5%	99,852	192,184	277,182
r = 10%	37,626	82,882	120,818
Private internal rate of return over Form 4 (percent)	28	33	31

Note: One Kenya shilling = US$0.14 in 1971; TTC = teacher training college.

Source: Fields (1975b, Table II).

a/ Average annual social cost = (recurrent expenditures + amortization of current development expenditures + depreciation on existing capital stock) ÷ number of pupils.

b/ Form 4 is the last level of secondary school.

c/ For the details on the calculations, see the source.

Who receives the benefits and who pays the taxes? The relevant data are given in Table 24. Columns 2 and 3 show the distribution of taxpayers and of taxes by income class. Columns 4, 5, and 6 present the distribution of students at the three levels of higher education by their parents' income class. Because at each level of education the direct costs and benefits are the same for all students, the last three columns also represent the distribution of benefits by income class.

These data can be evaluated with three different criteria:

Equal Opportunity. By this criterion the system is equitable if each income group has access to higher education equal to its proportion in the population. As Table 24 shows, this condition is not satisfied; the proportion of students coming from low-income families is less than the proportion of low-income families in the total population. From this observation it may be concluded (Fields 1975b, p. 256) that "...Kenya's higher education is found to be inequitable intergenerationally, since the few who are favored are disproportionately the children of the well-to-do, whether measured by income class, or various indices of socioeconomic status".

Cost-Benefit. By this criterion, the system is equitable if each group pays a proportion of the costs equal to the proportion of the benefits it receives. On this definition, the system appears to be close to equitable, although there is some tendency to favor middle-income groups as against the highest income groups.

Ability to Pay. By this criterion, the system is equitable if the cost-benefit ratio rises as a function of income. Comparing column (3) of Table 21 with columns (4) through (6), we find that the richest receive a much larger share of the benefits than the proportion they pay of the costs. The patterns for the other income classes, which contain the majority of families, are mixed. The approximate proportionality over those ranges might be regarded as inequitable if ability to pay is used as the standard.

These somewhat contradictory conclusions suggest that the way in which the data are analyzed is important in coming to qualitative conclusions about the equity of educational finance. Each of the preceding criteria applies to the questions of vertical equity -- that is, the fairness of different groups' contribution to the costs of education in relation to the benefits received. A less ambiguous conclusion, which is equally relevant to other countries, pertains to horizontal equity (Fields 1975b, p. 257): "...The main inequity in Kenya's higher educational system is horizontal. A select few receive a very large payoff and, if they were not relatively rich when they started their higher education, they will be relatively rich when they complete it. In other words, the system is horizontally inequitable *ex post* though less so *ex ante*." (Emphasis in the original.)

2. In Colombia

For Colombia, Jallade (1974) took the subsidies received by students as the benefits of education and used the tax cost of these subsidies as a measure of the costs of education. His estimates of costs and benefits for

Table 24:

INCIDENCE OF TAXES AND DISTRIBUTION OF HIGHER EDUCATION

BY INCOME OF STUDENTS' PARENTS, KENYA 1971

(in percentages)

Annual Income Bracket (Shs) (1)		Distribution of taxpayers (2)	Distribution of taxes (3)	Distribution of students by parents' income class		
				Primary TTCs (4)	Secondary TTCs (5)	University of Nairobi (6)
0-	2,400	90.5	67.9	70.7	74.7	60.2
2,400-	3,600	5.4	8.8	3.8	4.0	2.2
3,600-	4,800	1.3	2.2	6.2	4.9	2.2
4,800-	6,000	0.7	1.4	5.6	4.4	11.8
6,000-	8,400	0.5	1.5	6.2	4.7	11.8
8,400-	12,000	0.5	2.4	1.9	1.8	2.2
12,000-	16,800			3.4	0.9	
16,800-	24,000	1.1	15.7	0.8 } 5.6	2.2 } 5.5	9.6
Over	24,000			1.4	2.4	
Total		100.0	100.0	100.0	100.0	100.0

Source: Fields (1975b, Table III, p. 252).

urban Colombia are presented in Table 25. 1/ Columns (2) and (3) show the proportion of taxes paid by the different income classes under two alternative assumptions regarding tax incidence. The distribution of public subsidies by educational levels across income groups is presented in columns (4) through (7). Columns (8) and (9) measure, under two alternative assumptions, the ratio of public subsidies for education to that group's total tax burden.

