FOOD PRICES AND RURAL POVERTY

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Preface

Negotiating stronger disciplines on the agricultural trade and support policies of industrial countries, especially support for food crops, has been among the most difficult and controversial agenda items of the Doha Round trade negotiations. Much of the debate pits developing country exporters – who argue that these policies lower world food prices and hurt their farmers and rural communities – against other developing countries that are net importers, who are concerned that reducing subsidies in OECD countries would lead to higher food prices. These differences in interests are also prominent when it comes to other determinants of world prices of food: increases in price levels are detrimental to consumers, but beneficial to producers.

Who gains and who loses from policy reforms such as a removal of production subsidies and protection of farmers in OECD economies or from longer-term structural forces that result in higher world food prices depends therefore on the specific circumstances of households, and, at the level of nations, on the structure of production and net trade flows (comparative advantage). In the context of the Doha Round, it has sometimes been claimed that reform of agricultural policies would not benefit low-income countries or poor households in developing countries. Instead, export gains would be limited to only a few, mostly middle income, countries and that within these states the benefits would mostly accrue to wealthier people.

The papers that are collected in the volume are the result of a research program that was supported by the Bank-Netherlands Partnership Program and the DFID-supported Global Trade and Financial Architecture (GTFA) project. The aim was to use data from household surveys in a selection of low income countries to assess the poverty and distributional effects of commodity price changes. The objective was to use the micro level data to generate stylized facts about household income structures and, to the extent possible, document the income changes associated with price changes. When global commodity prices rose dramatically after 2007, an additional set of papers analyzing these price changes were added to the project.

The focus of the studies in this book is primarily on the effects of changes in price levels. These are just one—albeit important—factor from a development perspective. As is stressed in several contributions, agricultural policies in OECD countries and large net exporters that insulate domestic markets have the effect of increasing volatility of world markets, in part by making global markets thinner. From a poverty perspective this greatly increases the importance of a WTO agreement to discipline agricultural policies.

We hope that the studies collected in this volume will contribute to a better understanding of the impacts of global food prices and stimulate additional, more detailed and in-depth analysis of the effects of global food prices on rural household incomes and welfare.

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Food Prices and Poverty: Introduction and Overview

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Economic development theorists and practitioners have long focused attention on the question of the impact of food prices on poverty in developing countries. The interest of policymakers in this issue has fluctuated over time, depending on the volatility of world prices and the state of the global business cycle. In the early 2000s, the poverty impacts of agricultural trade reforms became an important element of trade debates, reflecting the fact that the 2001 Doha round of WTO negotiations had as one objective making the trading system more supportive of the economic development needs of poor countries and poor households in all countries. Many developing countries are net importers of food and were concerned that trade policy reforms may raise food prices, adversely affecting the terms of trade and the welfare of poor households, for whom food accounts for a significant share of total spending.

Sharp increases in food and other commodity prices during 2006–2008 generated renewed and widespread concern in development policy circles about their impact on poor households. The rise in prices had nothing to do with trade liberalization or changes in support to agriculture – as the Doha Round had not been making progress – but resulted from multiple factors. The most prominent of these were global economic developments: high sustained economic growth in China and other emerging markets, and a rise in the prices of oil and other natural resources. Energy price increases along with subsidies led to greatly increased production of biofuels in OECD countries that used maize and other cereals as feedstock, further driving up food prices (Mitchell 2009).[2] Droughts in key cereal producing countries further tightened food supplies. The entry of new and much

[1] The preparation of this volume and much of the underlying analysis was made possible by the DFID-supported Global Trade and Financial Architecture (GTFA) project. We are grateful to Ali Aslan Gurkan, John Baffes, Will Martin, Marcelo Olarreaga, and Guido Porto for helpful comments on an earlier draft of this Introduction. The views expressed are personal and should not be attributed to the World Bank.

[2] If trade had been free in agricultural products and biofuels, Brazil and other major sugar producing countries could have exported much more efficiently produced ethanol to the US and EU than these countries could supply themselves, without the associated additional negative impacts of diverting food crops towards biofuel production.

more extensive investment by fund managers in commodities accelerated the rise of prices and increased their volatility. Other causes of the high international food prices included decades of trade-distorting policies that encouraged inefficient agricultural production in rich countries and recurrent dumping of surpluses on global markets, resulting in underproduction in poor countries, thinner global agricultural markets, more volatility, and lower overall reserve supply capacity.

Matters were compounded in 2007–08 by the use of export controls by Argentina, Ukraine, Russia, and Kazakhstan for wheat, and Vietnam, India, and China for rice.[3] These restrictions were imposed in an effort to decouple domestic from global markets and rein in domestic food prices. Export restrictions went beyond food; China, for example, imposed export taxes on fertilizer in an effort to reduce input prices for its farmers. Internationally, fertilizer costs increased in line with oil prices, and the reduction in global fertilizer supply caused by export taxes further raised the prices of fertilizer in importing countries. The result was to put pressure on farmers in low-income countries that are credit constrained—reducing planting areas and future yields.

The 2008–09 financial crisis and the subsequent global slowdown resulted in a sharp fall in international food prices. However, at the time of writing (May 2010) food prices remain well above their levels of the late 1990s and early 2000s, and some have risen rapidly again. Though it is still too early to project their trend over the long term, there is growing evidence that food prices are likely to be high for some time to come. Structural factors—such as rising per capita incomes with an associated increase in demand for meat products; depletion of oil reserves with an associated increase in energy prices and incentives to produce bio fuels (Nelson 2009); and the impacts of climate change—imply continued upward pressure on the prices of basic food staples.

Current concerns about the poverty impacts of high food prices contrast with long-standing concerns in the development literature about *low* food and agricultural prices, and declining (structural) terms of trade for agricultural commodity exporters. Farmers in developing countries faced declining agricultural prices for almost 50 of the last 60 years, and low prices during the last 20. Only three price spikes have been seen in the last 60 years, together lasting just about ten years. For much of the period since 1950, many development economists and practitioners have taken the view that low prices for agricultural commodities discourage poverty alleviation in developing countries, because in low-income nations agriculture generates a major share of the economic output and is thus a key determinant of household incomes (Aksoy and Beghin 2004). Many of the

[3] Export restrictions tend to (1) distort prices and the allocation of resources, therefore impeding investment and the supply-side response; (2) prevent local farmers from receiving the higher world market price for their production; (3) displace local production into crops that are not subject to export restrictions, therefore aggravating concerns about food security and prices; and (4) exacerbate the rise and fluctuations of global food prices, therefore creating a vicious incentive for trading partners to follow suit, curb exports, and hoard (Chauffour 2008). In mid-2010, major producers of wheat – e.g. Russia – reimposed export restrictions in response to a major draught-induced fall in output.

poorest people in developing countries depend on agriculture and higher prices can therefore have major implications for poverty reduction (Hertel and Winters 2006).

As pointed out by Jo Swinnen in Chapter 1, there is a disconnect between the concerns expressed by many international organizations, NGOs and researchers concerning the poverty effects of the recent global price rise for food staples and the long-standing view that has been defended by the same entities that low food prices are detrimental to poor people in developing countries. Both views seemingly cannot be correct. Swinnen argues that an explanation may be that the international community has a bias towards those groups that lose from a specific situation or shock, and that in practice the interests of urban households tend to dominate those of rural communities – reflecting a variety of political economy factors. However, what matters from a poverty impact perspective is whether on average price changes benefits or hurts the poorest households, wherever they are located.

Whether high or low food prices are bad for the poor depends on initial conditions. At the level of a poor household, the impact of a change in food prices depends on the household's characteristics: how dependent it is on agricultural production and sales as a source of income, the extent to which it is a net food buyer, and how readily it can adapt to the (temporary) volatility of prices caused by good/bad harvests or global economic shocks. The same is true at the level of a country: all other things equal, the effect of changes in the level and volatility of (global) food prices will depend on whether the country is a net exporter or importer of the relevant commodities.

To determine whether and how governments should attempt to use policy to respond to an increase in global food prices calls for a good understanding of sources of income and patterns of consumption at the household level. The same is true of the associated policy questions: whether and how developing countries should support their agricultural sectors and/or poor households that are net buyers of food, and what the international community can/should do to help offset the adverse consequences of increasing food prices and volatility.

The chapters in this volume review trends in international prices of key food commodities and agricultural trade patterns and balances at the country level, and assess the evidence concerning the sources of income and consumption patterns of poor households in developing countries. The design of appropriate policies at the national or international (World Trade Organization) level is not the major object of the analysis—instead the focus is more narrowly on assessing the potential effects of food price changes on poor households in a selection of developing countries for which household survey data are available. Our focus is on rural households, because these tend to be poorer than urban households, because it is already well known that the policies required to address the adverse impacts of higher food prices on the urban poor are short-term targeted transfers (Wodon and Zaman 2008), and because most of the second-round effects of agricultural price increases take place in rural areas. While there are agricultural households who live in urban areas, the bulk of food production originates in rural areas.

Although some of the chapters discuss the 2007–08 price spike and the impact on the food trade balances of vulnerable countries, the main focus is on the structure of income sources for different groups of households, and case studies on the distributional outcomes when food or agricultural prices change over a longer time. Thus, this is not a study focused primarily on the recent price developments or short run impacts of food price changes, but on the longer run structural determinants of food price levels.

In what follows, we first provide a synthesis of the main findings in the literature on this subject, and then summarize the conclusions of the chapters in this volume. An important overall conclusion is that though it is not possible to generalize about the impact of a food price increase on the poor, it is important to focus attention on the second-order, longer-term, effects of price changes. The empirical studies in this book suggest that for many net buyers of food, the higher consumption cost due to higher food prices may be more than offset by higher income. The poorest rural households may benefit from higher food prices both directly, if they are net food sellers, and indirectly, through increased wage income and increased sales of services that are generated by the higher returns to food production.

FOOD PRICES AND THE POOR: WHAT DOES THE LITERATURE SUGGEST?

Here we briefly review the findings of the literature on three broad themes of concern in this volume: the effects of food price changes on household welfare, the long-standing effective taxation of agriculture in low-income countries, and the availability of food for import.

Effects of food price changes on households

Food prices can affect households through three major channels: by affecting the affordability of an important component of the consumption basket; by affecting the returns from farming, insofar as the household is directly engaged in this activity; and by affecting the demand for labor in agriculture and thus the wage income of household members who work for agricultural producers. Over time, food price changes may also have important indirect or second-order effects. For example, higher crop prices may generate investments that improve farm productivity and expand supply, to an extent that more than compensates for any negative short-run effects on consumption. Changes in food prices may also change the demand for a variety of products, whether related to agricultural production (fertilizer, transport, etc.) or not. Many studies of the effects of food price changes on households focus on the initial direct effects through consumption and returns to farming, since these are the easiest to estimate or measure. Debates focus more on the magnitude of the indirect or second-order effects, which are more difficult to model and/or estimate but are generally acknowledged as important.

The basic framework to assess the effects of changes in prices for staples is straightforward. Consumers will lose from price increases, producers will gain. As many households in developing countries will be both producers and consumers the net impact effect of price changes will be determined by which effect is greater: whether the household is a net consumer or a net producer (Deaton, 1989). In addition, impacts will depend on whether wage income is affected: if the household sells labor and the wage is affected by food price changes, this must be taken into account. In rural regions where producers employ workers, higher food prices are likely to lead to higher wages, and this may offset the negative effect of higher prices for net consumers. Higher food prices may also lead to higher derived demand for services and nontradables by (net producer) households that see incomes rise. Some net consumers may become net producers if prices rise. Assessing the impact of prices changes clearly requires empirical analysis. The only thing that can be said with confidence is that not everyone will gain or lose: there will be distributional effects.

Food price changes may reflect international market developments and/or national factors—both policies and exogenous variables such as local harvests. Although in 2008 the focus of attention and concern was on international price increases, what matters for producers and consumers in developing countries are the prices they obtain and pay for food staples. These prices almost never move on a one-to-one basis with international prices, because of differences between domestic and internationally traded products, exchange rates, inflation, and a variety of "frictions" that reflect internal transactions and transport costs as well as trade policies that are applied at the border (Hoekman and Olarreaga, 2007; Nicita, 2009).

As noted previously, much of the trade and development literature has presumed that high food prices are bad for the poor because in low-income countries most poor households, even in rural areas, are net food buyers (Ravallion 1990). Indeed, most of the studies that estimate the number of net food buyers and sellers and their incomes have found that among poor households, net food buyers outnumber net sellers. Christiaensen and Demery (2007), for example, analyze staple crop producers in rural areas of four African countries and find that even where agriculture was the dominant activity, net buyers of food were much more numerous than net sellers; this relationship held for all income quintiles, including the poorest. Jayne and others (2001) document that in Kenya net sellers of maize had higher incomes, were more concentrated, and were fewer in number than net maize buyers. Other studies have shown that even among the poorest households there are more net food buyers than sellers (Coady and others 2008; Seshan and Umali-Deininger 2007; Byerlee, Myers, and Jayne 2006; Warr 2005).[4]

At the household level, if the number of poor net food buyers substantially exceeds the number of net food sellers, the effect of a food price increase may well

[4] In a sense, this is an obvious result as it reflects the development process. As countries increase their per capita income and raise labor and total factor productivity in agriculture, the number of agricultural producers decline, and the number and share of households who are net buyers of food increase (Schultz 1978; Hayami 2005).

be anti-poor. This conclusion emerges from recent simulations that use household survey data to assess the likely impacts of global trade liberalization in low-income nations (e.g., Hoekman and Olarreaga 2007), as well as from analyses of the 2007–08 food price increase (Wodon and Zaman 2008). Ivanic and Martin (2008) and World Bank (2008), using general equilibrium models that incorporate detailed household-level data, conclude that, worldwide, the 2008 food price hikes may have pushed an additional 100 million people into poverty (this number is sensitive to the assumed pass-through of world price changes to domestic prices).

Because many poor countries, especially in Sub-Saharan Africa, are net food importers, an analogous argument has been made at the level of poor countries as a group. This is that global food price increases will not only impose a terms of trade loss on these countries but be anti-poor on average (Panagariya 2006).

Since much depends on the specific initial conditions that prevail in a country or region, however, the welfare impact of price increases on the rural poor could be positive even though the majority of households are net food buyers. This is the implication of a study by Ravallion and Lokshin (2004), who find that if cereals prices decline in Morocco, the losses suffered by net producers of cereals outweigh the gains accruing to net buyers among the rural poor. This result suggests that, conversely, rural poverty may decline as a result of an increase in food prices.

Poor rural households often produce food for subsistence and meet their cash needs through producing cash crops and working for wages. In the agricultural development literature, a shift into cash crop production has been seen as a necessary condition for raising incomes in rural areas and for switching from subsistence into commercial agriculture. Many authors find that cash crop and commercialization schemes have positive effects on smallholder incomes, nutrition, and food security (e.g. Van Braun and Kennedy 1994; Dorwald, Kydd, and Poulton 1998; Govereh, Jayne, and Nyoro 1999; Govereh and Jayne 2003; Barghouti, Garbus, and Umali 1992; Barrett and Darosh 1996; and Arwings-Kodhek and others, undated). However, a corollary is that, at the margin, poor households become more sensitive to food price increases. While overall agricultural production will respond to higher prices, generating greater demand for labor, the benefits may be skewed towards better-off households who have the assets and resources needed to expand output. Poorer smallholders may confront higher input costs as well as higher food prices, and not be able to invest to take advantage of higher commodity prices.

To summarize, lower (higher) food prices help (hurt) poor net buyers, but reduce (increase) agricultural incomes, and this in turn may weaken (enhance) the incentives or ability to expand production. Distributional effects will generally be important: policies that reduce food prices tend to transfer income from poorer rural to richer urban areas. The dynamic, second-round, effects of changes in food prices also need to be taken into account, even though these are harder to measure or estimate. Food prices may rise very quickly and, absent government intervention, have immediate effects on consumers and importers. But for a supply response to emerge, higher food prices need to be sustained for a period of time. Farmers may not raise their output if food price increases are reversed relatively rapidly—or if farmers expect them to be reversed rapidly. Factors such as credit constraints and possible asymmetries in responses to price changes that reflect market failures can also have important effects on investment. For example, if there are credit constraints (farmers have limited access to external finance), an increase in cash crop prices can allow an expansion of output with a lag, while a drop in prices can have major detrimental consequences on agricultural output (Porto, 2010).

Government policies and agricultural incentives

Much of the literature on the determinants of rural poverty in developing countries has pointed to the slow growth of agriculture and its underlying causes: long periods of low agricultural prices,[5] which reduced the return to agricultural investments and held back the development of the sector, and—especially in low-income countries—heavy taxation of agriculture through export taxes and high rates of protection for manufactures (Schiff and Valdes 1992; World Bank 1986, 2003, 2007).[6] Often marketing boards—monopoly buyers and distributors of food—were established that set prices for farm products below world market levels in an attempt to keep down the cost of subsidizing basic foodstuffs for the urban population, or to generate revenue for the government by taxing tradable commodities. Where such taxes are applied to cash export crops such as coffee, cocoa, tea, and cotton, the income effect dominates, because not much of these goods is consumed by the households who produce them, and adverse impacts on poverty are much more likely. In developing countries the results of depressing the profitability of farming often included declines in agricultural output, migration to cities, and rising imports of food.

In a number of developing countries the effects of such agricultural policy regimes were compounded by OECD countries' food aid, which further reduced the incentive to adopt more economically rational agricultural policies. More broadly, world agricultural prices tended to be suppressed by the farm policies of high-income countries, which led to an expansion in these countries' production, closure of certain markets, and periodic dumping of surpluses on world markets.

Trends in the assistance/taxation of agriculture in different country groups are illustrated in Figure I.1. These data derive from a 2008 World Bank research project, which has generated annual time-series estimates of rates and values of agri-

[5] Keeping food prices low to help accelerate industrial growth has been a major motivation for heavy taxation of the agricultural sector (Schiff and Valdes 1992).

[6] Policy reforms by developing countries have reduced the taxation of exportables and increased the protection of importables, but overall support to agriculture in lower-income countries is still much lower than in OECD countries, and still negative in Africa (Aksoy 2004; Anderson and others 2008). In 2007–08, many developing countries sought to minimize the impact of food price increases through export controls, import tariff reductions, and in some instances price controls. As discussed below, food price increases in most developing countries were lower than the increase in international prices, despite the fact that input prices (fuel, fertilizer, etc.) increased as much as output prices during the price cycle.

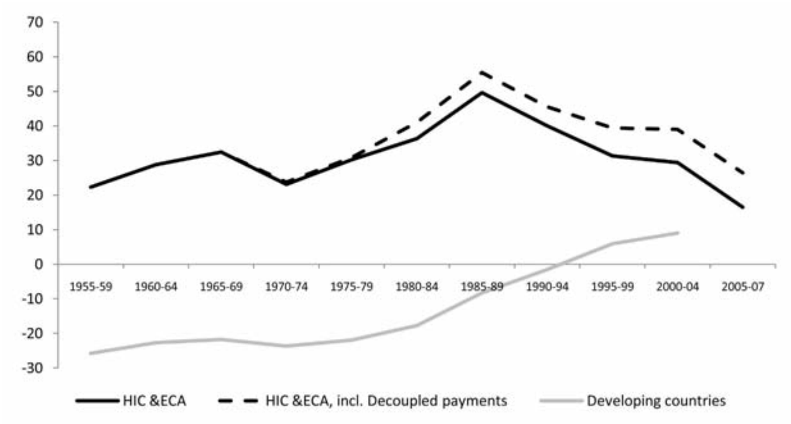

Figure I.1: *Nominal rates of assistance to farmers, 1960 to 2004 (percent)*

Source: Anderson (2009).
Notes: Decoupled support comprises transfers to farmers that are not linked to production. The nominal rate of assistance includes the effects of price distortions for both farm outputs and farm inputs and is expressed as a percentage of total farm production valued at undistorted prices. Averaged using weights based on the gross value of agricultural production at undistorted prices. High-income group includes Republic of Korea and Taiwan, Province of China.

cultural assistance/taxation over the past half century for around 75 countries that together account for 90 percent of global population, GDP, and agricultural production. For each country, nominal rates of assistance (NRAs) are calculated for key products (Anderson 2009).