By the criterion of ability to pay, the financing of Colombia's educational system appears to be highly progressive: the proportion of benefits received by the poor is much higher than their share of the costs [as shown by the indices greater than 100 in columns (8) and (9)], and the ratio of benefits to costs decreases steadily as income rises. We may conclude from these observations that the system of educational finance in Colombia redistributes significant amounts of income from richer families to the poorer groups.

A closer examination shows, however, that the redistributive effects vary across educational levels. In Jallade's own words (1974): "...it is clear that the positive effect of the public financing of education in Colombia is only due to the financing of <u>primary</u> education which strongly benefits the poor. This positive effect is partially but not wholly offset by the negative income-distributive effect of the public finance of secondary and higher education which benefits most of the lower and upper middle class, respectively..." (Emphasis in the original.) 2/

When the criterion of equal opportunity is applied -- that is, the proportion of the overall benefits received by the poor is compared with their share in the population -- Jallade's data suggest that the poor share less than proportionately in the benefits of education. But this conclusion has been challenged recently by Selowsky (1979b), who used data from Colombia for 1974, ordered households by their per capita income rather than their total income, and found that the distribution of benefits closely corresponds to the income distribution of households. A comparison of the results of both studies is presented in Table 26. The discrepancy can be fully explained by the reordering of households from one income concept to the other. 3/

To sum up, the evidence for Colombia shows whether or not the financing of public education appears equitable depends on the criterion used to compare the costs and benefits received by the different income groups.

1/ Jallade also reports results for rural and all of Colombia but he expresses less confidence in the quality of the rural data. Because the general conclusions do not change qualitatively, only the results for urban areas are presented here.

2/ The shares of the educational levels in total expenditures on public education were: 41.0 percent for primary, 31.4 percent for secondary, and 27.6 percent for higher.

3/ Similar evidence on this point has been illustrated by Datta and Meerman (1979), who used Malaysian data. It is likely that this discrepancy also characterizes the studies of Kenya and Chile presented in this section.

Table 25:

URBAN COLOMBIA: ALLOCATION OF TAXES AND PUBLIC SUBSIDIES FOR EDUCATION AMONG INCOME GROUPS, 1970

(in percentages)

Annual income bracket (pesos)	Distribution of families	Allocation of taxes		Allocation of public subsidies for education				Subsidies received as proportion of taxes paid	
		Alt.1	Alt.1	Primary	Secondary	Higher	Total	Alt.1	Alt.1
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0- 6,000	2.1	0.2	0.1	3.3	1.7	-	1.9	309	507
6,000- 12,000	12.6	1.5	0.9	11.9	1.7	1.0	5.7	119	182
12,000- 18,000	15.2	3.6	2.4	17.0	6.7	2.2	9.7	84	121
18,000- 24,000	15.1	5.3	3.5	18.6	15.1	5.4	13.9	81	117
24,000- 30,000	10.0	4.5	3.1	14.8	14.1	1.1	10.8	74	105
30,000- 36,000	7.5	4.4	3.0	9.9	9.9	6.8	9.0	63	90
36,000- 48,000	9.5	7.7	5.4	9.6	15.0	14.1	12.5	50	69
48,000- 60,000	7.3	6.7	4.6	4.6	11.9	18.6	10.8	50	69
60,000- 72,000	4.3	5.5	4.0	3.1	6.7	16.5	7.9	45	58
72,000- 84,000	3.6	5.0	3.6	2.3	4.8	6.6	4.3	26	36
84,000- 120,000	5.9	12.1	8.9	2.0	5.1	9.8	5.1	13	17
120,000- 180,000	3.7	11.4	14.8	1.6	3.9	11.1	4.9	13	10
180,000- 240,000	1.9	8.5	12.7	0.6	1.8	3.0	1.6	6	4
Over 240,000	1.3	23.5	33.0	0.6	1.6	3.8	1.8	2	2
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	31	30

Source: Jallade (1974, Tables 3.15 and 3.17).

Table 26

DISTRIBUTION OF PUBLIC SUBSIDIES FOR EDUCATION
BY HOUSEHOLDS' INCOME AND PER CAPITA INCOME, COLOMBIA

Household income (thousands of pesos)	Jallade, 1970		Selowsky, 1974	
	Distribution of households (%)	Distribution of subsidies (%)	Quintiles of households' per capita income	Distribution of subsidies (%)
0- 6	19.0	5.9	Lowest	19.8
6-12	20.2	9.5	Second	20.2
12-24	24.9	23.7	Third	18.6
24-60	22.9	38.7	Fourth	20.1
over 60	13.0	22.2	Highest	21.3
Total	100.0	100.0		100.0

Source: Selowsky (1979b, Table 3.20).

3. <u>In Chile</u>

A study of fiscal incidence in Chile may also be used to compare various groups' educational costs and benefits. Foxley, Aninat, and Arellano (1976, 1977a, 1977b) derived data by income class on the distribution of fiscal expenditure on education along with taxes (see Table 27). These authors used basically the same methodology as Jallade. Benefits were evaluated at the cost of government subsidies and were assigned to the enrolled students, whose distribution by parents' income class was known.

By the criterion of ability to pay, the educational financing in Chile appears to be highly equitable: as column (8) of Table 27 shows, the cost-benefit ratio increases steadily as income rises. However, we also observe that the proportion of benefits accruing to the lower 60 percent of the households is smaller than these households' share in the population, which means that the equal opportunity criterion is not met and the educational system is regressive by that measure.

When the data are disaggregated by educational level, it appears that the bulk of the benefits reaching the lower-income groups accrues through the subsidization of primary schooling. 1/ Moreover, at higher educational levels, a larger fraction of the benefits accrue to middle- and higher-income groups. This reflects the fact that the children of the poor participate relatively less in the higher levels of education.

C. Conclusions on Educational Finance and Income Distribution

In summary, we may draw the following conclusions from these studies of Kenya, Colombia, and Chile:

- Public educational systems are heavily subsidized by governments. Thus, who supplies the financing of public education depends mainly on the tax structure, which in turn seems to be proportional, or even progressive, to some degree in most developing countries.

- Private educational systems draw students disproportionately from the upper income groups. Because private educational systems are, in general, financed through direct fees paid by the students (or their parents), and the children of the higher income families tend to enroll more frequently in private schools, it follows that the higher income groups pay a disproportionately large share of the costs of private education.

- The distribution of the benefits from education in developing countries appears to be highly inequitable by the criterion of equal opportunity. That is, in all cases in which households are ordered by their total income, the proportion of benefits accruing to

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1/ The shares of the educational levels in total public educational expenditures were: 36.3 percent for primary, 18.4 percent for secondary, 27.2 percent for university, and 18.1 percent for other expenditures.

Table 27:

CHILE: DISTRIBUTION OF TAXES AND PUBLIC EXPENDITURES
IN EDUCATION BY INCOME CLASS, 1969

Household annual income (in minimum annual income units)	Distribution of households (1)	Distribution of direct and indirect tax burdens (2)	Primary (3)	Secondary (4)	University (5)	Other educational expenditures[a/] (6)	Total (7)	Cost-beeefit ratio, total (7)/(2) (8)
0 - 1	29.8	7.6	19.5	11.1	6.2	21.4	14.7	.52
1 - 2	31.6	18.1	38.4	31.0	27.8	36.1	33.8	.54
2 - 3	17.6	17.3	23.6	29.0	16.1	22.0	22.3	.78
3 - 4	7.4	9.6	10.4	12.3	13.8	9.9	11.6	.83
4 - 5	4.5	7.7	3.5	5.6	7.3	3.8	5.0	1.54
5 - 6	2.9	7.0	1.2	2.0	4.0	1.4	2.1	3.33
6 - 8	2.7	7.8	1.3	3.8	6.4	1.9	3.2	2.44
8 - 10	1.5	6.5	0.6	1.5	1.9	0.7	1.1	5.91
10 or more	2.0	18.2	1.5	3.7	16.5	2.8	6.2	2.94
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	