The figure shows that until the late 1980s, farmers in developing countries were at a double disadvantage in terms of competitiveness: while they tended to be taxed at an effective rate of at least 20 percent, their counterparts in OECD countries received significant support. For the last 15 years, however, data on the gross subsidy equivalents of support to farmers (Table I.1) show that the level of

Table I.1: *Gross subsidy equivalents of assistance to farmers by region, 1960 to 2004 (current US$ billion per year)*

Country groups	1960–69	1970–79	1980–89	1990–99	2000–04
High-income	36.7	72.7	153.55	208.25	190.9
Developing	−20.3	−57.85	−63.9	24.35	65.2
Africa	−0.95	−4.6	−1.25	−6.15	−7.9
Asia	−18.25	−46.45	−49.85	12.65	48
Latin America	−0.5	−5.8	−9.85	5.6	5.3
European transition	−0.55	−0.95	−3.0	12.25	19.7

Source: Anderson (2009).
Note: High-income group spans Western Europe, Japan, United States, Canada, Australia, New Zealand, Republic of Korea and, as of 1995, Taiwan, Province of China.

assistance to farmers has been rising in developing countries and virtually constant in high-income countries,[7] thus narrowing the competitive disadvantage of farmers in developing countries. (Worldwide, the net global transfer to farmers is now more than US$ 250 billion a year.)

Nonetheless, the overall effect of policies in the North and South is still to substantially reduce the returns to agricultural production in developing countries, especially the low-income countries in Africa. The trend towards a more neutral policy stance for agriculture relative to other sectors of activity is a positive development from an economic policy perspective, but many developing countries still maintain anti-agricultural tax and trade policies and have infrastructural weaknesses that generate high transport and transactions costs, keeping their farmgate prices below world prices.

While higher world prices—whatever their cause—will act to offset the price-lowering effects of prevailing policies in both high- and low-income countries, it is important to avoid the historical mistake of taxing the rural sector in developing countries. This would reverse the gains these countries have achieved over the last two decades in lowering agricultural taxation and the benefits they have attained from policies aimed at increasing the returns to/productivity of agriculture.

Advocates of freer trade in food are primarily concerned with resource allocation efficiency and the dynamic consequences of distorting incentives for resource allocation. Freeing world trade in agricultural commodities would have both efficiency and distributional effects. Further agricultural liberalization in OECD economies would improve allocative efficiency and consumer welfare in these economies while also benefiting developing country producers. Insofar as freer world trade would result in somewhat higher prices on average, as tends to be estimated by global CGE models,[8] it may have adverse consequences for poor households. But the likelihood of such effects, and their possible magnitude, are empirical questions. As seen above, the impact on poor households of policies that lower farmgate and/or consumer prices for basic foodstuffs depends on household circumstances: households in urban centers (who usually are better off, on average, than rural households) benefit, net sellers are harmed, and the overall effect on rural households (who generally are poorer, on average, than urban households) depends on whether they are net buyers or sellers.

[7] The growth of agricultural production support in high-income countries began to reverse in the 1990s, although if "decoupled" income support for farmers is included, the rate of support has not declined substantially since the Uruguay Round was completed.

[8] Reducing protection globally, along with attempts to reduce the taxation of agriculture in low-income countries, would lower excess production in industrial countries and increase it in developing ones. Simulation studies, such as those in Aksoy and Beghin (2004), suggest that rice prices would increase by an average of 33 percent, with some varieties almost doubling in price. In other food items such as sugar, dairy products, and wheat, estimates of increases in prices are in the 40, 20-40, and 5 – 10 percent range, respectively. Econometric and other modeling exercises that use general equilibrium frameworks estimate somewhat lower but still significant price increases, especially for foodstuffs.

Availability of food imports

Another important policy question related to liberalization of global food markets concerns the reliability of access to food imports. Generally it is assumed that countries will be able to import as much food as they need at whatever price clears the market. This presumes that exporters will not close off supplies in times of shortage and high global demand. But Mitchell (2009) has shown that this has happened in the past, when reliable suppliers such as the US and the EU restricted exports of wheat. And the export restrictions that a number of producers imposed in 2008 reveal that such behavior may still arise (Chauffour 2008).

Hence countries need to be aware that they may face constraints in their ability to import food, and that prices will fluctuate and may rise to very high levels when there is significant excess demand. This in turn has implications for agricultural policy and the trading system. In particular, it points to the importance of establishing binding disciplines in the WTO on the trade policies of net exporters as well as on the major OECD countries that heavily support their agricultural sectors in ways that distort global competition. A key cause of the high levels of volatility in the world prices of some agricultural commodities is the thinness of the markets concerned, which in turn reflects the nationalistic and protectionist policies pursued by major producing countries (Wright 2009).

THE CONTRIBUTIONS TO THIS VOLUME

The net effect of higher global food prices is an empirical question—as is the question of how much international prices of food will be affected by trade liberalization and to what extent changes in these prices will be reflected in the domestic prices that matter for local producers and consumers of food. The answers will vary across countries and regions, depending not only on national policies but also on the income levels and income sources of net food buying and selling households, the number and shares of households who are net sellers and net buyers, the state of infrastructure, and the degree of efficiency and competition in key service industries such as transport, warehousing, and distribution.

The chapters of this volume comprise a mix of analyses of trends in food prices and trade balances and studies on the microeconomics of household responses to price changes. A major objective of the microeconomic studies is to use household survey data to answer some of the questions posed above. Data constraints imply that the coverage of countries is selective, but the results of the various studies taken together illustrate the importance of undertaking such empirical analyses.

Price trends and cross-country descriptive statistics

Since the subject of interest is the impact of food and agricultural prices, it is important to understand the longer-term behavior of these prices and the correlates of commodity price cycles.

World food and commodity prices have been low and declining for most of the period since 1950. The exceptions are few: during the Korean War (early 1950s), the first oil price shock (1973–74), and the 2006–08 boom. Indeed, declining commodity prices and the expectation that they would continue declining formed a cornerstone of industrialization policies in the 1960s and 1970s. All three periods of major food price inflation lasted for only a few years each, followed by long periods of relative and absolute price declines (Deaton and Laroque 1992).

In Chapter 1, Jo Swinnen discusses the changing public policy perceptions regarding the development impacts of global food prices. He notes that until the second half of the 2000s the widely shared view was that *low* food prices were a curse to developing countries and the poor. The dramatic increase of food prices in 2006–2008 appears to have fundamentally altered this view. The vast majority of analyses and reports that were issued in 2008 and 2009 state that *high* food prices have a devastating effect on developing countries and the world's poor. Swinnen documents this reversal of opinion which raises questions about the old and the new arguments, as well as proposed remedies. The reversal also raises questions about the causes of this dramatic turnaround in analysis and policy conclusions. In his chapter, Swinnen discusses a number of potential implications and hypotheses on the cause of the change in views, arguing that many observers and analysts tend to focus on groups who lose from a particular shock or event. He stresses that any change in prices will benefit some households, including poor ones.

In Chapter 2, John Baffes and Tassos Haniotis focus on the historical behavior of prices and their determinants. They analyze the reasons behind the 2006–08 food price increases and compare this period to earlier price cycles. They find that each of the three commodity price booms took place under high economic growth and was followed by a serious slowdown of economic activity. All three booms triggered discussions on coordinated policy actions to address food security concerns, which dissipated with the reversal of price increases. The 2008 boom showed two important differences, however: it was not associated with high inflation, and it involved all three commodity groups (metals, agriculture, and energy).

Baffes and Haniotis argue that the 2008 price hikes were driven in part by demand in emerging economies such as India and China and by biofuel production, but that investment fund activity played a major role. They find that the comovement of commodity prices is very strong, suggesting that individual commodity markets cannot successfully be analyzed in isolation. They also find that over the long run the transmission elasticity from energy prices to agricultural prices is high and significant. Given this link, they conclude that the 2008 food price increases have a permanent component, because energy prices are expected to stay high for some time. At the same time, they cannot explain the magnitude of the spike and the reasons for commodity prices staying at historically high levels after the spike. Variables used to explain historical behavior of commodity prices do not explain the recent levels of these prices. This leads the authors to argue that greater involvement by the investment funds might be an important factor generating higher average price levels.

For households and consumers, as noted above, domestic food price developments matter more than international ones. In many cases, governments have used multiple instruments to lessen the impact of international food price increases on the domestic market. Thus governments of net importing countries may reduce tariffs, while net exporters may impose export taxes or controls. While such measures attenuate the impact of food price hikes on poor households that are net buyers, they also reduce the positive effects on producers of the relevant staples.

In Chapter 3, Ataman Aksoy and Francis Ng analyze the relationship between domestic and international food price developments, using quarterly CPI data for 2000 through the third quarter of 2008, when international food prices started to decline again. Comparing the behavior of the food component of the consumer price index in individual countries to that of the international food price index, they show that while domestic food prices were strongly influenced by international prices, there were significant lags and the increases in domestic prices were generally much smaller. Between the first quarter of 2000 and the second quarter of 2008, when international prices peaked, global food prices in US dollars rose by 188 percent as compared to only 55 percent for the food component of domestic consumer price indices. Part of the difference reflects the depreciation of the US dollar against many currencies; the overall international food price increase was only 146 percent when expressed in local currencies. Domestic price increases were bigger in food than in non-food commodities, whose observed average price increase was 43 percent. Aksoy and Ng also note that the pattern of domestic price increases differed widely across countries. Thus, for example, in industrialized countries domestic food and overall inflation rates were very similar, while in small net food importing countries including island economies, food prices rose much faster than non-food prices.

To know the impact of food price hikes on poor households, data are needed on the extent to which households rely on agriculture as a source of income, as are data on how income is distributed across households. Different analysts use different definitions of what constitutes an agricultural household, and the lack of reasonably consistent data across countries makes comparisons more difficult.

Responding to this problem, in Chapter 4 Ataman Aksoy, Javier Beverinotti, Katia Covarrubias, and Alberto Zezza analyze income sources at the household level for a group of 15 low-income countries for which detailed data are available. They document that different definitions of an agricultural household yield very different breakdowns of households and thus different answers to the question of interest: the impact of price increases on household welfare. They focus on three definitions used in the literature to determine whether a household depends on agriculture: location (rural or urban); the sector in which the head of household is occupied; and the proportion of household income derived from agricultural activity. A priori, it is not clear which definition is the right one to use. In the sample countries on average, only 32 percent of households match all three definitions, while 57 percent of households are classified as rural, 48 percent of household heads list their occupation as agriculture, and 46 percent of households earn more than 30 percent of their income from agriculture. Such differences may explain in part the different results recorded in the literature on the direction and magnitude of the poverty impacts of food price increases.

Regardless of which of the three definitions is used, however, Chapter 4 finds that agricultural households are poorer than non-agricultural households. This is the opposite of what is observed in industrial countries, whose farmers are often better off than non-farmers (Aksoy 2004).

Chapter 4 also explores the sources of income of different groups of households. On average across all households in the 15 countries studied, less than half of income originates directly or indirectly from agriculture, including agricultural wages. The bulk of this income comprises subsistence production, i.e., output that is both produced and consumed by the household. For rural households, wages supply less than 20 percent of total income (including the value of subsistence production), and wages from agricultural work constitute an even smaller proportion. Only in two countries, Bangladesh and Nicaragua, which have a high degree of landlessness, are large agricultural wage income shares observed. Poor households earn a larger share of their wage income from agriculture while richer households depend more heavily on non-agricultural work.

Cash crops are important for certain regions and households, but their direct contribution to cash income at the national or rural area level is very limited. Rural households, and especially the poor among them, earn much more of their cash income from food sales than from cash crop sales. Leaving subsistence income out of the calculation, food sales contribute 36 percent of income, while cash crop sales supply only 5 percent, thus contradicting the common belief that cash crops are the main sources of cash income for rural households. Food is also a major contributor to the commercialization of agricultural households, especially the poor ones.

In Chapter 5, Ataman Aksoy and Aylin Isik-Dikmelik focus on the features of poor households that are net buyers or sellers of food. Using a sample of nine low-income countries, they find that net food buyers have higher incomes, on average, than net food sellers in eight of the nine countries—implying that higher food prices will, on average, transfer income from relatively better off buyers to poorer sellers. Though poor net food buyers outnumber poor net sellers, about half the poor net buyers are marginal consumers, who buy only a small share of their total food consumption and so will not be greatly hurt by food price increases. However, in three of the nine countries there are pockets of vulnerable households who rely substantially on purchases of food. This finding implies that it is not enough to classify households on the basis of their net buyer/seller status—information on their degree of dependence on purchases or sales matters as well.

Aksoy and Isik-Dikmelik find that rural net food sellers and buyers have very different income sources: while net sellers are generally smallholders and farmers who combine food crop and livestock production with either business or wage income, net buyers differ across countries and regions. In general, rural net buyers earn their incomes mainly from businesses and from non-agricultural wages.[9]

[9] These businesses are mostly services. In countries where data on business income distinguish between manufacturing and services, almost all of business income originates in services. This is also true for non-agricultural wages, which mostly originate in services.

On average, they draw about 29 percent of their income from wages, of which about a quarter is earned in agricultural jobs. Among net buyers, the share of cash crop income in total income is highest in Ethiopia, at about 12 percent, and Vietnam, at about 7 percent; it is less than 4 percent in the other countries. In Ethiopia, net buyers are cash crop producers, livestock herders, and business people who are self-employed and earn very little wage income. In Bangladesh and Nicaragua, net buyers' main source of non-subsistence income is wages, suggesting that interactions between food price dynamics and the labor market are important in considering the effects of food price increases—a subject addressed in subsequent chapters. In Vietnam, net buyers' major sources of income are livestock, cash crops, and wages, and in Peru they are livestock and wages.

At the country level, an analogue of the net buyer/seller distinction among households is whether the country is a net importer or exporter of food. The vulnerability of poor net importing countries to food price increases has been used to argue for policy action to lower domestic food prices and for the continuation of agricultural support policies in OECD countries. In Chapter 6, Francis Ng and Ataman Aksoy update two earlier papers (Ng and Aksoy 2008a, 2008b) to analyze the changes in international food trade balances associated with the 65 percent increase in domestic food prices that took place between 2000/01 and 2006/07. The responses in different groups of countries shed some light on the adjustments that occurred in 2008.

The authors find that in all low-income countries, food trade balances deteriorated over the period analyzed, as a percentage both of imports and GDP, as food imports increased faster than food exports. In middle-income countries, the opposite happened. Low-income countries achieved much lower agricultural GDP growth rates than middle-income countries. Thus the responses of low-income countries to the food price increases were more constrained than those of middle-income countries. Among developing countries, the large importers of food relative to their GDP are either oil exporters or countries in conflict.

Although net food trade balances deteriorated in low-income countries, the average deterioration was small, amounting to about half of one percent of GDP, and 1.2 percent of total imports. Low-income countries in Sub-Saharan Africa fared worse than other low-income countries, which experienced no deterioration as a percentage of their GDP. Small island economies, which also have large food deficits, experienced deterioration in their net food trade balance equivalent to 0.8 percent of their GDP.

In general, the very small economies appear to be the most vulnerable. This suggests that beyond systemic efforts to improve agricultural performance in developing countries, small amounts of food aid could ease the most acute problems associated with food price inflation. The same is true for conflict countries that are large importers of food and cannot rely on domestic production to meet their basic food needs. These countries need to be supported by food aid and other mechanisms that distribute food to the worst-hit areas.

Extensions and second-order effects and linkages

The conceptual and theoretical literature suggests that the supply response to higher agricultural prices may be limited in low-income countries where farmers face serious operating constraints and high costs. The empirical studies in the second part of this volume investigate what happens to household incomes after a food price change.

Shocks or policies that reduce food prices and thus the incomes of net food sellers may also reduce the incomes of at least some of the net food buyers, as a result of the effects of the changes that the price reductions induce in demand. The data presented in Chapter 5 and 6 suggest that net buyer households in the countries studied are predominantly self-employed or workers who sell their services to rural employers, whether farmers or businesses. The absence of significant cash crop income, and the general lack of manufacturing activity in the rural areas of the low-income countries considered, suggests that many net food buyers may depend on net food sellers as the source of demand for their services.

The importance of the second-order effects of a food price change will vary across countries. For example, in Bangladesh, where most poor households are net food buyers and many depend largely on agricultural wage jobs, the initial, direct, impact of a food price increase would be very detrimental to the poor.[10] Ravallion (1990) has shown that the second-order (demand linkage) responses to rice price increases are unlikely to raise the agricultural wage rate even in the long run.

Chapters 7 and 8 analyze changes in the production and consumption behavior of households in Mexico and Vietnam in response to food price changes. Both chapters show that the changes in both production and consumption are quite large, with many households shifting from net buyer to net seller status. These results suggest that one should be very careful in drawing inferences on the basis of simulations of the first-round effects of price shocks on poverty, particularly when price changes are large. While the first order approximation can provide reasonable estimates of the impacts for the type of moderate-to-low price changes typically observed in most time periods, behavioral responses to large price changes are likely to occur when price changes are large and sustained—as noted earlier, transient increases are less likely to lead to such a response.

In Chapter 7, Guido Porto extends the analysis of the first-round impact of price changes by modeling household responses to price changes. He distinguishes three types of adjustments. The first is adjustment in production and consumption by households. When the price of a good increase, consumers will buy less of it and/or shift to cheaper substitutes. Producers may change their supply and input decisions to produce more of the good whose price has risen, and workers may reassess their labor supply. The second possible adjustment effect concerns intra-household spillovers. A change in the price of a good can have externalities to other activities of the household. For instance, if the price of a key cash

[10] Bangladesh is an outlier, however, being the only country in the sample of nine where the net food sellers were better off than the net food buyers.

crop increases, a farmer may be able to overcome credit constraints and invest in improved technologies not only in cash cropping but also in food production for home consumption. The third type of adjustment effect involves inter-household (cross-sectoral) spillovers. If a price change for a good affects the local demand for labor or other local non-traded goods, there may be repercussions for the local economy, including for households who were not producers before the shock.

Using data on rural households in Mexico, Porto estimates consumption, production, and labor market responses to a price shock. He finds that households who were net consumers before the shock may become net producers after it, thus benefiting from higher prices. Porto also uses data for Vietnam to identify the effects of changes in the price of one commodity (catfish) on household behavior. Lower catfish prices caused by a US antidumping action caused income and investment to decline, not only in catfish activities but also in other activities including crop production and livestock husbandry.

Most impact analyses using household-level information rely on income and expenditure data collected for only a single period. These numbers are then projected using observed price increases and/or by using a model of consumers' and producers' expected responses. But because many poor rural households shift between being net food buyers and sellers, and often are only "marginal" buyers at a given point in time, basing an analysis of the effect of price increases on a point estimate of the number or share of net buyers and net sellers can under- or over-estimate the number of households in each category. Lack of consistent panel data impedes econometric estimates of the magnitude of the shifts in either direction following a change in prices.

Vietnam is one of the few countries for which consistent panel data are available at the household level. Using Vietnamese panel data, in Chapter 8 Aksoy, Beverinotti, and Isik-Dikmelik assess the accuracy of analyses based on one-period estimates of net buying status. They note that between 1993 and 1998, some 21 percent of Vietnamese households switched between being a net seller and net buyer of rice. Households who make such a switch are of course just some of the households affected by price changes, and households who start as net buyers and remain so after a price increase may be more severely affected than those who shift their status. But identifying the set of households who switch provides a useful measure of the extent to which the initial distribution of households as buyers and sellers is an inaccurate predictor of the qualitative impact of a price change.