Sources: Columns (1) and (2): Foxley, Aninat, and Arellano (1977a, Table 13);
Columns (3) through (7): Foxley, Aninat, and Arellano (1977b, Table 14).

a/ Includes expenditures on technical and vocational training, provision of free lunch for primary students, other programs of financial assistance, and expenditures on school buildings.

students from the lower income groups is much smaller than the share of lower income groups in the population. In Colombia, however, when households are ordered by their per capita income, the system appears broadly equitable by the equal opportunity criterion.

- Although the poor participate less in the benefits of education, they also bear a lower proportion of the costs.

- On balance, the costs of education rise with income faster than do the benefits of education. Thus the cost-benefit ratios are higher for the richer groups in the countries examined, and hence fiscal financing of public education appears to be effective in redistributing income from the rich to the poor.

- This redistributive effect varies across educational levels. As the studies for Colombia and Chile show, most of the redistribution toward the poor takes place through primary education; the financing of secondary and higher education tends to benefit disproportionately the middle- and higher-income classes.

APPENDIX:

CRITIQUE OF SOCIAL COST-BENEFIT ANALYSIS IN EDUCATIONAL PLANNING

Social cost-benefit analysis is often used as a criterion for social decision-making in the field of education. This is done in either of two ways. One way is to estimate the net present value of benefits minus costs using an appropriate social discount rate. The social value of education is then estimated as the dollar difference between the discounted streams of benefits and costs. If this number is positive, the investment is said to be profitable; if negative, not profitable. The other way of conducting social cost-benefit analysis is to find that internal rate of return which equates the present values of benefits and costs. With this method, the social value of education is estimated as a percentage rate of return per dollar invested. This is then compared with the interest rate on the best alternative investment.

We economists pose the right question when we ask what additional benefits will result for a given extra expenditure of funds. But the economics of education has difficulty in translating this general principle into operationally meaningful terms. To evaluate the social cost-benefit studies, several issues arise. Are most if not all of the social costs and benefits enumerated? Are these benefits and costs evaluated correctly? What is the proper social interest rate to be used for comparison?

In actual practice, the general cost-benefit principle (that society should allocate resources to that activity with the largest marginal social benefit per dollar expended) is usually compromised, often severely. The result, too frequently, is neglect or misevaluation of the most important costs and benefits of education. On occasion, these studies are worse than useless: they may be downright misleading. My reasons for this critical assessment are explained in what follows.

I have two principal worries. One is that standard rate of return studies are only indirectly linked to development objectives such as poverty alleviation or inequality reduction. My other concern is that the benefits of education may be seriously misestimated by established procedures.

Before passing judgment on the costs and benefits actually included in social return to education studies, we must be clear on prevailing practices. In actual studies, on the cost side, social costs include the direct costs of education (teachers' salaries, amortization of school buildings, books and supplies, etc.) plus the indirect opportunity cost of income foregone while students are in school (approximated by the income earned by a representative individual in the labor force who had not completed that schooling level). On the benefit side, the social gain from education is taken as the difference in income between individuals with and without the education level in question. Sometimes, this differential is multiplied by a more or less arbitrary proportionality factor designed to adjust for selection and self-selection of students according to ability.