Fifteen percent of Vietnam's net rice buyer households of 1993 had become net sellers by 1998; they accounted for nearly nine percent of all households. Meanwhile, 29 percent of the net seller households of 1993 had switched to net buyer status by 1998 (12 percent of all households). In rural Vietnam, the shifts were somewhat larger: by 1998, 21 percent of the net buyer households of 1993 had become net sellers, and some 29 percent of the net seller households had become net buyers. Further, not all the households who switched from net buyer to net seller status were marginal buyers in 1993. Of those households whose net rice purchases took more than 10 percent of their total spending in 1993, 15 percent had become net rice sellers in 1998. A similarly large shift took place among initial net sellers.

Looking at the determinants of net buyer or seller status in rural Vietnam, Chapter 8 shows that net buyers were richer than net sellers, and tended to have non-agricultural wage income or to be farm households producing cash crops. Switchers were predominantly farming households, poorer than average, and tended to be marginal buyers or sellers, for whom net sales or purchases constituted a small share of their income or expenditures. The authors also find that, at the household level, food price changes had large and significant effects on net sales, production, and consumption. This suggests that price increases ultimately lead to higher production and to lower consumption, thus modifying their first-round effects on welfare.

Chapters 9 and 10 focus on changes in the incomes of net food buyers and sellers following a change in rice prices in Vietnam and Bangladesh, respectively. In both countries, rice is the main staple food. In Vietnam, the elimination of export controls on rice and of trading restrictions on fertilizer led to higher rice prices and a significant increase in rice output. In Bangladesh, the liberalization of imports of irrigation equipment and fertilizer led to structural changes in the agricultural sector, including an expansion of land under irrigation, an additional rice crop per year, higher yields, and lower rice prices.

In Chapter 9, Isik-Dikmelik uses panel data to analyze the changes in incomes following the price increases induced by the reforms in Vietnam. She finds that income grew faster in rural areas than in urban—a result consistent with higher food prices and large productivity increases.[11] Despite significant increases in domestic rice prices, net food buyers experienced greater income gains than net food sellers. Among the net buyers, the most vulnerable group—those for whom rice took more than 30 percent of their total spending—experienced the largest real income gain (80 percent), as compared to the average 56 percent gain for the net seller households. A decomposition of the sources of income growth across rural households shows that about half the income growth that accrued to poor net food buyers came from agriculture. Thus net buyers benefitted from the price increases, either because they also engaged in production (in Vietnam most rural families have some land), or because of second-order effects, or both.

In Bangladesh, unlike in Vietnam, agricultural liberalization in the early 1990s led to a decline in producer and consumer rice prices, of about 25 percent. In Chapter 10, Irina Klytchnikova and Ndiame Diop use a combination of ex-post and ex-ante approaches to analyze the distributional impacts of the reforms in rural Bangladesh. They find that the net effects of increased rice productivity and lower rice prices were very pro-poor. Regardless of the particular category of households analyzed, the poorest households benefited the most from the reforms. As expected, the price declines led to greater gains for rural net food buyers, who experienced significant growth in their agricultural and nonagricultural wage income. The poorest net food seller households also gained, in contrast to

[11] Net food sellers and buyers are defined on the basis of their food balances in the initial period, 1993.

the net seller households in the three richest quintiles, who suffered from the decline in prices.

In Chapter 11, Maurizio Bussolo, Olivier Godart, Jann Lay, and Rainer Thiele focus on non food agricultural commodities and investigate the impact of coffee price increases and reforms in coffee marketing in coffee-growing regions of Uganda, using a data set derived from three consecutive household surveys taken in 1992, 1995, and 1999. Coffee prices increased fourfold between the first and second survey but then fell by 50 percent between the second and third surveys. During this latter period, food prices rose as coffee prices came down. The authors analyze income changes in coffee-producing regions, distinguishing between coffee grower households, who benefited directly from higher coffee prices, and other households, who lived in the coffee-growing regions but pursued other activities, thus generating information on the potential linkages among rural households.

During 1992–95, the biggest income gainers were coffee growers, but in coffee-growing regions the real incomes of non-coffee growers also increased, partly because of an increase in derived demand for their goods and services. Among the non-coffee growers, most of the income growth came from non-agricultural sources.[12] During 1995–99, when coffee prices fell by 50 percent, incomes from coffee declined, with the greatest decline occurring for the poorest producers. However, the coffee growers' incomes from other agricultural commodities rose substantially, reflecting a shift into other crops. For poor non-coffee-growing households, both agricultural and non-agricultural incomes continued to increase after the end of the coffee boom. These findings suggest that there are significant externalities from one group of farmers to another.

In Chapter 12, Ekaterina Kivonos and Marcelo Olarreaga assess the impact of an increase in global sugar prices (driven by potential liberalization of sugar regimes in OECD countries) on household labor income and poverty in Brazil. The results suggest that the increases in prices will translate in increases in wages, with the largest increases occurring for workers in sugar growing and sugar processing sectors. Workers in other sectors also experience modest wage gains, with the exception of unskilled workers with little formal education in the services sector who see their wages decline. More surprisingly, the increase in the price of an unskilled labor-intensive good such as sugar generates greater increases in the wages of skilled workers. However, the largest labor income gains are experienced by unskilled workers, mainly as a result of movements out of unemployment. Their estimates show that approximately 280,000 individuals would move out of poverty following a hypothetical 10 percent increase in sugar prices. The analysis highlights the importance of considering the employment channel when studying the poverty impacts of increases in commodity prices.

Finally, in Chapter 13, Olivier Cadot, Laure Dutoit and Marcelo Olarreaga provide estimates of the cost of moving out of subsistence for farmers in

[12] In the rest of Uganda, very little income growth took place during the first period. During the second period, while incomes from coffee fell, incomes from other crops increased both for coffee and non coffee growers, and maize prices more than doubled.

Madagascar. As noted previously, the effect of price changes on farmer's behavior and household welfare will depend in part on how "connected" producers and consumers are to markets as determined by access to credit, the availability and quality/price of transport, distribution services, etc. Cadot, Dutoit and Olarreaga develop a simple asset-return model of occupational choice to estimate the magnitude of the entry costs associated with moving out of subsistence. They find that these are large—on the order of 125 to 150 percent of a subsistence farmer's annual production. While they cannot determine what share of the estimated costs reflects a lack of public inputs (e.g., road infrastructure) as opposed to private costs (e.g., acquisition of tools), their results make it possible to identify the types of farm characteristics that are likely to generate large gains if they can be moved out of subsistence. They also suggest that 1980s and 1990s trade reforms in Madagascar were not a major factor underlying the observed increase in subsistence farming during this period: the economic opportunity cost of the high entry costs are estimated to be less than 0.5 percent of GDP, reflecting very low levels of productivity in the agricultural sector.

CONCLUDING REMARKS

International prices of food and other agricultural products are expected to continue rising, pushed by structural factors including income growth in emerging markets, climate change, energy scarcity, and the related rise in biofuel production. Though the 2009 global slowdown brought prices down, they are nowhere near as low as in the early 2000s or 1990s. Reforms in agricultural policies have helped to create a floor for agricultural prices, with policy changes in both OECD and developing countries supporting higher food prices in developing countries. Though these are welcome reforms, for reasons discussed above, estimates suggest that their effect in terms of increasing world prices will be limited, certainly when compared to the more structural drivers of these prices.

Over the medium term, sustained price increases should generate additional supply, from international and—where a country has a comparative advantage and capacity to produce the staples concerned—domestic sources. Up to now, for most net importing countries the effects of higher international food prices have not been large in aggregate terms, with impacts exceeding 1 percent of GDP in only a few countries. Cross-country analysis of food trade balances (Chapter 6) shows that the supply response has come mostly from middle-income developing countries. An aggregate supply response has been less prevalent (observed) in low-income countries, and nonexistent in conflict and very small countries.

Output prices play a decisive role in decisions to expand supply. To some extent, the cross-country pattern of supply responses simply reflects patterns of comparative advantage. Also important is whether a country's business environment allows rural households to expand their agricultural output. In middle-income countries that expanded aggregate supply, it is likely that greater incentives to expand production encouraged the required investments, while better institutions for agricultural R&D and better rural infrastructure encouraged productivity growth. But while better transport, credit, markets, and the like are important—and gains in productivity will make it more profitable to produce at any given output price and thus can be expected to result in higher output—such improvements in complementary inputs may not be sufficient to induce a significant supply response.[13] Sustained higher prices can help provide such an incentive. Even where farmers face serious constraints (costs) that tend to slow down their supply response to higher prices, these do not stop their response completely.

What of the effects of rising food prices on poverty? Differences in view regarding these effects depend partly on the time frame that is used. They also depend on which specific groups are the focus of attention or concern. The poorest households in low-income countries tend to be rural; while many urban households are poor, they tend to be less poor than rural households. Urban households are much more likely than rural to be net food buyers, even though some produce food.

The country-level analyses in this volume suggest there will often be a significant agricultural supply response to increases in food prices, and that this in turn will raise rural incomes, not just for net food sellers but also for many poor households who are net food buyers. Producers may switch towards production of the food or cash crops whose price/profitability has risen. And increases in their incomes may in turn stimulate other rural activities, raising incomes and expanding job opportunities for a broader range of poor rural households.

If supply will respond to higher food prices, predictions of the impacts or incidence of food price increases should go beyond the initial pattern of net food buying and selling households. For some rural households, to be sure, the first-round, consumption-based, effects of a food price increase will dominate. These households include those with non-farm jobs that are relatively independent of the health of the rural economy (though in the rural areas of most low-income countries such jobs are few). They also include the more numerous group of net food buyer households who receive a significant part of their income from producing cash crops or from working for wages on cash crop farms, as well as net food buyers who depend on remittances and transfers. For these groups, which may be large net food buyers, higher food prices will have potentially large direct effects on consumption but little compensating effect on incomes.

In the case of a significant, non-transient, price increase it is vitally important to take account of second-order or linkage effects. This calls for an appreciation of the relationship between net buyers and sellers at the level of rural communities and regions. Rural areas and small towns are where poverty is widespread, and where most poor food buyers are located in lower-income countries. Though studies that focus on the first-round effects often assume that the incomes of net

[13] Porto (2010) stresses the importance of complementary factors for supply responses to changes in prices to occur. Weak transportation infrastructure, for example, can isolate regions within countries. As a result, rising (or falling) world prices will not be transmitted to producers or consumers in these regions. Nicita (2009) shows that Mexican states that are closer to the U.S. border benefitted more from trade liberalization than Southern states because consumer prices declined more the closer households were located to the border.

buyers and sellers are independent of each other, in fact in rural areas and small towns many non-farm jobs depend on the fortunes of farming households. Non-agricultural households supply agricultural inputs and consumer goods to the agriculturalists, as well as, more importantly, a diverse set of services to rural communities. Insofar as food price increases result in wage increases or a rise in employment levels, labor-selling households will benefit.

The historical behavior of international food prices suggests that many of the issues related to first- and second-order effects will remain controversial. When food prices increase they almost always rise quickly, and this tendency is heightened by the increased speculative activity discussed by Baffes and Haniotis in Chapter 2. A sharp rise in food prices has an immediate negative impact on food consumers, and often provokes governments to try to curtail the increase. Higher-income countries' policies to insulate and support their farm sectors make world prices more volatile, and so saddle the low-income countries with more of the burden of adjustment to demand or supply shocks. These policies also attenuate the potential supply response, and thus limit the positive effects of higher food prices.[14] Lower-income countries may suffer as food prices go up, both because their consumers pay higher prices but also because their producers feel the price-reducing effects of the expansion of supply that takes place in higher-income countries. Thus, it is important to differentiate between the short- and the longer-run effects of price peaks, and to appreciate the need to allow higher prices to be sustained for some time if positive second-order effects are to emerge.

Overall, it is not possible to generalize about the impact of higher food prices on the poor. Much of the trade literature has tended to assume, at least implicitly, that households in poor countries are mostly net food buyers. Clearly this is not the case, as illustrated in this book. Much depends on the specific economic structures of individual countries and the focal point of the analysis. For many poor households, including the urban poor and many poor rural net food buyers, the short-run impact of higher food prices will be unambiguously negative—which calls for offsetting safety-net programs. But from a longer-term development perspective, the analytical focus should include the second-round effects of the price increase on rural households. Some of the empirical studies in this book suggest that higher prices might be good not just for net food sellers but also for rural net food buyers. The poorest (rural) households may benefit from higher food and other agricultural prices, both directly if they are net sellers, and indirectly through increased wage income, increased sales of services, and so forth. For many rural net buyers, the higher consumption cost due to higher food prices is more than offset by higher income.

Discussions in the context of the Doha Development Agenda have often been driven by worries that trade liberalization will raise global food prices and thus hurt net importing countries. Many observers have expressed concerns that higher food prices may prevent the achievement of poverty alleviation goals, given the

[14] The fact that industrial countries did not do much to insulate domestic markets in the 2007–08 period of price inflation was a major improvement over earlier episodes of food price increases.

large number of net food buyer households in low-income countries. But the studies in this book suggest that higher prices for food and cash crops can also be beneficial for many poor rural households. The evidence—admittedly partial and incomplete—suggests that the concerns of the many trade and development analysts regarding the negative consequences of net taxation of cash and food crops and low prices for poverty reduction remain valid, and that sustained higher prices need not be detrimental for poverty alleviation in developing countries.[15]

Of course, prices are just part of the equation: reducing poverty in rural areas requires investments to raise productivity and enhance connectivity to markets. There is a large gap between the amount of investment that is needed to promote agricultural productivity in developing countries and what is currently allocated to agriculture, and an urgent need in many countries to reduce marketing costs, improve the functioning of supply chains, enhance rural infrastructure, and so forth (World Bank, 2007). The Global Agriculture and Food Security Program that was established in 2009 as a focal point to increase funding for agricultural investments in developing countries reflects a recognition by the development community of the importance of addressing the global financing gap for agriculture.

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[15] This is not an argument for protection of import-competing staple foods, because the aggregate income effects of domestic price-increasing trade barriers on households are likely to be negative.

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PART I
Cross-Cutting Issues

1

How the Food Crisis Changed Policy Perspectives

JOHAN F.M. SWINNEN[16]

Only a few years ago the widely shared view was that *low* food prices were a curse to developing countries and the poor. The following statement from the Food and Agricultural Organization (FAO) of the United Nations on the state of the world food markets and its implications for developing countries represents the common view as recently as 2005: *"The long-term downward trend in agricultural commodity prices threatens the food security of hundreds of millions of people in some of the world's poorest developing countries where the sale of commodities is often the only source of cash."*[17]

The dramatic increase of food prices in 2006–2008 appears to have fundamentally altered this view of the food system. The vast majority of reports in 2008 and 2009 state that *high* food prices have a devastating effect on developing countries and the world's poor. A typical example is the following statement from the 2008 annual report of the International Food Policy Research Institute (IFPRI): *"In 2007, longstanding disruptions to the world food equation became widely evident and rapidly rising food prices began to further threaten the food security of poor people around the world. ... The current food-price crisis can have long-term, detrimental effects on peoples' health and livelihoods, and can contribute to the further impoverishment of many of the world's poorest people."*[18]

This reversal of opinion was widespread as I have documented in detail in Swinnen (2010). This raises questions about the correctness of the old and the new arguments and about the proposed remedies. It also raises questions about the causes of this dramatic turnaround in analysis and policy conclusions.

In this chapter I present a simple framework to assess welfare effects of food price changes and then review the positions of a variety of organizations active

[16] I thank Mara Squicciarini for excellent research assistance and Kym Anderson, John Bensted-Smith, Luc Christiaensen, Tassos Haniotis, Tom Hertel, Michiel Keyzer, Andrzej Kwiecinski, Will Martin, Alan Matthews, Alessandro Olper, Manohar Sharma, Peter Timmer, Alan Winters and various other colleagues for discussions on the issues raised in this paper. The opinions expressed here are mine only. Contact: jo.swinnen@econ.kuleuven.be This chapter is a shorter version of the analysis in Swinnen (2010): "The Right Price of Food: Reflections on the Political Economy of Policy Analysis and Communication". For more details and documentation I refer to this paper.

[17] FAO newsroom, *Agriculture commodity prices continue long-term decline,* 15 February 2005, Rome/Geneva. http://www.fao.org/newsroom/EN/news/2005/89721/index.html

[18] IFPRI, Annual Report 2007-08, p.3

in the food policy arena and review a series of hypotheses to explain their apparent change of views as reflected in their public statements.

FOOD PRICE EFFECTS: SOME BASIC PRINCIPLES

Before reviewing analyses and policy statements let us first present some basic principles on the effects of food price changes – which I presume are generally known but, given the variety of conclusions presented, it appears useful to start by setting the framework. Consider first a simple model of an open economy with two groups, producers and consumers of food, where prices are determined at the world market with local production or consumption having no impact on global prices (i.e. the so-called small country assumption in international trade theory). In this situation, a change in world market prices (caused by some external factor which is exogenous to the country) affects producers and consumers, but in opposing directions: consumers gain and producers lose from a decline in prices, and vice versa when prices increase.

To make this model more realistic one can consider several extensions. First, in reality the distinction between producers and consumers may not be so simple. Many rural households in developing countries are both producers and consumers of food and are thus affected in different ways by price changes. The net household effect depends on their net consumption status. Second, the change in world market prices may differ from the change in the local prices and the latter may even differ for local producers and local consumers, as these changes are affected by various policies (trade policy, taxes, …), by infrastructure and institutions, and by the industrial organization of the food chain. Third, local production and consumption may also affect local prices, in addition to exogenous external shocks. Fourth, the "exogenous" shocks may be caused by nature (e.g. the weather) or by men (e.g. changes in trade policies or consumption or production in other countries). Fifth, short-run effects may differ from long-run effects, as pass-through may take some time.[19]

What is important for our purposes is that all these extensions do not fundamentally change the basic result of the simple model: when prices go up consumers lose and producers gain, and vice versa. Hence, when rich countries increase (reduce) export subsidies which leads to a decline (increase) in world markets, this will benefit (hurt) urban consumers and net consuming rural households in poor countries and hurt (benefit) net producing rural households in poor countries. The size of the benefits/losses will of course depend on various factors, such as local policies, institutions, the food chain organization, time, etc.

Moreover, the net benefits of price increases and decreases for a country should be roughly symmetric. Countries that benefit most from price decreases (e.g. if they consume lots of food but produce little) will lose most from price increases. The same holds at the household level within a country. Households which only

[19] There are more factors that would need to be taken into account in a truly complete model such as "exogenous" shocks versus "endogenous" price changes, etc.

consume food and do not produce food will be affected stronger when prices change than households which both produce and consume food. Another implication is that households which are directly affected by world market prices will gain or lose more than those living in areas largely isolated from market transactions when world prices change.

A straightforward implication of these basic principles is that low food prices on the world market in most of the pre-2005 period benefited consumers and hurt farmers in developing countries, and vice versa during 2006–2008. Another implication is that households that suffered strongly in 2007 from high food prices (e.g. those urban market centers and producing little food themselves) would have benefited significantly from low food prices prior to 2005. Conversely, some rural households may not have benefited (much) from the high prices in 2007 (e.g. because they live in remote places with poor pass-through of prices from the world market or because they consume all their food production themselves). These rural households would also have experienced limited negative welfare effects from the low food prices prior to 2005.

Surprisingly, however, while these basic principles are well known, we do not find them reflected in most arguments put forward in the food policy debate. For example, there has been hardly any mention of the benefits of low food prices for urban consumers and net consuming rural households during the pre-2006 low price era, and there has been very little emphasis in more recent statements on the benefits for producers in poor countries from high food prices.

A 180° TURNAROUND IN FOOD POLICY ANALYSIS & COMMUNICATION

Before trying to understand the reasons for this, I will document by a series of quotes that this was indeed the case, i.e. that there are conflicting analyses and communications prior to 2006 and afterwards, and that there is a lack of consistency in analysis and policy recommendations. [20] I then discuss whether these quotes are representative and address the critique that this approach may not be appropriate by taking quotes out of their context.

To start, let us take a look at statements from some of the nongovernmental organizations (NGOs) working in the area of food policy before and after the food crisis. In 2005, Oxfam International argued that:

"US and Europe['s s]urplus production is sold on world markets at artificially low prices, making it impossible for farmers in developing countries to compete. As a consequence, over 900 millions of farmers are losing their livelihoods."[21]

[20] See Swinnen (2010) for a more elaborate analysis of policy statements.

[21] OXFAM International, *International celebrities get dumped on at the WSF*, 1 November 2005 (underlining added). http://www.oxfam.org/en/node/283

Three years later, at the height of the food crisis, Oxfam International's view was that:

"Higher food prices have pushed millions of people in developing countries further into hunger and poverty. There are now 967 million malnourished people in the world...."[22]

Other NGOs share this analysis: prior to 2006 they claimed that low food prices are hurting the poor and creating food insecurity; after 2006 they claimed that high prices are hurting the poor and leading to food insecurity. Whatever happens to prices – either decreasing (pre-2006) or increasing (post-2006) – hundreds of millions of people would end up in poverty.

The apparent contradiction in these statements is obvious. One justification for the statements could be that they refer to different groups in society (farmers in one case, urban consumers in the other case). If so, the lack of emphasis on this and the absence of recognition that other groups may benefit remains striking. Moreover, the excuse that the conflicting arguments are due to focusing on different groups (while selectively ignoring other groups) cannot credibly be used. In several cases, NGOs claim that the same group (e.g. poor rural people) is hurt by low prices (in 2005) and hurt by high prices (in 2009) (Swinnen 2010).

One explanation could be that NGOs are advocacy groups and their primary objective is not to provide objective and carefully balanced analyses, but rather to raise awareness of problems and to pressure governments to do something about them, or to raise funds for their projects.[23] What follows therefore turns to the views of international institutions that are not (expected to be) advocacy groups, but to provide analyses and recommendations to enhance social welfare. Such institutions include the FAO, IFPRI, OECD, the IMF and the World Bank. Interestingly, these entities appear to have adjusted their analyses and policy communications in a similar way to the NGOs.

Before the food crisis, reports from FAO, IFPRI, the OECD, the World Bank, and the IMF typically claimed that low agricultural prices hurt developing countries and argued that liberalization would help the poor by increasing world prices as rich countries cut their agricultural subsidies. This is illustrated by the following quotes:

"The long-term downward trend in agricultural commodity prices threatens the food security of hundreds of millions of people in some of the world's poorest developing countries." [24]

[22] OXFAM International, *Lessons from the food price crisis: Questions & Answers*, 15 October 2008 (underlining added). http://www.oxfam.org/en/campaigns/agriculture/food-price-crisis-questions-answers

[23] For economic models of NGOs, see e.g. Aldashev and Verdier (2010), Andreoni and Payne (2001), Chau and Huysentruyt (2006).

[24] FAO newsroom, *Agriculture commodity prices continue long-term decline*, 15 February 2005, Rome/Geneva. http://www.fao.org/newsroom/EN/news/2005/89721/index.html

"Many (developed countries) continue to use various forms of export subsidies that drive down world prices and take markets away from farmers in poorer countries. ... Much of this support depresses rural incomes in developing countries."[25]

In contrast, during the food crisis of 2007–2008, these organizations, like NGOs, communicate very different effects of food prices:

"When food prices skyrocket this can quickly pose a threat to the lives of the poorest, particular in developing countries." [26]

"Preliminary estimates suggest that up to 105 million people could become poor due to rising food prices alone."[27]

"The rapid increase in food prices has had an adverse impact on poverty, and effectively denied many poor people access to food."[28]

In summary, (virtually) all the major international organizations that focus on food and agricultural policy issues globally have shifted from emphasizing how low food prices, often argued to have been caused by rich country agricultural policies, cause poverty and food insecurity in developing countries in the pre-2006 period to emphasizing that high food prices cause poverty and food security in the post-2006 period, without mentioning the benefits (in either period).

Out of Context?

An obvious critique of my argument is that I am making false claims by taking statements out of context. That is, I am just selecting one element of a broader and more complex message and the full analyses are more complete and nuanced. It is of course true that these quotes are taken out of their context – that's why they are quotes to begin with – and that reading the full documents may provide more nuance. However, I would hold that these quotes quite accurately represent the key arguments in the context of the recent debates. First, in the vast majority of the cases the quotes summarize quite well the key message of the reports. This is particularly important because "key messages" are an important focal point for these organizations as the target audiences (political decision-makers and the general public) have no time to read long reports. Therefore, the institutions devote significant effort in developing "key messages" and their com-

[25] Declaration by the Heads of the IMF, OECD and World Bank, 4 September 2003. http://www.bfsb-bahamas.com/photos/old_images/Declaration.pdf

[26] OECD, Ensuring food security for the world's poor: Questions and Answers, 07 May 2009. http://www.oecd.org/document/50/0,3343,en_2649_37401_42666830_1_1_1_1,00.html

[27] World Bank, *Double Jeopardy: Responding to High Food and Fuel Prices, G8 Hokkaido-Toyako Summit,* July 2008, p. 4. http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/ 0,,contentMDK:21827681~pagePK:64257043~piPK:437376~theSitePK:4607,00.html

[28] IMF Food Security and the Increase in Global Food Prices, Speech by Mark Plant, IMF Deputy Director, Policy Development and Review Department, 19 June 2008. http://www.imf.org/external/np/speeches/2008/061908.htm

munication strategy is typically centered on these messages. The rest of the policy document is typically substantiates the key messages.[29] Hence, the quotes I have listed do represent the key arguments made.

Second, even if one reads the full report and one takes on board all the nuances, there remain striking differences in the pre- and post-2006 analyses and conclusions. For example, in very few of the reports published before the recent food price increases is there any mention of the fact that urban consumers in developing countries benefit (and the few that do mention it do not consider it as a major element). Neither is the argument made that many poor rural households are net consumers, and may thus benefit from low food prices. However, the (mirror versions of these) arguments are emphasized very strongly in all the post-2006 reports. All the attention there goes to the losses of these two groups. Paradoxically, at the same time very little attention is paid to benefits for poor farmers in these reports. Both observations are in total contrast with the pre-2006 arguments.

Do Poor Farmers Benefit from High Food Prices?

A potential justification of this bias in focus and argument is that poor farmers were hurt by low agricultural prices before 2006 but that consumers did not benefit from low food prices, and that during the 2006–2008 period of high prices poor farms did not benefit from high prices but that poor consumers did get hurt. It is well known that in developing countries there exist a variety of market imperfections and transaction costs which may influence the extent to which consumers and producers are affected by price changes. Some have used such arguments to argue, for example, that consumes were strongly negatively affected by the food crisis, while prices for farmers increased very little, if at all.

I do not find these arguments to be convincing as an explanation for the bias in policy messages. First, if farmers in rural areas are not (very much) affected by the high prices, then how can one argue that many poor rural households are negatively affected by the price increases since they are net consumers? If prices do not benefit (net producing) farmers, they should not harm net food consuming households living in the same rural areas.

Second, the problems of imperfect price pass-through between farms and consumers (domestic or international) is of course not new and not restricted to a period of high prices. These problems reflect a combination of institutional, policy, and infrastructural constraints. If they are important – and they are in many regions of developing countries – they should have also have limited the pass-through of low prices to farmers in the pre-2006 period. Continuing the same logic, as urban consumers would have been more directly affected, this should

[29] In fact, any academic researcher who starts working for such organizations is reminded from day one to move complicated analyses and sophisticated messages to the appendix and the footnotes and to focus on bringing out the key messages in simple, easy to understand, sentences. I have extensive personal experiences on this.

then have caused greater positive aggregate (net) effects of low food prices than generally argued in the pre-2006 period.[30]

POLICY IMPLICATIONS (WHAT'S THE PROBLEM?)

An explanation for these observations could be that the objective of the organizations is to assist those in need, i.e. those who are negatively affected by shocks. When prices fall (are low) farmers are negatively affected and, therefore, aid and policy focus should be targeted towards them. When prices increase (are high) consumers are negatively affected and they should attract most policy attention and aid. Hence, when conditions change, attention will shift from one group to another depending on how they are (relatively) affected, i.e. who is benefiting and losing from the change. If this is indeed the case, instead of worrying about this, one may instead appreciate the change in policy attention and international organizations' re-focus towards those who are in need. Hence: what's the problem?

One problem concerns the policy messages that are being communicated and recommended, and the fact that they seem to ignore that there are always winners and losers. In addition, one should expect a good policy framework to be coherent and be relevant and correct both when prices go up and when they go down. Recommendations to assist developing country consumers, such as cutting export restrictions in food exporting countries, would hurt poor farmers in food importing countries and food consumers in food exporting countries. In fact, export restrictions in food exporting countries with many poor people (such as India and Thailand) have been blamed by international organizations for hurting poor consumers in food importing countries. However they have benefited poor consumers in food exporting countries – and some experts have argued that these governments have indeed made the right policy choice.[31] Similarly, policy recommendations intended to help developing country farmers prior to 2005 — such as cutting export subsidies from the EU – typically ignored that they would hurt consumers in developing countries.

In summary, even if the objective of NGOs and international organizations is to assist those who are negatively affected by food price changes, this is no excuse for overly simplistic policy analyses and conclusions. To the contrary: the policy choices are difficult and involve trade-offs, and would therefore benefit from careful analyses and nuanced messages.

These arguments are important for current policy debates and choices. In many rich countries some have embraced the new policy focus and communications messages for advocating for farm subsidies. For example, inside the EU various interest groups have started using "food security" (including global food security)

[30] Additional arguments are that farmers may not have benefited because their costs (in particular fertilizer and energy) went up by more than the price of their output (food). This is an important point, but to draw conclusions one should take into account the extent to which poor farmers rely on external inputs.

[31] See e.g. Timmer (2009).

as an argument to defend the € 50 billion in subsidies that are paid each year to EU farmers from the EU budget. In fact, the main EU farm lobby (COPA-COGECA) and the EU association of land owners (ELO) argue that food security should be a key motivation for continuing the subsidization of EU agriculture in the future. Moreover, recently the United Nations explicitly praised the attractiveness of the EU's old Common Agricultural Policy (CAP) as a model:

"While the establishment of the EU Common Agricultural Policy (CAP) in 1962 had 'many negative externalities', ... the policy is a good example of how to achieve food security in a given area."[32]

That the old CAP raised EU food prices, thereby hurting urban consumers in the EU and thus *lowering* food security in the "given area" and that the "negative externalities" have been attacked by all international organizations (literally from "left" to "right", i.e. from Oxfam to the IMF) as being detrimental to poor country farmers does not seem to be a major concern to those who are making such statements.

THE POLITICAL ECONOMY OF POLICY ANALYSIS AND COMMUNICATION

In this last section I discuss some potential explanations – in addition to the arguments made earlier – for the puzzling observations that I have outlined above.

Scientific Progress (Analysis vs. Communication)

Perhaps the simplest explanation is that the analyses and arguments in the past were wrong and the recent food crises, in combination with improved economic modeling and better data, has contributed to better analysis and improved insights. There certainly has been significant progress in economic models and data to measure the impact of global price changes and policies on developing country households.[33] The simulation results of the most recent economic models are more reliable, more precise and more detailed in their impact assessments.

However, the issue is not the outcomes of the models, but instead the communication of their results and the policy messages that are derived from them. In the same way that benefits for poor consumers from low market prices have not been emphasized in the past,[34] the benefits to poor farmers from high prices are not emphasized now. In fact, several organizations published analytical reports with detailed findings and carefully nuanced interpretations and conclusions

[32] UN special rapporteur on the right to food, Interview with EurActiv on 26 November 2009 (www.euractiv.com)

[33] There are a series of improvements in data and models in this area, including in models run by OECD, FAO, IFPRI, GTAP, the World Bank, etc.

[34] Very few pre-2006 studies emphasize the benefits of low food prices for the poor. Note also that many model runs of trade liberalization in agriculture show that the impact for Africa is negative, precisely because Africa is a net consuming region and is benefiting more from low food prices (as consumer) than it is losing (as producer).

around the same time when their communication departments released statements on the food price issues which demonstrated the shift in emphasis (bias) which I have documented above.[35]

Urban Bias and Relative Incomes

For decades the poor situation of African farmers has been caused at least partially by policies which were said to be "urban biased", i.e. favoring urban interests and at the detriment of rural farmers through (implicit) taxes. This, in fact was one of the main conclusions from the famous Krueger, Schiff and Valdes (1992) study of the World Bank, which contributed to the motivation for structural adjustment programs in the 1990s. These programs have contributed to reduce taxation of developing country farmers, as documented by the recent World Bank study led by Kym Anderson (Anderson, 2009).

The 2007-2008 food crisis led to a surge in attention to food policy caused by pressure from urban interests.[36] As soon as urban protests reached the streets and the media, international organizations reacted much like local politicians and paid a disproportionate amount of attention to the problems of urban consumers. There are a variety of explanations for the urban bias in developing countries. When hit by a negative relative income shock, such as an increase in food prices, urban consumers will react politically, e.g. through demonstrations.[37] Since they are concentrated in cities and are easier to mobilize than dispersed farmers in distant rural areas (i.e., they face lower transport, organization and communication costs), they may receive disproportionate attention from policy-makers.[38] It may be that a similar urban bias effect plays a role in drawing reactions and policy attention from international organizations, e.g. through global media markets.

Fundraising and Legitimacy

If one wants to help the poor or stimulate development, funding is needed. NGOs need to invest in fundraising activities in an environment where there is vigorous competition for attention and funding (e.g. Andreoni and Payne, 2003; Rose-

[35] See, for example, the studies in this volume as well as Anderson et al (2010), Christiaensen and Demery (2007), Hertel and Winters (2006) and the 2008 World Development Report, all published by the World Bank, Sarris and Morrison (2010) published by FAO and the policy analyses in various OECD reports on the state of agricultural markets and policies over the past decade. See Swinnen (2010) for a more detailed analysis of the relationship between the policy analysis of the research departments and policy communication of the organization.

[36] See Hendrix et al (2009) and Maas and Matthews (2009) for empirical political economy analyses on the determinants of protests and riots against the food price increases.

[37] This shift in policy attention reflects the relative income effect, which is widely observed to be a determinant of food and trade policy. When prices fall (are low) farmers are negatively affected and aid and policy focus is targeted towards them. When prices increase (are high) consumers are negatively affected and they attract most policy attention and focus. Hence, when conditions change, attention will shift from one group to another depending on how they are (relatively) affected, i.e. who is benefiting and losing from the change. The relative income effect in agricultural and food policy was emphasized by, for example, de Gorter and Tsur (1991) and Swinnen (1994).

[38] The organization cost argument was made first by Olson (1965) and has been applied to agricultural and food policy by, for example, Anderson and Hayami (1986) and Gardner (1987).

Ackermann, 1982). From this perspective, the statements listed above could be interpreted as part of a marketing strategy by NGOs.

While academic studies analyzing this have focused on NGOs, the general argument regarding stressing the costs and ignoring the benefits of price changes as a marketing strategy may apply more widely.[39] All international organizations – whether NGOs or IFPRI, the World Bank, or FAO – rely to some extent on funds from public or private donors to operate and implement their projects. Groups within international organizations have to compete internally for funding. While funding sources may differ, in a world where financial means are limited and where there is continuous pressure to demonstrate relevance, all these organizations need to demonstrate the importance of their work. Focusing their reports and analyses on those hurt by price changes may fit in such strategy to show relevance and importance – and thus help in securing and raising funds.

A closely related argument is that, with mass media reports focusing on those hurt by changing food prices – in particular consumers post 2006 – the donor community, the organizations' shareholders, and the public at large may expect (or even demand) that these organizations focus their attention on those who are suffering from price changes. If they would not publicly react to the reported problems, then it would hurt their legitimacy as development organizations. This could undermine overall support for their existence.

For some of the organizations discussed here, the objective is directly linked with addressing negative welfare consequences. Others, however, should be expected to focus more on the overall (aggregate) welfare effects. Hence for the first group of organizations, the incentive to bias their message may be stronger, both for fundraising purposes and for their legitimacy.

MASS MEDIA AND POLICY COMMUNICATION

The arguments above already point to the important role of the media in inducing organizations to act, either in order to preserve their legitimacy, to raise funds, or as a consequence of pressure from the public at large or their stakeholders. There are two important, but distinct, mechanisms at work in the interaction between these organizations and the mass media. The first is the impact of stories that appear in the mass media on the actions (analysis and policy focus) of the organizations. The second is the desire of the organizations to appear in mass media in order to achieve their objectives (Cottle and Nolan 2007).[40]

Several characteristics of mass media are relevant to explain these mechanisms (McCluskey and Swinnen, 2010). First, the agenda setting effect of the media in

[39] Most academic research on the behaviour of international organizations has focused on their lending strategies and much less on their communication or fundraising strategies (see e.g. Aldenhoff (2007); Dreher, Sturm and Vreeland (2009), Vaubel et al. (2007)).

[40] The latter is analyzed in detail by Cottle and Nolan (2007) who conclude that *"aid agencies have become increasingly embroiled in the practices and predilections of the global media and can find their organizational integrity impugned and communication aims compromised. These developments imperil the very ethics and project of global humanitarianism that aid agencies historically have done so much to promote."(p862).*

international and aid policy. This has sometimes been referred to as the "CNN factor" (Hawkins, 2002) and involves the process through which the media influences policy by invoking responses in their audiences through concentrated and emotionally based coverage, which in turn generates pressure on governments to (re-)act. Similarly, the absence of media coverage reduces priority in agenda-setting (Jakobson, 2000). In this logic, public officials react to media news because they see it as a reflection of public opinion (Kim, 2005).

Several studies have analyzed the impact of media coverage of poverty, humanitarian crises, and natural disasters on foreign aid flows. Van Belle, Rioux and Potter (2004) and Kim (2005) find that a higher level of media attention to developing country problems lead to more aid in several developed countries. Eisensee and Stromberg (2007) argue that disaster relief decisions and aid allocations are driven by media coverage of disasters, but that other newsworthy events may crowd out this news coverage.

Second, media attention is typically concentrated around "events" or "shocks" (Swinnen and Francken, 2006).[41] Hence, sudden changes with dramatic effects, such as the 2008 food crisis, not only present important challenges to the international organizations in addressing their consequences, but also important opportunities for development organizations to capture media attention and signal their relevance and importance to their donors and the public.

A third factor is that the public at large will be more interested in media reports concentrating on negative (development) effects. This follows from the so-called "bad news hypothesis." Media consumers in general tend to be more interested in negative news items than in positive news, ceteris paribus. This demand effect of the media market drives mass media to pay more attention to "bad news" (McCluskey and Swinnen 2004).

Together, these factors created a set of incentives for international organizations to emphasize negative welfare implications in their analyses and policy communications, and to de-emphasize the positive effects around the food crisis in 2007–2008. In doing so, they were more likely to attract media coverage on their work and, in turn, more likely to reach a wide audience and to influence policy-makers. Such a media strategy could have a direct effect in influencing public and private donations and policies of governments in the short run. It could also have an indirect effect in encouraging appreciation and enhancing the perceived legitimacy of their work, as well as the organizations themselves, which could lead to greater support in the long run.

SOME CONCLUDING COMMENTS

As discussed above, there are several factors that may explain why the policy messages of NGOs and international organizations may be biased towards emphasizing the negative welfare effects of shocks or policy changes and give less weight (or ignore altogether) the positive welfare effects for groups that gain.

[41] For example, Swinnen and Francken (2006) find that virtually all the attention to globalization, trade and development issues in mass media is concentrated around 'international summits'.

Policy Bias

The main question, of course, is to what extent this bias in focus and communication of effects is affecting policy-making, and ultimately welfare and economic development. The answer to this question is difficult since it depends on various assumptions regarding (a) the processing of these information sets by voters, policymakers and the organizations themselves, (b) the type of welfare function one has in mind, and (c) the political economy of policy decisions at various levels. That said, it is likely that ultimately a bias in the analysis and the policy messages does influence policy-making, and, thus welfare and development.