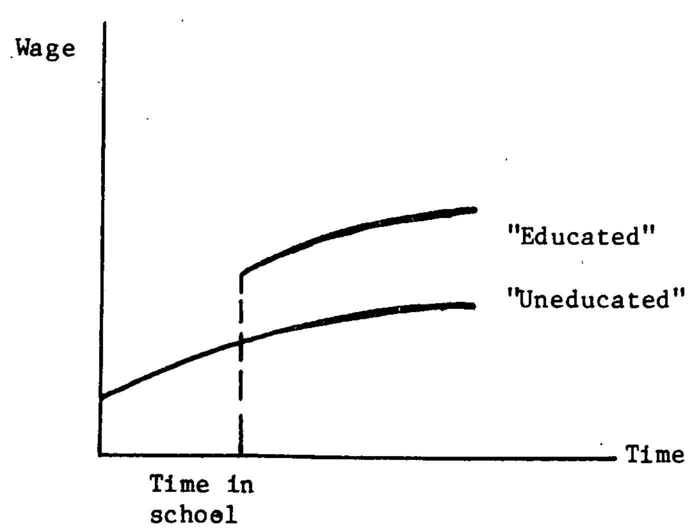
NOTE: This appendix is reprinted from Fields (1978b).

After itemizing factors which are taken into account in social return to education studies, it should be clear that much is missing. When education is considered as an indicator of progress and commitment toward development, much weight is given to the participation of the poor in education. In contrast, conventional social rate of return studies ignore who the beneficiaries of education are and who pays the costs. Without this kind of information, it is impossible to weigh the contribution of education to development as compared with, say, public health programs or rural electrification. The success of an antipoverty or pro-equality program cannot be judged by comparing aggregate costs with aggregate benefits alone.

It is also evident that many of the presumed noneconomic benefits of education are not dealt with. Most economists would not worry too much about this. They would say that the economic benefits are fairly well enumerated and evaluated. Thus, most economists would regard conventional social rate of return estimates as a reasonable approximation to the economic returns to social investments in education; but since noneconomic returns are neglected, they would consider the true social return to education to be greater. Hence, if social rates of return are calculated in the usual way and are found to be high, their presumption is that investment in education is worthwhile, both economically and socially. On the other hand, if the estimated social rates of return are found to be low, educational programs must be justified on some other, noneconomic grounds. It is in this way that virtually all education economists use social rates of return estimates for policy evaluation and planning.

I disagree with accepted practice on this. While incomplete enumeration of social benefits may lead to an underestimate of the actual returns to education, my concern is that the usual way of evaluating social benefits is improper and leads to an overestimate of the economic returns, conceived of as the gains in output produced by a more educated labor force. To see why the accepted evaluation procedure may be unjustified and misleading in a less developed country context, we must look carefully at the way social benefits to education are evaluated in the standard literature.

Customarily, the benefits of education are found by comparing income profiles of persons with and without a particular level of education (for simplicity, termed "educated" and "uneducated" respectively). These profiles may look like this:

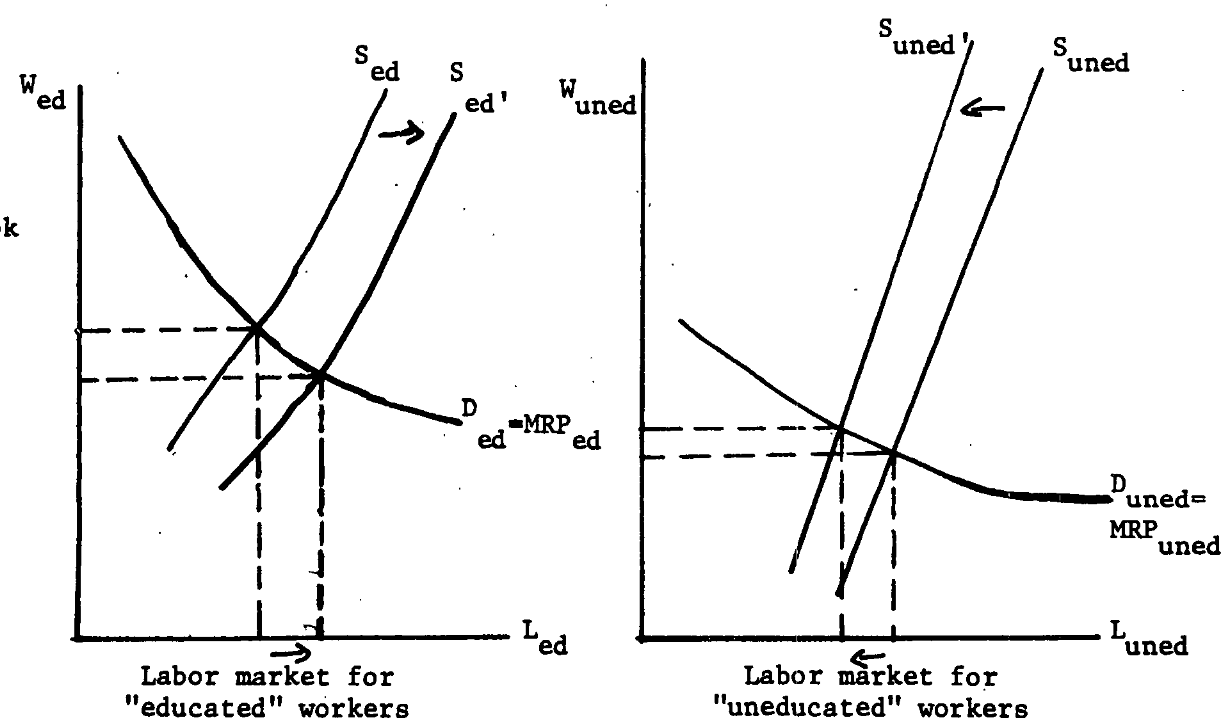


This diagram depicts profiles for the average individual. Rates of return based on such profiles are therefore average rates.

As always in economics, for policy purposes, the interest is in the marginal expenditure, in this case, the marginal dollar spent on education or the marginal individual who receives that education. That is to say, the question for social decision-making in the education field is this: if society invests $X in more education, what is the extra benefit?

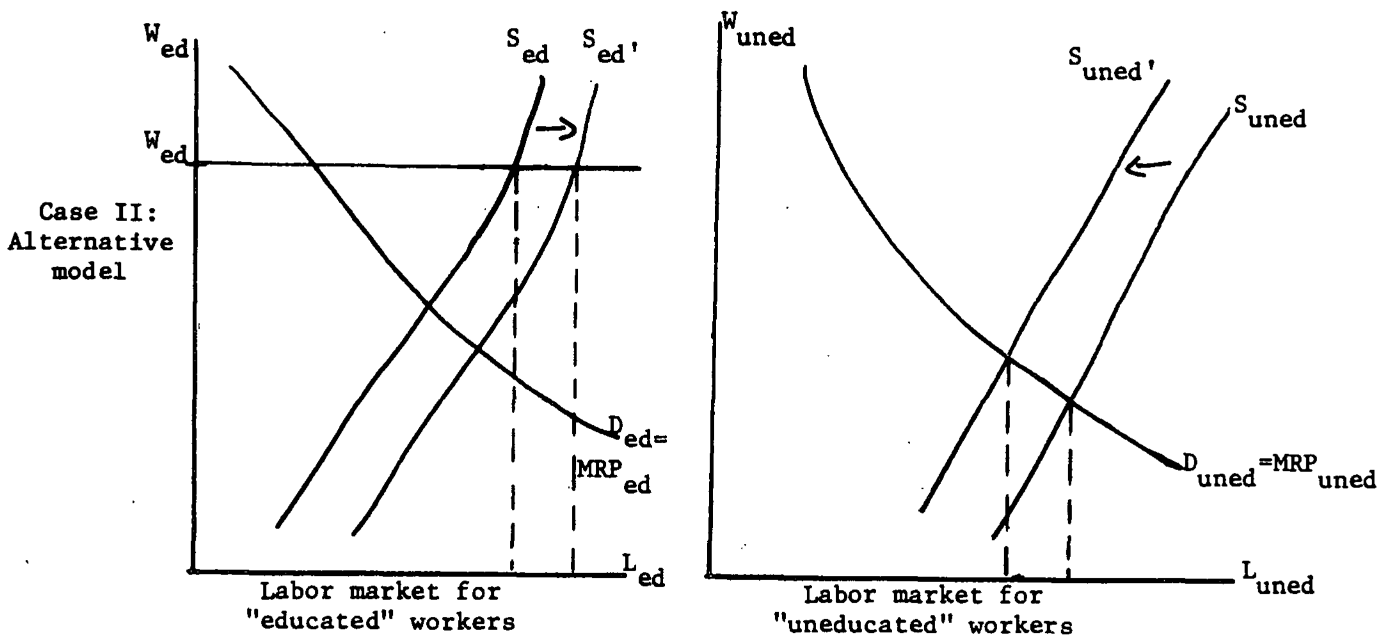
The conventional assumption maintained in the literature is that the marginal and average benefits from education are approximately equal, as are the marginal and average costs. On the cost side, this assumption poses little problem. On the benefit side, the assumption of equal marginal and average benefits is correct if the labor market works in the standard textbook fashion, i.e., wages and employment are both determined by supply and demand:

Case I: textbook model



Educating an additional person shifts the supply of educated labor by one unit to the right and shifts the supply of uneducated labor by one unit to the left. The newly-educated worker is employed at the educated worker's wage (W_{ed}), which is only slightly different from the wage received previously by other educated workers. Likewise, the wage for uneducated workers changes slightly, but only by a small amount. Under the maintained assumptions of the textbook model--that the demand for labor reflects the marginal revenue product of labor and that the labor market is in full competitive equilibrium--the average wage differential between educated and uneducated workers then approximates the gain in social output due to the education of an additional worker.

Now, I contend that the textbook model does violence to the actual workings of labor markets in many less developed countries. Often, these countries are characterized by a surplus of educated labor (surplus in the sense that more educated persons are available for work at the prevailing wage than are demanded at that wage). Graphically, the situation looks like this:



Unlike the competitive model where both employment and the wage are determined by supply and demand in the labor market, I think it is more realistic to view the causal ordering as follows:

(i) the wage is determined above the market-clearing level by some combination of institutional and market forces;

(ii) firms determine employment in the textbook way by hiring until the marginal revenue product of labor equals the wage; and

(iii) the supply of labor is a function of both the wage received while working and the volume of employment.

Suppose now that one more person is educated. If the labor surplus situation holds, the newly-educated individual enters the educated labor market (shift of the supply curve from S to S′). But unlike the textbook case, he will not be employed, since the wage does not fall to accomodate him. No new output is gained. The marginal social benefit in economic terms is zero. On the other hand, output is foregone (approximately MRPuned) and real resources are used to educate him. The marginal social return (marginal social benefits of education minus marginal social costs) is negative, at least in familiar output terms.

A numerical example may help illustrate these points. Consider a simple case of two types of labor (skilled and unskilled) and two occupations: clerks (the skilled occupation) and gardeners (the unskilled occupation). Wages for the two occupations are taken as given. Assume that education is required for a job as a clerk and is preferred for a job as a gardener. This means that in a labor surplus situation, the educated workers compete amongst one another for jobs as clerks, but any educated person who seeks a job as a gardener is hired preferentially at the gardeners′ wage.

Suppose the state of the economy is:

Wage of clerks (dollars per day)	$20
Employment of clerks	50
Supply of clerks	100
Wage of gardeners (dollars per day)	$10
Total employment of gardeners	40
Supply of educated gardeners	25
Employment of uneducated gardeners	15
Supply of uneducated gardeners	75

The question is whether additional investment in education is profitable. It would appear from these data that the answer is yes. Educated workers employed as clerks receive twice the wage of uneducated workers employed as gardeners, and educated workers have three times the probability of being employed at all. It might be presumed, therefore, that educational investment is worthwhile for society. But still, we should carry through the appropriate calculations.

To compute private and social rates of return to education, (ignoring still who receives the benefits and who pays the costs) we need three additional pieces of information: a projection of future labor market conditions to gauge the private benefits, a measure of the educated-uneducated productivity differential to gauge the social benefits, and knowledge of the costs of education.

Concerning the future state of the labor market, let us make the simplest possible assumption: that current labor demand conditions (i.e., number of workers demanded in each occupation and the wage paid in each) will remain the same forever. This implies:

(i) The current expected income differential between educated and uneducated workers ($8 per day = $2,000 per year) is expected to prevail throughout the individual′s working life.