Land Grabbing and Headline Grabbing

Finally, the issues discussed here are relevant beyond the food price debate.[42] The analysis and policy communication on issues such as the effects of biotechnology, foreign investment in developing countries, including the so-called "land grabbing" debate, the supermarket revolution, and so forth have been influenced by similar mechanisms.

An example is the recent debate on foreign investment in land in Africa, which has been captured by the term "land grabbing" – a concept which in itself emphasizes the potentially negative implications. This is somewhat remarkable given the empirical evidence on the huge benefits that farmers in other parts of the world have gained from foreign investments in the food system. Several colleagues and I have argued on several occasions that foreign investment in the agri-food system has been a crucial factor behind the post-1995 growth in agricultural productivity and performance in Eastern Europe, with major positive spillovers for small and large farms (Dries and Swinnen, 2004; Gow and Swinnen, 1998). The same phenomenon appears to have occurred in some places in Africa (Maertens et al. 2009).

However, from a media strategy and communications perspective, coining this by the term "land grabbing" has been a remarkable success as it is now widely used to describe the process of foreign investment in the food system and its risks. The potential problem of course is that with such a negative connotation it has become much more difficult to communicate an unbiased evaluation of the benefits and costs, the pros and cons, of foreign investment in land in Africa. Even if evidence would show that such investment has been beneficial for the local population, it is now certainly more difficult to overcome opposition to "land grabbing". Similarly, the focus on one side of the effects in the food policy debate both before and after the recent food crisis is likely to have a cost in terms of policy-making and thus in terms of welfare and poverty reduction.

[42] The food crisis itself also affected the communication on other policy issues. For example, for most of the 1980s and 1990s, biofuels and biochemicals were seen as a potential source for enhancing farm incomes. As an alternative outlet for agricultural commodities, they were seen as potentially providing an opportunity to stop the long-run downward trend in prices for farmers. This perspective has changed totally with the recent food crisis to the extent that biofuels have been called "a crime against humanity" by a UN special rapporteur on food in 2007.

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2

Placing the Recent Commodity Boom into Perspective

JOHN BAFFES AND TASSOS HANIOTIS[43]

The recent commodity boom was one of the longest and broadest of the post-World War II period. The boom—and especially the 2008 rally, when crude oil prices peaked at US$ 133/barrel (up 94 percent from a year earlier) and rice prices doubled within just five months—has aroused renewed interest in the long-term behavior and determinants of commodity prices, and raised questions about whether commodity prices have reversed the downward course that most of them followed during most of the past century.[44] It has also produced numerous calls for coordinated policy actions at the national and perhaps international level to address food availability and food security concerns.[45]

To put the recent commodity boom into perspective calls for a good understanding of the key characteristics and determinants of long-term commodity price movements—and an appreciation of how limited is our current understanding, especially regarding the conditions under which the recent boom unfolded. Having such a perspective is important in order to avoid policy pitfalls that in the name of mitigating food security concerns or improving the functioning of the markets may, in fact, exacerbate problems.

This chapter has two objectives. The first is to analyze the nature of the recent boom, especially in food commodities, by examining the key factors that fueled it and whether such factors are likely to remain in place in the long term. The second objective is to place the boom into perspective by examining long-term trends and characteristics of commodity prices. Thus Section 1 begins with a discussion of recent price trends, including the causes of the boom as well as a com-

[43] The views expressed in this chapter are those of the authors and should not be attributed to their affiliated institutions. We would like to thank Ataman Aksoy, Betty Dow, Chris Gilbert, Louis Goreux, and Gauresh Rajadhyaksha for comments and suggestions on preliminary drafts.

[44] Numerous authors have analyzed the recent commodity boom. See, for example, Abbot, Hurt, and Tyner (2008), Timmer (2008), Gilbert (2009), Mitchell (2009), Piesse and Thirtle (2009), Sarris (2009), Trostle (2008), and Coady, Dorosh, and Minten (2009). *Agricultural Economics* devoted an entire issue to the subject (Masters and Shiverly 2008).

[45] See, for example, Von Braun and Torero (2009) on virtual reserves and Mendoza (2009) on rice insurance mechanisms. Today's discussions call to mind those in earlier booms (for example, Meadows and others 1972).

parison with earlier episodes of high prices. Particular attention is paid to three key (real or perceived) causes of the boom: speculation, food demand growth by emerging economies, especially China and India, and use of some food commodities to produce biofuels. Section 2 analyzes the long-term behavior of commodity prices, including stationarity, co-movement among prices of food commodities, and the price link between energy and non-energy commodities. The final section summarizes and discusses some policy issues, including the rationality and viability of proposals for dealing with price spikes.

We conclude that a stronger link between energy and non-energy commodity prices is likely to be the dominant influence on developments in commodity, and especially food, markets. Demand by developing countries is unlikely to put additional pressure on the prices of food commodities, although it may create such pressure indirectly through energy prices. We also conclude that the effect of biofuels on food prices has not been as large as originally thought, but that the use of commodity markets by investment funds may have fueled the boom, especially the 2007/08 spike. Finally, econometric analysis of the long-term evolution of commodity prices supports the thesis that price variability overwhelms price trends.

THE NATURE AND CAUSES OF THE RECENT COMMODITY BOOM

The recent commodity boom emerged in the mid-2000s after nearly three decades of low and declining commodity prices (Figure 2.1). The long-term decline in real prices had been especially marked in food and agriculture. Between 1975–76 and 2000–01, world food prices declined by 53 percent in real US-dollar terms. Such price declines raised concerns, especially with regard to the welfare of poor agricultural producers. In fact, one of the Doha Round's chief motives (and also one of its perceived main obstacles) was the reduction of agricultural support and trade barriers in high-income countries—a set of reforms that was expected to induce increases in commodity prices and hence improve the welfare of low-income commodity producers (Aksoy and Beghin 2005). Starting in the mid-2000s, however, most commodity prices reversed their downward course, eventually leading to an unprecedented commodity price boom.

Between 2003 and 2008, nominal prices of energy and metals increased by 230 percent, those of food and precious metals doubled, and those of fertilizers increased fourfold. The boom reached its zenith in July 2008, when crude oil prices averaged US$ 133/barrel, up 94 percent from a year earlier. Rice prices doubled within just five months of 2008, from US$ 375/ton in January to $757/ton in June.

The recent boom shares two similarities with the two earlier major commodity booms of the post-WWII period, during the Korean war and the early 1970s energy crisis (see Radetzki (2006) for a discussion of the three booms.). Each of the three booms took place against a backdrop of high and sustained economic growth as well as an expansionary macroeconomic environment, and each was followed by a severe slowdown of economic activity. And all three triggered discussions on coordinated policy actions to address food security concerns.

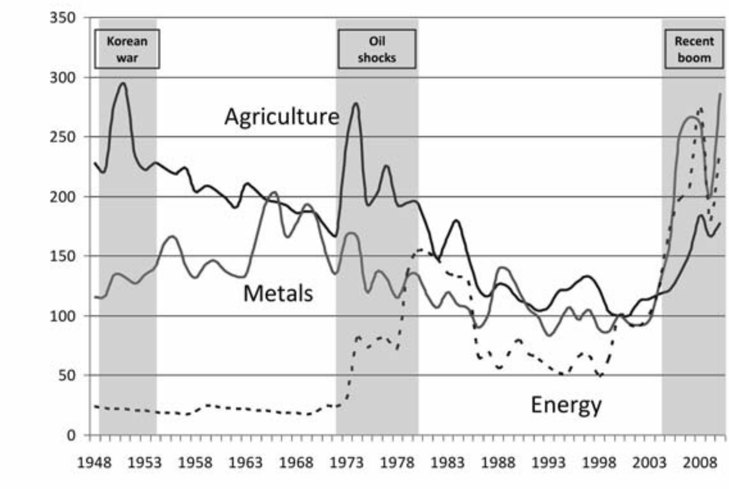

Figure 2.1: *Unlike earlier booms, the current boom involved all commodity groups*

Note: MUV: Manufacturing Unit Value Index, which measures the prices of trade in manufactured products.
Source: World Bank.

Yet the recent boom also shows some important differences from the previous ones. By most accounts, it was the longest-lasting and the broadest in the numbers of commodities involved. It was the only one that simultaneously involved all three main commodity groups—energy, metals, and agriculture (World Bank 2009). And it was not associated with high inflation, unlike the boom of the 1970s. Another important characteristic was that it unfolded simultaneously with the development of two other booms—in real estate and in equity markets—whose end led most developed countries to their most severe post-WWII recession.

The recent boom took place in a period when most countries, especially developing ones, sustained strong economic growth. During 2003–07, growth in developing countries averaged 6.9 percent, the highest five-year average in recent history (Figure 2.2).

Apart from broad and prolonged economic growth, the causes of the recent boom were numerous, including macro and long-term as well as sector-specific and short-term factors. Fiscal expansion in many countries and loose monetary policy created an environment that favored high commodity prices.[46] The depreciation of the US dollar—the currency of choice for most international commodity transactions—strengthened demand (and limited the supply) from non-US$ commodity consumers (and producers). Other important causes include low past

[46] Calvo (2008) and Frankel (2007) have argued that interest rates played a key role during the boom.

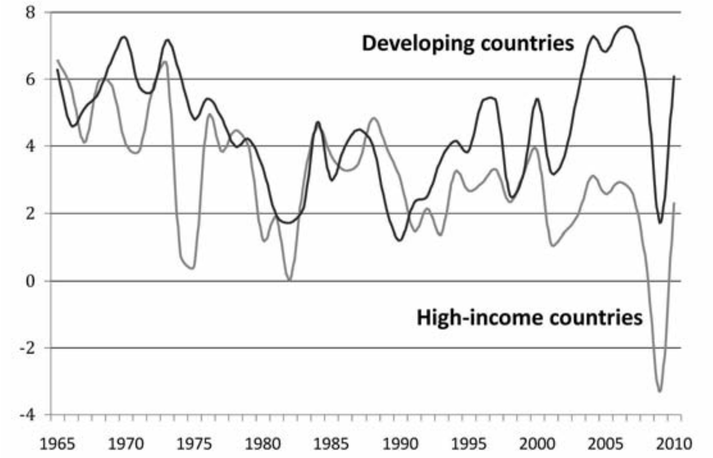

Figure 2.2: *GDP growth was high before and during the boom*

Source: World Bank.

investment, especially in extractive commodities[47]; investment fund activity by financial institutions that chose to include commodities in their portfolios; and geopolitical concerns, especially in energy markets. In the case of agricultural commodities, prices were affected by adverse weather conditions, as well as by policy actions including export bans and prohibitive taxes that were introduced in 2008 to offset the impact of increasing food prices. These factors, along with the diversion of some food commodities to the production of biofuels (notably maize in the US and edible oils in Europe) pushed the global stock-to-use ratios of several agricultural commodities down to levels not seen since the early 1970s, further accelerating the price increases (Figure 2.3). The combination of these factors created the "perfect storm."

The weakening and/or reversal of these factors, coupled with the financial crisis that erupted in September 2008 and the subsequent global economic downturn, induced sharp price declines across most commodity sectors. But though most commodity prices have now declined sharply since their mid-2008 peak the key commodity price indices are still twice as high as their 2000 levels (Figure 2.4).

Thus the key question is whether the causative factors behind the recent boom are likely to remain in place. In the past, food commodity price spikes were mainly driven by supply shocks, with high prices often acting as the best incentive for mitigating the shocks that generated them. In attempts to explain the current

[47] Although underinvestment has been cited very often as the key factor in the boom, this assessment is essentially derived ex post. Certainly, any level of past investment will be considered low at high prices; conversely, the same level of investment would look high at low prices. Yet, research reported in World Bank (2009) shows that the level of investment was "right" at the time it was made. First, during 1980–2007, R&D and investment expenditures by major multinational oil and gas companies track very closely output prices (as evidenced by their strong correlation with energy prices, $R^2 = 0.95$). Second, public R&D agricultural expenditures also follow agricultural GDP.

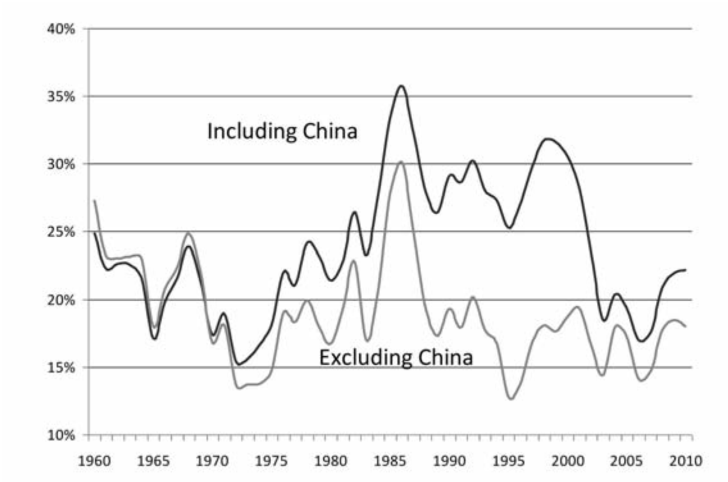

Figure 2.3: *Global grain stocks fell to levels not seen since the mid-1970s*

Source: World Bank calculations based on USDA data.

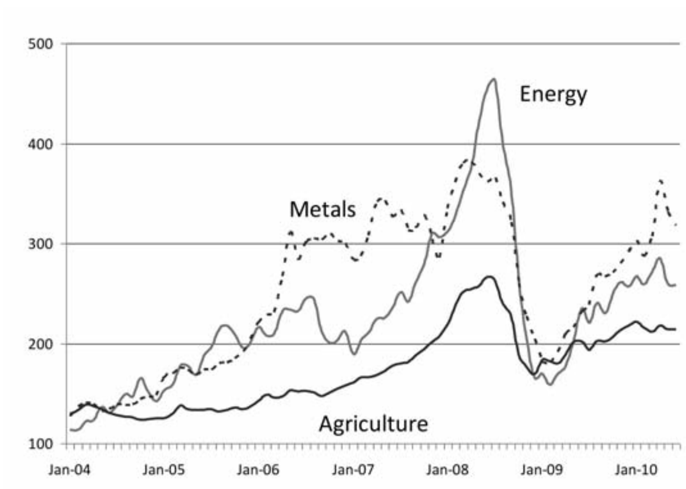

Figure 2.4: *All commodity prices have declined sharply since mid-2008*

Source: World Bank.

boom, some factors have received considerably more attention than others, and some have been the subject of a considerable amount of misinformation. With this in mind, the rest of this section examines the contributions made by speculation, income growth and dietary changes in China and India, and biofuel production.

"Speculation"

This topic received considerable attention during the recent boom, including numerous articles in the popular and financial press and several hearings in the US Congress. The topic has often been misunderstood, as it is not always clear what type of speculative activity is being referred to (see the appendix to this chapter).

Blaming speculative activity in periods of sharp price increases is not uncommon. Pushed by such a belief, numerous attempts have been made to restrict or even close the US futures markets. Markham (1987) reports that during 1907–09 (60th US Congress), 25 bills were introduced, designed to prohibit futures trading. (For a comprehensive treatment of all attempts to regulate/prohibit futures trading see Cowing 1965.) Schaede (1989) documents similar attempts for the D jima rice market in Japan, often cited as the world's oldest futures exchange—it began operation in 1730. Baffes and Kaltsas (2004) describe how numerous cotton futures exchanges were shut down during the first half of the 20th century as the result of government intervention, again because of perceived speculative activity.

The "speculative" activity most relevant to the current boom is that of index funds. Index fund investors allocate funds across a basket of commodities by taking long positions in various commodities that are traded in organized futures exchanges. Since 2003, index funds have invested almost US$ 250 billion in US commodity markets, more than half of it in energy commodities, according to Masters (2008). While such transactions are not associated with real demand for commodities, they may have influenced prices for a number of reasons. First, investment in commodities is a relatively new phenomenon, and funds have flowed mostly in, not out, implying that some markets may have been subject to extrapolative price behavior; that is, high prices leading to more buying by investment funds, in turn leading to even higher prices, and so on. Second, index funds invest on the basis of fixed weights or past performance criteria, and hence investment often behaves differently from what market fundamentals would dictate, especially in the short run. This pattern was apparent during 2008, when prices in several commodity markets appeared to be delinked from market fundamentals. Third, the large size of these funds compared to commodity markets may exacerbate price movements. Or, as Soros (2008: 3) characteristically put it "… the institutions are piling in on one side of the market and they have sufficient weight to balance it."

The econometric evidence on whether speculative activity contributed to the recent commodity price boom is mixed. Two IMF studies (2006, 2008) found no evidence that speculation had systematically influenced commodity prices. A similar conclusion was reached by a series of studies undertaken by the US Commodities Futures Trading Commission, the agency that regulates US futures exchanges (Büyükşahin, Haigh, and Robe 2008; CFTC 2008). Sanders, Irwin, and Merrin (2008) expressed skepticism about the assertion that speculation has led to bubbles in agricultural futures prices.

But numerous other authors share the view that investment fund activity was the key driver behind the boom; see for example, discussions in Medlock and

Jaffe (2009) for the crude oil market and in Wray (2008) for all commodities. Robles and others (2009) found that speculative activity might have been influential during the boom. Plastina (2008) concluded that between January 2006 and February 2008, investment fund activity might have pushed cotton prices 14 percent higher than they would otherwise have been. In the non-ferrous metals market, Gilbert (2007) found no direct evidence of the impact of investor activity on the prices of metals, but found strong evidence that the futures positions of index providers had affected the prices of soybeans (though not of maize) in the US futures exchanges. In a later study, Gilbert (2009) concluded that futures trading activity by investment funds was the single most important factor behind the 2007–08 rally of agricultural prices.

In summary, while the earlier literature gave mixed and inconclusive evidence regarding the effect of investment fund activity on commodity prices, more recent work increasingly supports the view that the large amount of money flowing from investment funds into commodities has affected commodity prices. Though the precise magnitude and the duration of this effect is unclear, investment fund activity does appear to have induced higher price variability by exacerbating the length and the amplitude of the 2007/08 price cycle. Equally, however, it should be noted that such activity is unlikely to alter long-term price trends, which ultimately will be determined by market fundamentals.

Dietary changes and income growth, especially in China and India

Typically agricultural price booms are linked to supply shocks—weather events or animal diseases that disturb the normal pattern of variation that is expected from agricultural production. The recent boom was no exception. Droughts played a major role in the reduction of dairy exports from New Zealand. Australia's production of grain (especially wheat) was severely affected by the three droughts experienced during 2002/08 (a highly unusual weather pattern, often linked to global warming), and the more recent drought in Argentina is still affecting the soybean market. But the extent of these events, although cumulative and coming after a long period of normal weather patterns, fails to explain the extent of the food price spike.

Could a demand shock offer a more plausible explanation, as has often been suggested? For this to be the case, such a shock would need to happen either unexpectedly and suddenly or through a rapid shift in long-term expectations about food demand patterns. Such a demand shock took place with the growth of biofuels, as discussed in the next section. What about the demand for food? It has often been argued that a structural shift has taken place in the demand for grain by emerging countries, especially China and India, and especially during the past decade when these two countries experienced high income growth. The June 2009 issue of *National Geographic*, for example, noted that "... as countries like China and India prosper and their people move up the food ladder, demand for grains has increased." Similar arguments have been advanced by noted scholars as well. Krugman argued that "... there's the march of the meat-eating Chinese—

that is, the growing number of people in emerging economies who are, for the first time, rich enough to start eating like Westerners" (*New York Times* editorial, April 7). Likewise, Wolf asked "So why have prices of food risen so strongly?" and then answered "... strong rises in incomes per head in China, India, and other emerging countries have raised demand for food, notably meat and the related animal feeds" (*Financial Times*, April 29, 2008). Indeed, the size of China and India, which together account for almost 27 percent of the world's population, implies that even a minor change in their pattern of demand growth has a major effect on world market prices.

A closer look at the growth trends of population and income over the past decades, coupled with those of demand for food commodities, shows no evidence that food demand growth accelerated either in China and India or in the world as a whole. Table 2.1 summarizes demand growth patterns for a number of key food commodities since 1961 for four 12-year periods roughly corresponding to four price cycles: the period of the "green revolution" (1961–72); the aftermath of the two energy shocks (1973–84), the recovery of agricultural prices until their mid-1990s price spike (1985–96), and the last period until the recent price peak (1997–08). The data clearly show that demand growth has slowed for most grains—including those used for feed, reflecting a slowdown in the growth of demand for meat.

Table 2.1: *Annual growth in global GDP, population, and demand for selected food commodities (percent)*

	1961–1972	1973–1984	1985–1996	1997–2008
Macro variables				
Population	2.0	1.8	1.6	1.3
GDP	5.4	5.8	8.1	4.7
GDP per capita	3.3	3.9	6.3	3.4
Demand				
Rice	3.3	2.7	1.9	1.2
Wheat	3.9	2.9	1.4	0.9
Maize	3.7	2.5	2.7	2.8
Soybeans	4.8	2.6	5.5	4.0
Palm oil	8.4	10.2	7.7	8.8
Beef	3.2	1.8	1.1	1.0
Pork	3.7	4.9	2.7	2.2
Poultry	12.1	6.9	6.8	4.0

Source: Authors' calculations based on FAO, FAPRI, World Bank, and UN data.

During the most recent decade, despite a clear acceleration of GDP growth since 2003, stronger demand for agricultural products both at world level and in China and India has been the exception—it occurred in maize and in soybeans (driven by demand for oils), and was rather mixed in grains, but certainly did not occur in meats or dairy products (see Table 2.2 with a breakdown of the 1997–2008 period for the world, China and India).[48]

[48] Similar findings on the role (or, the non-role) of China and India have been discussed in Alexandratos (2008) and FAO (2009).

Table 2.2: *Annual growth in consumption of selected food commodities (percent)*

	World		China		India	
	1997–2002	2003–2008	1997–2002	2003–2008	1997–2002	2003–2008
GDP	2.81	3.45	8.24	10.80	5.31	8.48
Wheat	1.29	2.71	−0.72	0.16	2.66	1.80
Rice	1.55	1.47	0.45	−0.62	0.95	1.90
Maize	1.77	3.64	2.83	3.43	1.86	5.45
Soybeans	5.77	3.3	16.09	8.66	−1.41	7.08
Palm oil	10.52	7.52	22.08	8.19	21.38	7.16
Beef	0.79	1.61	3.76	2.83	−0.51	−2.24
Pork	2.66	1.31	2.84	1.21	1.00	0.38
Poultry	4.71	3.79	4.88	4.57	17.63	7.70

Source: Authors' calculations based on FAO, FAPRI, World Bank, and UN data.

These developments reflect the huge gap that existed during the price boom between the fundamentals of agricultural markets and the corresponding price levels. The best example of this is the fact that the highest price increases took place in two commodities—wheat and rice—where food demand was stagnating and yet were widely explained as being driven by strong food demand. By contrast with food commodities, demand growth accelerated in recent years for maize-based ethanol and edible oils. Thus while supply shocks may explain some of the price pressures in certain food commodities, the only real shift in demand occurred in maize and oilseeds for biofuels, as discussed below.

Biofuels

An increasing interaction between the price movements of energy and non-energy commodities during the boom focused attention on the impact of growing demand for biofuels, including for maize-based ethanol (mainly in the US) and oilseed-based biodiesel production (mainly in Europe). During the boom, maize and crude oil prices moved in tandem, pointing to an emerging new and fixed relationship between them. Obviously, maize and its use for ethanol moved into the picture as significant factors affecting price developments. But how much impact was there, and was there a similar one in oilseeds, resulting from their use for biodiesel?

The contribution of biofuels to the recent price boom, and especially the price spike of 2007/08, has been hotly debated. Mitchell (2009) argued that biofuel production from grains and oilseeds in the US and the EU was the most important factor behind the food price increase between 2002 and 2008, accounting, perhaps, for as much as two thirds of the price increase. Gilbert (2009), on the other hand, found little direct evidence that demand for grains and oilseeds as biofuel feedstocks was a key cause of the price spike. FAO (2008) compared a baseline scenario, which assumes that biofuel production will double by 2018, to an assumption that biofuel production will remain at its 2007 levels; it concluded that in the latter case grain prices would be 12 percent lower, wheat prices 7 percent lower, and vegetable oil prices 15 percent lower than in the baseline scenario. OECD (2008) arrived at similar conclusions for vegetable oils, finding that their prices would be 16 percent lower than the baseline if biofuel support policies were abolished; abolishing these subsidies would have smaller impacts on the prices of coarse grains (–7 percent) and wheat (–5 percent). Rosegrant (2008), who simulated market developments between 2000 and 2007 (excluding the surge in biofuel production), concluded that biofuel growth accounted for 30 percent of the food price increases seen in that period, with the contribution varying from 39 percent for maize to 21 percent for rice. Looking ahead, Rosegrant found that if biofuel production were to remain at its 2007 levels, rather than reaching its mandate level, maize prices would be lower by 14 percent in 2015 and by 6 percent in 2020.[49]

Banse and others (2008) compared the impact of the EU's current mandate to (i) a no-mandate scenario and (ii) a mandate whereby the US, Japan, Brazil also adopt targets for biofuel consumption. They estimate that by 2020, in the baseline scenario (no mandate), cereal and oilseed prices will have decreased by 12 and 7 percent, respectively. In the EU-only scenario, the comparable changes are –7 percent for cereal and +2 percent for oilseeds. By contrast, under the "global" scenario (adding biofuel targets in US, Japan, and Brazil) oilseed prices will have risen by 19 percent, and cereal prices by about 5 percent. The European Commission's own assessment of the long-term (2020) impacts of the 10 percent target for biofuels (i.e. that renewable energy for transport, including biofuels, will supply 10 percent of all EU fuel consumption by 2020) predicts fairly minor impacts from ethanol production, which would raise cereals prices 3–6 percent by 2020, but larger impacts from biodiesel production on oilseed prices; the greatest projected impact is on sunflower (+15 percent), whose global production potential is quite limited. Taheripour and others (2008) simulate the biofuel economy during 2001–06. By isolating the economic impact of biofuel drivers (such as the crude oil price, the US and EU biofuel subsidies, and replacement of methyl tertiary butyl ether) from other factors at a global scale, they estimate the impact of these factors on coarse grain prices in the US, EU, and Brazil at 14 percent, 16 percent, and 9.6 percent, respectively.

A joint US Department of Agriculture and Department of Energy assessment (USDA/USDE 2008) concluded that the recent increase in corn and soybean prices appears to have little to do with the run-up in prices of wheat and rice. It found that if the amounts of corn used for ethanol and soybean oil used for biodiesel in the US had remained unchanged at their 2005/06 levels, prices in 2007/2008 would have been 15 percent lower for maize, 17.5 percent for soybean, and 13 percent for soybean oil. It also concluded that the impact of biofuels production in 2007 was a 3–4 percent increase in retail food prices and a 0.1–0.15 percent increase in the all-food CPI.

[49] The models used in the studies discussed in this section are the following: FAO (2008) and OECD (2008) used AGLINK; Rosegrant (2008) used IMPACT; Banse and others (2008) used GTAP-E; EU (2008) used ESIM-PE; Mitchell (2009) used simple statistical analysis; and Gilbert (2009) used a CAPM-type econometric model.

Clearly US maize-based ethanol production, and (perhaps to a lesser extent EU biodiesel production) affected the corresponding market balances of both US maize and EU oilseeds, as well as land use in the US and the EU. Yet, worldwide, biofuels account for only about 1.5 percent of the area under grains/oilseeds (Table 2.3). This raises serious doubt that the recent commodity price boom can be attributed to biofuels. Maize prices hardly moved during the first period of increase in US ethanol production, and oilseed prices dropped when the EU increased impressively its use of biodiesel. On the other hand, prices spiked while ethanol use was slowing down in the US and biodiesel use was stabilizing in the EU.

While the debate has focused mostly on the amount of food crops that have been diverted to the production of biofuels, and the resulting effect on prices, less attention has been paid to a more important issue: what is the level at which energy prices provide a floor to agricultural prices? Analysts often use a rule of thumb to express a perceived new relationship between agricultural and crude oil prices. One such rule is that the price of maize expressed in US$/ton is roughly double the price of crude oil in US$/barrel (thus a US$ 75/barrel price for crude oil would correspond to US$ 150/ton for maize). Other commentators (in the US) have argued that a price of US$ 3/gallon of gasoline at the pump is the level at which the maize price is determined by the crude oil price. The World Bank (2009) has argued that a crude oil price above US$ 50/barrel effectively dictates maize prices; this conclusion is based on the strong correlation between the maize price and crude oil prices above US$ 50/barrel and the absence of correlation below that level. Whether such rules of thumb have any empirical support is linked to the issue discussed in the next section.

Table 2.3: *Key biofuel statistics*

	2000–01	2002–03	2004–05	2006–07	2008–09
Biofuels as a share of global grain and oilseed area (percent)					
EU Oilseeds	0.00	0.06	0.15	0.24	0.34
US Maize	0.13	0.27	0.37	0.76	1.11
Total US and EU	0.00	0.06	0.15	0.24	1.45
Land used for US ethanol from maize as a share of (percent)					
US Maize Area	3.63	7.32	9.45	18.03	27.54
US Grain Area	0.99	2.00	2.79	5.68	8.44
World Grain Area	0.16	0.32	0.43	0.85	1.26

Note: The shares have been calculated based on average world yields.

COMMODITY PRICES: LONGER-TERM TRENDS

This section focuses on three key characteristics of commodity price behavior over the longer term: lack of trends, co-movement among prices, and a special case of the latter, i.e., the link between energy and non-energy commodity prices.

Trends, cycles, and everything in between

The long-term behavior of commodity prices was first examined systematically by Prebisch (1950) and Singer (1950), who noted that since the late 19th century the prices of primary commodities had been declining relative to the prices of manufactured goods (the barter terms of trade). They warned of potential problems for producers of primary commodities, and in fact the notion of declining terms of trade formed the cornerstone of the industrialization policies that many developing countries pursued during the 1960s and 1970s. The so-called Prebisch-Singer (PSH) hypothesis has been, perhaps, one of the most researched areas in commodity price behavior. Early research (e.g., Spraos 1980; Sapsford 1985; Grilli and Yang 1988), which focused mainly on identifying negative trends, supplied broad support for PSH. However, later authors found that prices did not simply move along a linear trend but instead contained strong stochastic elements, i.e., long and irregular cycles, thus producing more mixed results (e.g., Cuddington and Urzua 1989; Cuddington 1992). Studies using better econometric techniques and longer time series allowed for structural breaks (e.g., Leon and Soto 1997; Zanias 2005; Kellard and Wohar 2006). And very recent literature, focusing on non-linear or time-varying alternatives (e.g., Balagtas and Holt 2009), finds even less support for PSH.

All this research is perhaps best summarized by Cashin and McDermott (2002: 196) who concluded that “Although there is a downward trend in real commodity prices, this is of little practical policy relevance, because it is small when compared to the variability of prices.” Or as Deaton (1999: 27) succinctly put it, “What commodity prices lack in trend, they make up for in variance.”

Variance in commodity prices is at the core of the current policy debate in developed and developing countries alike. The difficulty associated with describing past price behavior, and hence with making inferences regarding future trends, can be inferred from Figure 2.1 above; the conclusions reached depend on what time period is chosen for analysis. Further, it is this difficulty with defining and measuring variability that limits our ability to quantify the impact of investment fund activity on commodity prices, as discussed above.

Statistically, this difficulty reflects the problem of nonstationarity, i.e. the fact that the average price does not exist in the statistical sense. Table 2.4 shows the results of an analysis of stationarity for prices of six food commodities (wheat, maize, rice, soybeans, soybean oil, and palm oil). For sensitivity purposes, we report results from two tests, with and without trend, both in nominal and real terms. All lend strong support to non-stationarity, thus reaffirming the conclusions reached by Cashin and McDermott (2002) and Deaton (1999).

The fact that commodity price variability overwhelms trends has a number of key implications. On the methodological side, analysis involving prices needs to recognize that correlations may not be meaningful unless certain conditions are met (see next section), and also that because a mean or a trend of the price series cannot be properly defined, the variability in prices is difficult to calculate.

On the policy side, attempts to introduce mechanisms with price triggers (as has often been proposed recently) are likely to fail. In fact, the absence of trends (or

Table 2.4: *Stationarity statistics for key food commodity prices, 1960–2008*

	Without Trend		With Trend	
	ADF	PP	ADF	PP
Real (MUV-deflated) series				
Wheat	−2.32	−1.70	−1.83	−1.47
Maize	−1.59	−1.49	−1.84	−1.83
Rice	−1.59	−1.71	−3.08	−1.92
Soybeans	−1.72	−1.59	−2.09	−1.96
Soybean oil	−1.34	−2.06	−0.96	−2.28
Palm oil	−1.41	−2.14	−1.31	−2.47
Nominal series				
Wheat	−1.63	−0.84	−3.10	−2.02
Maize	−1.69	−1.22	−2.76	−2.21
Rice	−2.53	−1.62	−3.40*	−2.27
Soybeans	−1.32	−1.23	−2.11	−2.14
Soybean oil	−1.08	−1.17	−1.99	−2.56
Palm oil	−1.41	−2.14	−1.31	−2.47

Notes: ADF and PP denote the Augmented Dickey-Fuller (Dickey and Fuller 1979) and Phillips-Perron (Phillips and Perron 1988) statistics for unit roots. Asterisks denote significance at 10 percent (*), 5 percent (**), and 1 percent (***) levels. The corresponding t-statistics are −2.60, −2.93, and −3.58 for the tests without trend and −3.18, −3.50, and −4.16 for the tests with trend. The ADF statistic corresponds to the MacKinnon one-sided p-value. The lag length of the ADF equations was determined by minimizing the Schwarz loss function, while the bandwidth of the PP statistic was based on the Newey-West method.

simply put, the non-existence of an “average price”) may be the key reason why earlier price stabilization (or other) mechanisms failed.[50] When prices stay low for long periods, stabilization funds run out of resources, and when prices stay high for long periods, stabilization funds tend to be misused. Consider, for example, that the agricultural commodity price index (shown in Figure 2.1 above) exceeded its period average (equal to 173) in all years during 1948–71 and fell below it in all years during 1981–2007.

Co-movement

Because some agricultural commodities can be substituted for one another, while resources on the input side (e.g., land, labor, and machinery) can be shifted from one crop to another, the changes in fundamentals or policy actions in one market will eventually be transmitted to other markets as well. Thus, assessing how the prices of various food commodities move with respect to each other is paramount in understanding the way and the degree to which market conditions and policies affect prices. Examining such relationships ultimately comes down to estimating the degree of price co-movement among various commodities.

[50] Such failed arrangements include the 1962 International Coffee Agreement (and a subsequent series of agreements) to restrict exports and boost coffee prices, the 1972 International Cocoa Agreement, and similar efforts by producers of cotton and grains; the International Tin Agreement; and the International Natural Rubber Organization.

While the general subject of price co-movement has been extensively studied in the literature, analysis of the co-movement among prices of specific commodities is scarce. (For a brief literature review of price co-movement and the reasons why the issue has not been adequately researched see the appendix to this chapter.)

Here we analyze the co-movement of prices using a simple econometric model. The degree of co-movement is analyzed among six food commodity prices, using Ordinary Least Squares with annual data from 1960 to 2008: $P_t^i = \mu + \beta_1 P_t^j + \beta_2 MUV_t + \beta_3 t + \varepsilon_t$, where P_t^j and P_t^i denote the logarithm of commodity price i and j in year t (expressed in nominal dollar terms), MUV_t denotes the deflator, t is the time trend, and ε_t denotes the error term; μ, β_1, β_2, and β_3 are parameters to be estimated.

The results are reported in Table 2.5. Because prices are non-stationary (see previous section) examining the stationarity properties of the error term is a crucial step in establishing the validity of the model. All the regressions show strong performance, with an average R^2 of 0.84 and with unit root statistics that strongly confirm the stationarity of the error term. Moreover, in all cases the slope estimate of the price variable is significant at the 1 percent level.

The results imply that it is important not to analyze commodity markets in isolation from one another, because the impact of events that seemingly affect one market will eventually be equalized among most commodity sectors. Consider, for example, the palm oil/soybean oil parameter estimate of 0.97 and an R^2 of 0.93 (Table 2.5, bottom row). This suggests an almost synchronous movement of palm and soybean oil prices, despite the fact that soybean oil is an annual crop produced chiefly in North and South America and palm oil is a tree crop produced almost exclusively in East Asia. The implication is that, whether biofuel mandates are applied to one or the other edible oil market, the effect will be eventually diffused among all edible oil markets. Not surprisingly, policies favoring biofuel production in the name of environmental benefits may in fact lead to less desirable outcomes. That is, the environmental benefits from switching from fossil fuel use to, say, rapeseed-based biodiesel in Europe or soybean oil-based biodiesel in the US may be less than the environmental costs of expanding palm oil production in East Asia. (A large body of literature discusses this issue; see for example, Searchinger and others 2008; Fargione and others 2008). Similarly, prices of wheat, maize, and soybeans—key food crops, produced primarily in the US, EU, and South America—show an equally large co-movement, as their R^2 averaged 0.93, much like that of palm and soybean oil.

For inflation, by contrast, the estimated coefficient is either not significantly different from zero or, in the few cases where it is significant, it is small; this is consistent with the earlier observation that the current boom was not associated with inflationary pressures. And the time trend parameter estimate is almost always zero—implying that there is either no trend or the same trend for all prices.