On the cost side, let us assume:

(ii) It takes one period to educate a person; and

(iii) The private cost of being educated (out-of-pocket cost plus foregone earnings) is \$1,000.

Equating the present value of private benefits with the present value of private costs, the private rate of return is given implicitly by

$$2{,}000 \quad \frac{1}{1+r} + \frac{1}{(1+r)^2} + \ldots + \frac{1}{(1+r)^T} = 1{,}000,$$

where T is the relevant time horizon, presumably retirement. For sufficiently large T, the left hand side is approximately 2,000/r. We then find that the private rate of return to educational investment is 200 percent. It would be an understatement to say that education would be a very lucrative personal investment.

Consider now the social rate of return as conventionally computed. To compute the conventional social rate of return, we also need data on the social cost of education. To reflect the realistic condition that education in LDCs is typically highly-subsidized, assume:

(iv) The social cost of educating one person is \$10,000.

The conventional social rate of return is given implicitly by

$$2{,}000 \quad \frac{1}{1+r} + \frac{1}{(1+r)^2} + \ldots + \frac{1}{(1+r)^T} = 10{,}000,$$

and is found to be 20 percent. By the customary calculations, educational investment would appear desirable, provided the return on other alternative investments were lower, say 10 percent. Some might even say that this hypothetical country is not fully committed to education, since it is foregoing a seemingly advantageous social investment.

The problem with the inferences of the previous paragraph is that they are based on average rather than marginal calculations. The marginal social rate of return is that internal rate which equates the marginal social benefits to the marginal social costs. This rate may be large, small, zero, or negative, depending on the size of the productivity gains resulting from education. Nothing in the data we have so far tells us which is the case (unless, that is, we make the assumption that an additional newly educated individual would be employed at the skilled wage; this assumption is inconsistent with the spirit of the labor surplus model under investigation).

The proper guide for assessing the economic costs and benefits of educational investment is the marginal social rate of return. To compute it, we need some assumption about the productivity of educated workers relative to uneducated ones in the unskilled occupation, since that is where the newly educated individual will be employed. 1/ Suppose in our example:

(v) An educated gardener is 2 percent more productive than an uneducated one.

The marginal social benefit is 2 percent of the gardener's wage, 2% x $10/day x 250 days/yr. = $50/yr. The marginal social rate of return is given implicitly by

$$50 \left[\frac{1}{1+r} + \frac{1}{(1+r)^2} + \dots + \frac{1}{(1+r)^T} \right] = 10{,}000,$$

the solution of which yields a marginal social rate of return of one-half of one percent. 2/ Despite the earlier findings that the average private and social rates of return are very high (200 percent and 20 percent respectively), we would probably all agree from this final calculation that educational investment would be undesirable, at least in a strict economic sense.

I would conclude from this theoretical exploration that the usual types of estimates of social rates of return to education in less developed countries are unreliable and possibly grossly misleading.

At least one real-world study supports this theoretical skepticism. I am familiar with only one empirical cost-benefit study of education which calculates a marginal social rate of return. In a study of Greece, Psacharopoulos (1970) constructed a linear programming model with different skill grades of labor and estimated the shadow wage rates for each. For our purposes, the most interesting conclusion is: "In the case of Greece, investment priorities with respect to investment in skills estimated on the basis of observed labour earnings would have suggested a change <u>in the wrong direction</u> of the educational output." (Emphasis added.)

Lest the critique of this appendix be misinterpreted, let me reiterate: the logic of social cost-benefit analysis in education is sound. Social cost-benefit analysis asks the right questions. It must do a better job of answering them.

1/ The reason he will be employed in the unskilled occupation is to maintain supply side equilibrium. The educated workers' labor market is in supply side equilibrium only when the expected wages are equal in the two alternative occupations, which they are in the hypothetical data. If a newly educated worker enters the skilled occupation (clerk), his presence there would depress the expected wage for clerks below the expected wage for educated gardeners; he (or someone like him) could gain by taking up employment as a gardener.

2/ It is mathematically impossible for the internal rate of return to be negative if T, the time horizon, is allowed to approach infinity in the limit.

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