The energy/non-energy price link

It has become increasingly clear that the energy price increases of the last few years have a permanent character. In the 20 years between 1984 and 2004, the

Table 2.5: *Parameter estimates: co-movements of food commodity prices*

	μ	β_1	β_2	$100^*\beta_3$	*Adj-R^2*	*ADF*
Maize-Wheat	0.29	0.85@	0.06	−0.33	0.94	−4.86***
	(1.37)	(14.40)	(0.77)	(1.35)		
Soybeans-Wheat	0.90@	0.78@	0.19@	−0.45	0.92	−5.20***
	(3.20)	(10.21)	(1.99)	(1.40)		
Wheat-Rice	0.34	0.60@	0.26*	0.41	0.90	−4.54***
	(1.01)	(8.31)	(2.36)	(1.02)		
Soy oil-Wheat	1.75@	0.97@	−0.08	0.03	0.81	−6.54***
	(3.90)	(7.83)	(0.51)	(0.05)		
Wheat-Palm oil	0.02	0.63@	0.39*	−0.04	0.87	−5.30***
	(0.02)	(6.64)	(3.26)	(0.10)		
Maize-Soybeans	−0.16	0.85@	0.04	−0.01	0.91	−6.18***
	(0.54)	(10.82)	(0.39)	(0.92)		
Rice-Maize	0.48	1.02@	0.13	−0.86	0.77	−5.60***
	(0.99)	(7.24)	(0.81)	(1.54)		
Palm oil-Maize	1.27@	1.09@	−0.04	−0.17	0.79	−5.64***
	(2.69)	(8.00)	(0.27)	(0.31)		
Soy oil-Maize	1.45@	1.12@	−0.13	0.39	0.86	−6.90***
	(3.64)	(9.72)	(0.98)	(0.86)		
Rice-Soybeans	0.00	1.01@	0.06	−0.79	0.76	−5.19***
	(0.01)	(7.13)	(0.32)	(1.41)		
Soybeans-Palm oil	0.54	0.53@	0.41	−0.35	0.89	−4.54***
	(1.48)	(7.75)	(3.96)	(0.91)		
Soy oil-Soybeans	0.89@	1.12@	−0.23	0.47	0.86	−7.73***
	(2.09)	(9.82)	(1.61)	(1.04)		
Palm oil-Rice	1.70@	0.64@	0.18	0.01	0.69	−5.15***
	(1.48)	(5.40)	(1.01)	(0.02)		
Soy oil-Rice	1.94@	0.64@	0.12	−0.71	0.74	−5.71***
	(3.71)	(5.80)	(0.53)	(0.86)		
Palm oil-Soy oil	−0.13	0.97@	0.08	−0.54*	0.93	−4.32***
	(0.44)	(16.83)	(1.03)	(1.79)		

Notes: All regressions were run in both directions. We report the direction with the largest ADF statistic. The variances have been estimated using White's method for heteroskedasticity-consistent standard errors. ADF denotes the Augmented Dickey-Fuller (Dickey and Fuller 1979) statistics for unit roots. (@) denotes parameter estimate at the 5 percent level. For other notes see table 2.4.

price of crude oil averaged a little more than US$ 20/barrel in real 2000 terms.[51] Now most analysts and researchers believe that the "new" equilibrium price of oil

[51] The low energy prices between mid-1980s and early 2000s prompted most analysts to argue that the high prices of the 1970s were an aberration and that the pre-1973 levels were the norm. For example in its March 6, 1999 edition, the *Economist*'s leader article entitled "Drowning in Oil" concluded that (p. 19): "$10 might actually be too optimistic. We may be heading for US$ 5. Thanks to new technology and productivity gains, you might expect the price of oil, like that of most other commodities, to fall slowly over the years. Judging by the oil market in the pre-OPEC era, a 'normal' market price might now be in the US$ 5-10 range. Factor in the current slow growth of the world economy and the normal price drops to the bottom of that range." Indeed, most energy analysts were forecasting real prices to average between US$ 15/barrel and US$ 20/barrel in the long run. For example, the World Bank's nominal crude oil price forecast in 1999 was US$ 18/barrel for 2005 and US$ 19/barrel for 2010. The December 2008 WTI futures contract opened at US$ 18.88 in January 15, 2002, when it was first introduced. During 2008, crude oil prices averaged US$ 97/barrel, almost five times higher than the highest forecasts.

will be at least three times higher than this, and expect proportional changes to take place in all other types of energy. If they are right, then high energy prices coupled with the high energy intensity of agricultural commodities imply that developments in non-energy (especially food) markets will depend strongly on the nature and degree of the price links between energy and non-energy commodities.

The channels through which energy prices affect other commodities are numerous (see for example FAO 2002; Baffes 2007; World Bank 2009). On the supply side, energy enters the aggregate production function of most primary commodities through the use of various energy-intensive inputs and, often, transport of outputs over long distances. Some commodities have to go through an energy-intensive primary processing stage. In other cases, the main input may be a close substitute to crude oil, as when nitrogen fertilizer is made directly from natural gas. And, to the extent that some commodities are used to produce biofuels in response to high energy prices, another important dimension is added to the energy/non-energy price link.

We examined the energy/non-energy price link by estimating a regression similar to the one used for the co-movement estimates above.[52] The results for eleven commodity price indices are presented in Table 2.6. They show that energy prices, and to a lesser extent inflation and technological change (as measured by the trend parameter estimate), explain a considerable part of commodity price variability; the adjusted R^2 of all regressions averaged 0.85. Specifically, the parameter estimate of the non-energy index (top row of Table 2.6) is 0.28, implying that a 10 percent increase in energy prices is associated with a 2.8 percent increase in non-energy commodity prices, in the long run.

Three earlier studies—Gilbert (1989), Borensztein and Reinhart (1994), and Baffes (2007)—that estimated the elasticities of non-energy commodity prices with respect to energy prices reported these as 0.12, 0.11, and 0.16, respectively (Table 2.7, top row).[53] When the sample underlying the current analysis is adjusted to match the samples used in these studies, the pass-through coefficient becomes remarkably similar, at 0.13, 0.12, and 0.18, respectively.

[52] Here the model is the same as the one used above for co-movement, except that P_t^i denotes the prices of food commodities and P_t^j denotes the energy price index. The rest of the coefficients and variables have the same interpretation. However, in contrast to the price co-movement regressions, regressing food prices on energy prices has a well-defined endogeneity pattern; energy affects food prices but not vice versa. Thus we estimated only the regressions with the energy price index (along with deflator and time trend) as the explanatory variables. The estimates can be viewed as energy price transmission elasticities rather than just co-integration parameters. See Baffes (2009) for the structure of the indices.

[53] Table 2.7 indicates that the elasticities for food commodities are higher than those for raw materials and metals. This is consistent with the input-output table of the GTAP database, which shows that the direct energy component in the US agriculture and manufacturing sectors is 12 percent and 3 percent respectively.

Table 2.6: *Parameter estimates: price indices regressed on energy price index*

	μ	β_1	β_2	$100^*\beta_3$	$Adj\text{-}R^2$	*ADF*
Non-Energy	3.03@	0.28@	0.12	–0.01	0.90	–3.35**
	(6.54)	(5.24)	(0.68)	(0.02)		
Metals	3.77@	0.25@	–0.17	1.93@	0.82	–3.30**
	(4.80)	(3.14)	(0.60)	(2.31)		
Fertilizers	3.58@	0.55@	–0.30	0.39	0.81	–3.97***
	(4.12)	(4.79)	(0.95)	(0.48)		
Agriculture	2.51@	0.26@	0.33@	–0.99@	0.90	–3.81***
	(6.90)	(5.54)	(2.43)	(2.73)		
Beverages	1.83@	0.38@	0.55@	–3.12@	0.76	–4.95***
	(3.10)	(4.87)	(2.63)	(5.22)		
Raw Materials	1.85@	0.11@	0.51@	0.08	0.91	–3.15**
	(4.16)	(2.15)	(3.15)	(0.19)		
Food	2.91@	0.27@	0.21	–0.71	0.85	–3.85***
	(7.11)	(4.93)	(1.39)	(1.80)		
Cereals	3.13@	0.28@	0.17	–0.87	0.78	–3.83***
	(5.94)	(4.23)	(0.89)	(1.76)		
Edible Oils	3.33@	0.29@	0.12	–0.80	0.80	–2.82*
	(6.16)	(4.51)	(0.58)	(1.50)		
Other Food	1.86@	0.22@	0.45@	–0.42	0.89	–3.60***
	(6.28)	(3.81)	(4.44)	(1.18)		
Precious metals	–1.40@	0.46@	1.05@	–1.75@	0.98	–3.91***
	(3.58)	(9.40)	(7.61)	(3.68)		

Source: Baffes (2009).
Notes: See table 1.4 and 1.5.

Table 2.7: *Comparing long-run transmission elasticities*

	Holtham (1988) 1967:S1–1984:S2	**Gilbert (1989) 1965:Q1–1986:Q2**	**Borensztein & Reinhart (1994) 1970:Q1–1992:Q3**	**Baffes (2007) 1960–2005**	**Baffes (2009) 1960–2008**
Non-energy	–	0.12	0.11	0.16	0.28
Food	–	0.25	–	0.18	0.27
Raw Materials	0.08	–	–	0.04	0.11
Metals	0.17	0.11	–	0.11	0.25

Sources: Holtham (1988), Gilbert (1989), Borensztein and Reinhart (1994), and Baffes (2007, 2009).
Notes: Holtham uses semiannual data; Gilbert and Borensztein and Reinhart, quarterly data; and Baffes, as in the present study, annual data. Gilbert's elasticities denote averages based on four specifications. Holtham's raw materials elasticity is an average of two elasticities based on two sets of weights.
– indicates that an estimate is not available.

Underlying these aggregate pass-through coefficients for non-energy commodity prices are variations within sub-indices. Among the sub-indices, the highest pass-through elasticity is in fertilizer, at 0.55—not surprisingly, since nitrogen-based fertilizers are made directly from natural gas. Interestingly, the fertilizer and energy price increases during the recent boom were in line with those experienced during the first oil shock: from 1973 to 1974 phosphate rock and urea prices increased four-fold and three-fold, while the crude oil price increased from US$ 2.81/barrel to US$ 10.97/barrel.

The pass-through elasticity for agriculture, estimated at 0.27, reflects a wide range among the components of the agriculture index: beverages (0.38), food (0.27), and raw materials (0.11). For the components of the food price index, by contrast, the elasticity estimates fall within a very narrow range: cereals (0.28), edible oils (0.29), and other food (0.22). Based on the same regression, Table 2.8 reports parameter estimates for the six food commodities under consideration. The estimates for all six fall within a narrow range, from a low of 0.27 in maize to a high of 0.36 in soybean oil. This result contrasts sharply with estimates for metals, which show a high degree of diversity (see Chaudhri 2001; Baffes 2007).

A number of key conclusions emerge from these results. First, the prices of most commodities respond strongly to energy prices. More importantly, the difference between the last two estimates (last two columns of Table 2.6) indicates that the effect of energy prices on the price indices of all commodities has increased considerably when the recent boom is taken into consideration—suggesting that the energy/non-energy price link has strengthened (see earlier discussion). Many observers have attributed such strengthening of the relationship to the use of biofuels, which also coincides (roughly) with the boom. Yet, it is important to realize that the effect of energy on non-energy prices is more pronounced in non-food commodities (e.g. raw materials and metals) than in food.

Table 2.8: *Parameter estimates: individual commodities regressed on energy price index*

	μ	β_1	β_2	$100^*\beta_3$	$Adj\text{-}R^2$	*ADF*
Wheat	3.27@	0.30@	0.12	−0.49	0.84	−4.35**
	(6.50)	(5.02)	(1.49)	(1.07)		
Maize	3.15@	0.27@	0.13	−0.74	0.80	−3.49**
	(6.23)	(4.66)	(0.70)	(1.58)		
Soybeans	3.58@	0.26@	0.25	−0.82	0.82	−3.85***
	(8.11)	(4.92)	(1.51)	(1.83)		
Rice	3.57@	0.25@	0.32	−1.62@	0.58	−4.05***
	(5.14)	(2.67)	(0.26)	(2.78)		
Palm oil	4.94@	0.35@	−0.01	−0.95	0.63	−3.16**
	(6.44)	(3.72)	(0.02)	(1.38)		
Soybean oil	5.25@	0.36@	−0.09	−0.42	0.70	−2.56
	(7.83)	(4.13)	(0.39)	(0.53)		

Notes: See table 2.4 and 2.5.

Second, food commodity prices respond to energy prices by moving in a very synchronous manner, since the elasticities fall within a very narrow range (from 0.25 to 0.36). Such a result not only emphasizes the interdependence of agricultural markets (as discussed earlier) but also indicates that since a key determinant of food commodity prices is energy prices, analyzing food markets requires an understanding of energy markets as well.

Third, though the transmission elasticities of energy prices to non-energy prices are broadly similar to one another, this is not the case with the inflation coefficient, estimates of which vary considerably in sign, magnitude, and level of significance. The inflation coefficient is positive and significantly different from zero only for agriculture and some of its sub-indices, and effectively zero for metals and fertilizers. This implies that the relationship between inflation and nominal commodity prices is much more complex and, perhaps, changing over time. This may not be surprising if one considers that during 1972–80 (a period that included both oil shocks) the MUV increased by 45 percent, and that during 2000–08 it increased by only half as much. The increases in the index of nominal non-energy prices during these two eight-year periods were identical, at 170 percent.

Lastly, the estimates of trend parameters are spread over a wider range than the estimates of energy price pass-through and inflation. For example, the aggregate index of non-energy prices shows no trend at all, while the index of metal prices shows an almost 2 percent positive annual trend and the index of agriculture prices shows a 1 percent negative annual trend. Further, the trend parameter estimates of the agriculture sub-indices vary considerably, from 0.08 for raw materials to –3.12 for beverages—confirming the point made earlier that commodity prices do not exhibit well-defined trends.

CONCLUDING REMARKS

Numerous factors have contributed to the recent commodity boom, and have been analyzed extensively in the literature. Yet their relative weight continues to be contentious. In this chapter we examined three key factors whose role has been somewhat controversial: speculation, the growth of demand for food commodities by emerging economies, especially China and India, and the role of biofuels. We find that index fund activity (one type of "speculative" activity among the many that the literature refers to) played a key role during the 2007/08 price spike. Biofuels played some role too, but much less than initially thought. And we find no evidence that alleged stronger demand by emerging economies had any effect on world prices. Although tentative, these conclusions provide insights into the determinants of the future path of commodity prices, which is still uncertain.

Central among the uncertainties is the relationship between the prices of energy and of food commodities. Our examination of the key characteristics of longer-term commodity price behavior, including co-movement among the prices of food commodities and between the prices of food and energy commodities, revealed that among food commodities the co-movement of prices is very strong. This implies that events taking place in one sector (e.g., increased demand for maize for the production of ethanol) will affect other markets (e.g., for wheat) through reallocation of resources, especially land. It also implies that policy changes in one market may affect other markets. For example, because of the strong substitutability among vegetable oils, increased use of rapeseed oil for biodiesel production not only drives up the price of rapeseed oil (an annual crop produced primarily in Europe) but also induces proportional changes in the price of palm oil (a perennial crop produced primarily in Southeast Asia) and thus an expansion of palm oil production. Our results also show that farm commodity market fundamentals appear, in the short term, to be playing somewhat less of a role than in the past, tending to be overshadowed by the much stronger pull of energy prices.

Our conclusion about the long-term evolution of commodity prices is consistent with earlier literature, and supports the thesis that price variability overwhelms price trends. Variability is such that the average price does not exist in the statistical sense (i.e., prices exhibit non-stationary behavior), and the conclusions reached about trends depend on what time period is chosen for the analysis.

Despite its simplicity, this conclusion has important implications. Following the recent food price boom, there have been calls for policy actions, essentially aiming to alleviate the impacts of price spikes on developing countries, through reliance on some level of buffer stocks (whether physical or in the form of options). History has not been kind to collective measures designed to prevent the decline or reduce the variability of prices. What type of measures would be more pertinent to mitigate any undesired effects of price variability would depend on the better understanding of the factors that not only affect, but also potentially alter, long-term price trends.

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APPENDIX A. WHAT IS SPECULATION?

Speculation has been one of the most controversial and hotly debated issues during the recent commodity boom. On the one hand, numerous noted economists and analysts have argued that speculation did not play a key role. For example, Krugman in a series of *New York Times* blogs and editorials not only rejected the view that speculation fueled the recent commodity boom but also dismissed the idea that commodity trading activity in futures exchanges may have affected commodity prices, arguing that "… a futures contract is a bet about the future price. It has no, zero, nada direct effect on the spot price" (*New York Times*, June 23, 2008). Others too have argued that speculation played no role. Wolf argued that "if speculation were raising prices above the warranted level, one would expect to see inventories piling up rapidly, as supply exceeds the rate at which oil is burned. Yet there is no evidence of such a spike in inventories" (*Financial Times*, May 13, 2008). Frankel cited the Congressional testimony by the chief economist of the Commodities Futures Trading Commission on April 3, 2008 to support in his weblog (July 25, 2008) that "The evidence does not support the claim that speculation has been the source of, or has exacerbated the price increases." Wright (2009) echoed similar views by noting that if long futures positions were behind the grain price spike of 2008, stocks would have increased.

At the other end of the spectrum, Soros (2008: 4) called commodity index trading at his US congressional testimony "… intellectually unsound, potentially destabilizing, and distinctly harmful in its economic consequences." Eckaus (2008) and Khan (2009) authored papers entitled "The Oil Price Is Really A Speculative Bubble" and "The 2008 Oil Price 'Bubble'," respectively. Calvo (2008) noted that speculation and low inventories are not necessarily inconsistent and concluded that "… [increases in] commodity prices are the result of portfolio shift against liquid assets by sovereign investors, sovereign wealth funds, partly triggered by lax monetary policy, especially in the US." Views along similar lines were expressed by Medlock and Jaffe (2009) and Wray (2008).

Such stark differences in opinion, even among noted scholars and analysts, are partly explained because they refer to different types of "speculative activity." Indeed, the lines between hedgers and speculators, between physical and financial transactions, as well as between legal and illegal trading activities are complex, blurry, and go beyond text-book definitions. To gauge such complexities, consider the traditional separation of the place in which transactions take place (physical *versus* financial) and the actors involved (hedgers *versus* speculators), as depicted in table A1. The first column shows hedging transactions by producers, consumers, and traders (with the banks as intermediaries) take place either in physical or financial markets (the latter in commodity futures exchanges). This is the typical text-book case. The picture becomes more complicated when speculators engage in physical transactions by holding inventories, keeping resources in the ground, or engaging in various types of market manipulation. A more complex picture emerges when speculators engage in financial transactions (often combined with physical transactions).

Understanding the complexities and the controversial nature of speculation ultimately comes down to understanding the right-bottom cell of the Table A1. One way to analyze speculation is to map its sources and its effect on commodity markets to the place where transactions take place, the actors involved, and their motivation.

Place of transaction

Commodity transactions take place either in futures exchanges or physical markets. Speculation taking place in commodity exchanges forms the backbone of the functioning of the futures markets by injecting the necessary liquidity to complete the transactions. This is the type of speculative activity that was typically given as a reason for the closure of commodity futures exchanges discussed in the main text.

In the physical market, on the other hand, traders may buy and hold large quantities of commodities with the expectation that an upward movement in prices will generate profits (often called hoarding). This is the type of speculative activity that Paul Krugman and Martin Wolf (among others) have referred to. Unless such activity entails market manipulation (in which case it would be an illegal activity), it is the intertemporal equivalent of Adam Smith's "invisible hand:" traders buy at current prices to sell later when (in their opinion) the market will be tight, thereby balancing the market and hence reducing price variability. There is no evidence that hoarding took place during the recent boom, as known inventories in almost all commodities reached historical lows. However, in the case of extractive commodities—especially crude oil—one may well argue that "targeting" output to levels below what the market fundamentals dictate (as is the case with OPEC quotas) is a form of hoarding. The difference is that the commodity is kept in the ground, rather than in above-ground and therefore off the market storage facilities.

Actors involved

Apart from the hedgers (e.g., producers, consumers) with interest in the physical transaction of commodities, two other actors have been operating in the market during the last two or so decades with purely financial incentives and no transactions in the physical markets. They are hedge funds and commodity trading advisors (CTAs). During the past few years, investment funds (mostly pension funds and sovereign wealth funds) also entered the financial markets. It has been argued these groups (mostly the latter) may have affected commodity prices.

Hedge funds. These undertake investment and trading activities in a broad range of assets, including commodity markets. A hedge fund may trade and invest in commodity asset classes in order to "hedge" the diverse risks inherent in their portfolios. In such a case, taking a position in the futures market for a particular commodity or commodity class can represent an investment in a non-correlated asset that provides diversification benefits to the overall portfolio. Hedge funds have existed for decades and their effect on commodity markets is typically of short term nature (i.e., they affect short term price movements).

- *Commodity trading advisors* (CTAs) are asset managers that operate almost exclusively in commodity markets. They invest for portfolios under management and for clients with the objective of earning profits from market volatility. CTA's will typically trade on the basis of examination of market fundamentals or technical analysis.
- *Investment funds*. They include sovereign wealth and pension funds which during the past few years began including commodities in their portfolio mix as another asset class. Their chief motivation has been asset diversification. In addition to the way these funds invest in futures markets (i.e., fixed weights and past performance criteria), it is their sheer size that matters most. The global value of pension and sovereign wealth funds during 2008 has been estimated at US$ 20 and US$ 3–4 trillion, respectively. Therefore, the US$ 250 billion invested in commodity markets through index funds represents only 1 percent of their total asset holdings. It is this type of speculation that matters most and is believed to have fueled the recent boom (especially the 2007/08 price spike). It is also what Soros and Masters referred to in their respective testimonies to the US Congress.

Motivation

Very often speculation takes place in the form of market manipulation. This refers to illegal activity typically isolated in one or a few commodity markets. It can take place in the physical or financial markets (often it involves both). Well publicized cases are the US onion market in the 1950s, where onion producers argued that traders in the Chicago Mercantile Exchange cornered the market (this resulted in the passage of the *Onions Futures Act* which prohibited futures contracts on onions); the Hunt brothers who attempted to corner the silver market in the late 1970s and early 1980s; Sumitomo's chief copper trader, Yasuo Hamanaka, who cornered the copper market in the 1990s; and the BP cornering of the propane market in 2006, which resulted in a US$ 300 million fine. Such activity is not known to have prevailed during the recent boom.

Table A2.1: *"Speculation" in Commodity Markets*

PLACE \ ACTOR	HEDGERS	SPECULATORS
PHYSICAL	• Producers/consumers • Traders • Banks	• Holding inventories (e.g., hoarding) • Keeping resources in the ground (e.g., OPEC) • Market manipulation (e.g., cornering the market)
FINANCIAL	• Producers/consumers • Traders • Banks	• Investment funds (e.g., pension funds, sovereign wealth funds) • Investment and diversification instruments (e.g., CTAs, hedge funds) • Market manipulation (e.g., cornering the market)

APPENDIX B. CO-MOVEMENT OF COMMODITY PRICES

The general subject of commodity price co-movement has been examined extensively and in various contexts. Yet some topics have received much more attention than others. The topics that have received less attention matter most in the current policy debate.

Overall, the research on commodity price co-movement falls largely within two strands. The first examines co-movement among prices of the same commodity in different locations within the market efficiency context, a phenomenon also known as spatial market integration or the law of one price. While most of these studies examine co-movement in a bivariate context, some use models capable of examining it within a multivariate setting. This topic has been studied extensively (see Fackler and Goodwin 2001 for a literature review). A less researched subject (though one more useful for policy analysis purposes) within that strand has been the co-movement between world and domestic commodity prices, a relationship that includes a policy dimension. Specifically, these studies examine whether world price signals have been fully transmitted to domestic markets or instead have been subjected to policy distortions (see, for example, Baffes and Gardner 2003; Mundlak and Larson 1992). Now, for agricultural products, a research project led by Kym Anderson has produced a consistent global database that includes prices received by farmers and paid by consumers in 75 countries (Anderson and others 2008 www.worldbank.org/agdistortions>). That is expected to generate more research on the subject.

The second strand of literature examines price co-movement (or lack thereof) among different commodities. The genesis of this literature goes back to Granger (1986: 218), who wrote: "If x_t and y_t are a pair of prices from a jointly efficient, speculative market, they cannot be co-integrated ... if the two prices were co-integrated, one can be used to help forecast the other and this would contradict the efficient market assumption. Thus, for example, gold and silver prices, if generated by an efficient market, cannot move closely together in the long run." Granger's assertion led to research in commodity markets (e.g., MacDonald and Taylor 1988) and other markets as well, notably exchange rates (see, among others, Baillie and Bollerslev 1989; Hakkio and Rush 1989). This research was later questioned on several grounds including the fact that co-movement reflects responses to common fundamentals rather than market inefficiencies. (See, for example, Agbeyebbe 1992; Baffes 1993; Dwyer and Wallace 1992; and Sephton and Larsen 1991.)

A similarly controversial subject has been the "excess co-movement" hypothesis first discussed by Pindyck and Rotemberg (1990) who, after analyzing price movements of seven seemingly unrelated commodities (cocoa, copper, cotton, crude oil, gold, lumber, and wheat), concluded that these prices co-moved in excess of what the macroeconomic variables could explain. A number of likely explanations were given, including an incomplete model, endogeneity of the macroeconomic variables, rejection of normality assumption, and bubbles or market psychology. Subsequent research, however, challenged the excess co-movement hypothesis on data and methodological grounds (see Ai, Chatrath, and Song 2006; Cashin, McDermott, and Scott 1999; Deb, Trivedi, and Varangis 1996; and LeyBourne, Lloyd, and Reed 1994). In a more recent paper, Vansteenkiste (2009) concluded that commodity price co-movement is driven mainly by exchange rates, interest rates, and the price of crude oil.

One may argue that the rejection of the efficient market hypothesis in the presence of co-movement argued by Granger (1986) corresponds to Pindyck and Rotemberg's (1990) bubbles or market psychology explanation for excess co-movement—provided that prices used in Granger's sense have been adjusted accordingly by the fundamentals. Perhaps, the fact that two leading articles on price co-movement among different commodities have been somewhat controversial may have led to a slowing down of research in that area as well.

3

International and Domestic Food Prices

M. ATAMAN AKSOY AND FRANCIS NG[54]

Food prices in international markets increased dramatically during 2007 and 2008, especially when measured in US dollars. The standard measure of food prices—the World Food Price Index—rose from 100 in 1980 to 140 at the end of 2004, and reached a peak of 282 in the second quarter of 2008. By contrast, the Manufacturing Unit Value (MUV) Index, which measures the prices of trade in manufactured products, increased to only 110 in 2004 and 127 in 2008.[55]

The increases in international food prices have raised broad issues of food availability and cost for poor households. But their actual impact on the poor is determined by how they affect domestic consumer prices. Most of the debate on household poverty relies on the behavior of consumer prices of food, which could even be independent of international food prices.

For several reasons, the high food prices experienced in international markets have not been fully reflected in the domestic markets of many countries. One is that during the latest price spike many countries intervened in their food markets, for both international and domestic transactions, to keep food prices lower. Another reason has been the depreciation of the US dollar, the currency in which most food commodities are priced in international markets. Countries whose currencies appreciated against the dollar during this period experienced lower international food prices in their domestic currencies compared to the global price index measured in US dollars (World Bank 2008).

Even if international food prices are fully reflected in the prices of similar commodities in domestic markets, their impact on consumer food prices might be very limited. First, the components of an international price index and domestic consumer price indexes are not identical. Second, many food commodities are not traded. Third, the food prices faced by a consumer include a large manufactur-

[54] Correspondence email: ataman.aksoy@gmail.com and fng@worldbank.org We are grateful to Rafael de Hoyos, who initially analyzed the same data for the 2009 *Global Economic Prospects* and alerted us to its existence. We have updated his data and extended his work. We would like to express our special thanks to Israel Osorio-Rodarte who helped us to obtain these data. John Baffes made many useful comments. However, we are solely responsible for errors.

[55] See Chapter 2 of this volume for a detailed discussion of price movements and their determinants.

ing and services component, leaving the raw commodity quite a small share in the total price. Finally, the impact will depend on the share of food purchases in the total expenditures of households.[56]

This chapter measures recent changes in domestic food prices as reflected in the food component of the consumer price index and compares them to the behavior of international food prices. More specifically, we ask: What happened to the food component of consumer price indexes over this food price spike? How did the behavior of consumer food prices relate to the behavior of both non-food consumer prices and overall consumer prices? And did the relationships between different price measures differ among country groups?

We show that though domestic food prices were influenced by international prices, they did not rise anywhere near as fast. Between the first quarter of 2000 and the second quarter of 2008, international prices in US dollars increased by 182 percent, but domestic food prices only increased by 55 percent. As expected, the slower domestic price increase partly reflected the depreciation of the US dollar against many currencies; this limited the international food price increases in local currency terms to 146 percent for the period.

While the domestic price increases were not commensurate with international price increases, they were strongly influenced by them: the 55 percent increase in domestic food prices was much higher than the increase in non-food prices, at 43 percent.

The price effects took different forms in different groups of countries. In industrial and Eastern European countries, partially due to their appreciating currencies, domestic food price increases and overall inflation rates were very similar. In island economies, by contrast, food prices increased at much faster rates than non-food prices.

If we focus on 2006–08, when international food prices doubled, the impact of international food prices on domestic food prices becomes more apparent, but it is still muted: during this period, domestic food prices increased by only 26 percent, and non-food prices increased by 17 percent. Thus again, the conclusion is that while international food price increases do affect domestic prices, they are not fully reflected in these prices, which increase much more slowly.

AGGREGATE FOOD PRICES

Recent food price increases came after a long period of relatively stable and somewhat declining prices, as shown by Baffes and Haniotis in Chapter 2 of this volume. For most of the last three decades, international food prices declined, though with upticks during the mid-1990s (Figure 3.1). The average world food price index during the period 1980 to 2003 fluctuated between 90 and 160 (2005=100). Thus, the recent price increases are unusual and have not been seen since the 1970s; this is only the third price spike since the Second World War.

[56] See Chapter 5 of this volume for the potential impact of food prices on poor households.

Figure 3.1: *World prices of food and manufactures (index, 2000=100)*

Note: These data are annual because data for the Manufacturing Unit Value Index are annual.

Given this historical background, this paper uses quarterly data for the period between 2000 and 2008 to analyze in more detail the behavior of food-price and general inflation.[57]

The first question we address is the relationship between international food prices in US dollars and international food prices expressed in local currency. Figure 3.2 (blue line) shows the ratio of the global food price index in local currency to the same index in US dollars, averaged (unweighted) for 90 sample countries. The variation in the ratio over time is caused by changes in the value of the US dollar relative to the other currencies. Between 2000 and 2002, due to the depreciation of local currencies, international food prices increased at a faster rate in local currencies than in US dollars: prices in local currencies increased by 27.5 percent—nearly twice as much as prices in US dollars (16.5 percent). This situation reversed itself after the first quarter of 2003, and by the end of 2005 the cumulative price increases since 2000 had become about the same in both indexes; at about 33 percent.[58] After 2005, a rapid food price spike occurred that peaked in 2008 Q2.[59] During that period, US-dollar-denominated international food prices rose by 112 percent, while international food prices in local currency rose

[57] The appendix to this chapter describes the data and lists the 90 sample countries studied. It should be noted here that the CPI price series used starts in the first quarter of 2000 and ends in the third quarter of 2008 for all 90 countries. For about half the countries in the sample there are also data for the fourth quarter of 2008. For some of the graphs in this chapter, these last-quarter data are included to indicate what happened in that quarter, but they are not representative of all the countries and do not fully match the rest of the data. They are not used in the estimations or the tables.

[58] In the context of historical food prices, a 33 percent increase in five years is highly significant. See Chapter 2 of this volume.

[59] It is possible that few transactions might have taken place at the peak prices. Unfortunately, the annual global trade data used in the trade analyses mask the rapid increase and the subsequent decrease in international food prices.

by only 85 percent. Then, during the last two quarters of 2008, there was a rapid decline in international food prices and a slight appreciation of the US dollar. By the end of 2008, both international food price series were only about 80 percent higher than their levels in 2000 Q1 and were continuing to decline.

Our second question concerns the behavior of international food prices in local currency compared with the food consumer price index (food CPI), which represents the food prices paid by consumers. After 2005 this ratio decreased rapidly, because domestic food prices rose more slowly than international prices (Figure 3.2).

Figure 3.3 shows the behavior of these two price series separately. As expected, the food CPI changed much more slowly than global food prices in local currency, though it followed the direction of the international price changes. When

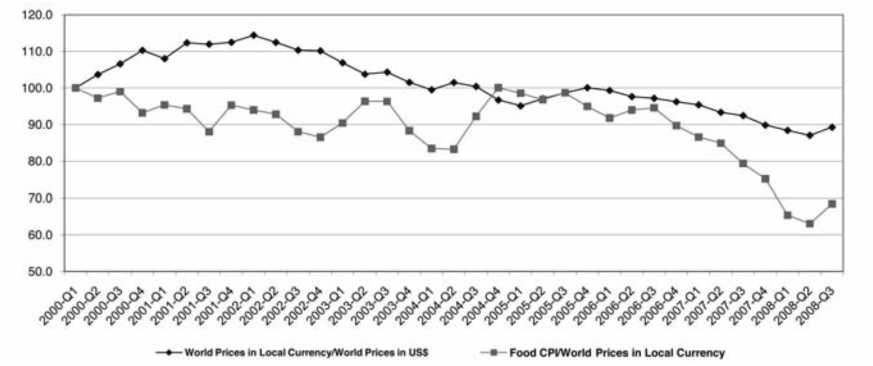

Figure 3.2: *World: key price ratios (indexes, 2000 Q1 = 100)*

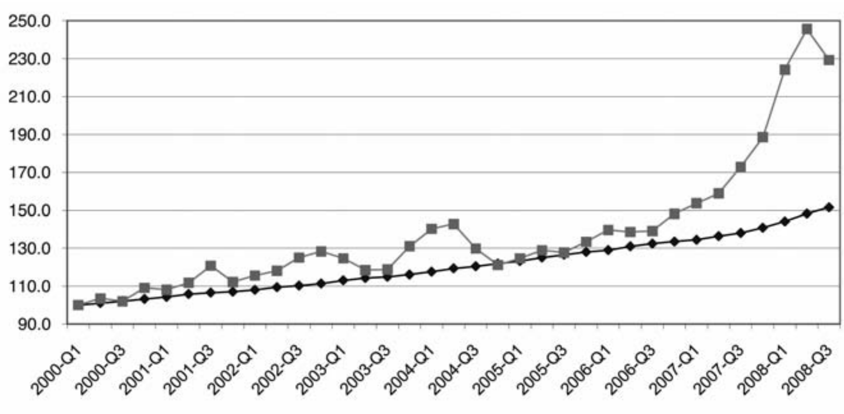

Figure 3.3: *World: Global and domestic food prices (indexes, 2000 Q1 = 100)*

food prices rose very rapidly, as they did after 2005, the CPI series seemed to adjust reasonably fast, but during smaller cycles the relationship seems not to have worked to the same extent.

Last, we compare movements in food prices with movements in non-food prices and with the overall inflation rate. At the global level, between 2000 and 2008, international food prices increased much more than international manufactured goods prices as measured by the MUV—as can be seen from the annual data in Figure 3.1 above. From their base levels in 2000, the World Food Price Index had increased 85 percent by 2007 and 148 percent by 2008, while the MUV had increased only 18 percent and 26 percent. Thus the relative price of food in global markets had more than doubled.

Unlike the international trade prices, the consumer prices of food and non-food goods have moved together, with only small changes in their relative values. Figure 3.4 shows the CPI for food divided by the overall CPI and by the non-food CPI. During the last food price cycle, the food CPI pushed up the overall CPI. But its rise was quite modest compared with the change in international prices: while international food prices rose more than twice as fast as international manufactured goods prices, consumer prices for food rose only 9 percent more than consumer prices for non-food goods and 6 percent more than the overall consumer price index.

Though international food prices do affect domestic food prices, the effects are not large.[60] When international prices started declining after the second quarter of 2008, domestic food prices fell while the overall CPI continued to rise. Data for the last quarter of 2008 are incomplete so it is difficult to observe the full impact

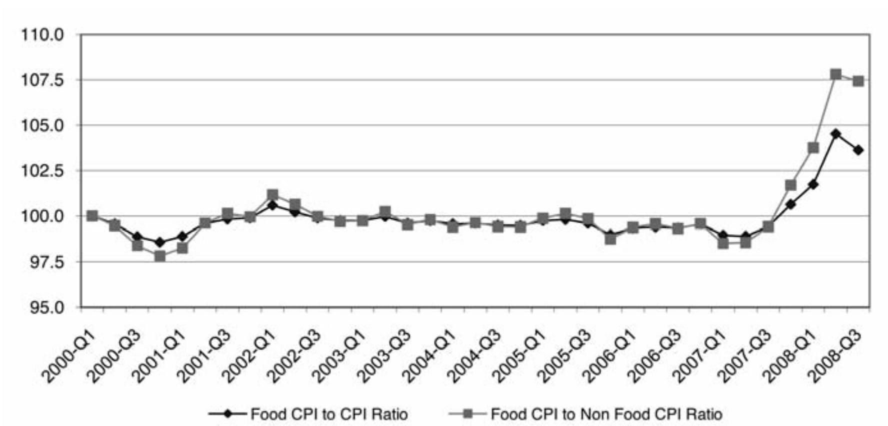

Figure 3.4: *Ratio of food prices to non-food prices and overall consumer price index (indexes, 2000 Q1 = 100)*

[60] Our regression estimates, reported later in this chapter, show that, after adjusting for currency changes, only about 10 to 15 percent of the international price is passed through to local consumer food prices.

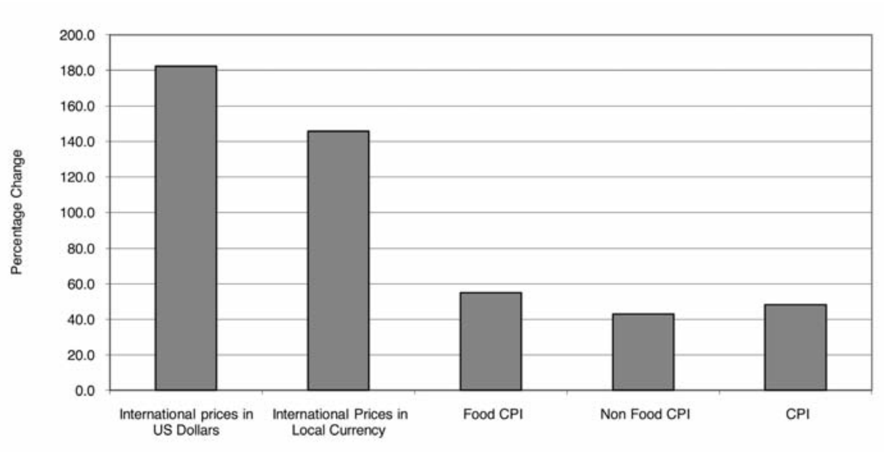

Figure 3.5: *Price changes between 2000–Q1 and 2008–Q2 (percent)*

of global food price declines. Future data will shed more light on the movements of these price series.

Looking at the period from the start of the first quarter of 2000 to the peak in the second quarter of 2008, the various measures of price increases differ widely (Figure 3.5). While the international food price index in US dollars increased by 182 percent, the same index in local currency increased by only 146 percent. Meanwhile, domestic consumer prices of food (the food CPI) increased by 55 percent, the non-food price index by 43 percent, and the overall consumer price index by 48 percent. Thus the increase in domestic consumer prices of food was about a third as large as the international food price increase in dollar terms. Further, the food CPI increased only slightly more than the non-food CPI and the overall CPI.

To sum up, our analysis above has shown that most of the rapid increase in global food prices was not replicated in domestic consumer prices. Over the past few years, global food prices increased faster than the prices of non-food items and faster than overall inflation, reversing the relative food price declines of the early 2000s. Global food prices affected domestic prices in a statistically significant way but these effects were not very large; on average, domestic food price increases were about 38 percent as large as the international food price increases expressed in local currency, and only 30 percent as large as the international food prices increases expressed in US dollars. Thus the average pass-through was less than one third of the global food price increases as measured by US dollar indexes.

REGIONAL DIFFERENCES

The results given above are for an aggregate of 90 countries, but individual countries or groups of countries might have very different experiences. To examine whether the relationships between the international food price index, international food prices in local currency, and food consumer prices behave differently in different groups, we distinguish five groups of countries: former socialist countries of Eastern Europe, low-income countries, small island states, middle-income countries, and industrial countries. The small island states, which import much of their food, are grouped separately because our earlier results showed that they might be more vulnerable to food price shocks (Ng and Aksoy, 2008).

One reason why price relationships might differ among countries is that the share of food in the consumption basket differs from place to place. Notably, low-income countries have a much larger share of food in their consumption basket, so a change in international food prices will have a greater impact on them than on more developed countries. In our sample of 90 countries the average share of food in the CPI is about 40 percent, but the range is from 59 percent in low-income countries, on average, to 27 percent in industrial countries.

Another factor that affects the potential impact of international prices is the behavior of real exchange rates. For the 90 countries between the first quarter of 2000 and the peak of the price cycle in the second quarter of 2008, international food prices increased by 182 percent in US dollars, but the behavior of exchange rates meant that the increase was smaller in local currencies, at 146 percent. This pattern held for all groups of countries except the middle-income group, whose currencies depreciated against the US dollar. The food price increase in US dollar terms was passed through at very different rates in different groups of countries: the increase in local currency terms ranged from 69 percent in Eastern Europe to 226 percent in middle-income countries (Table 3.1, column 1).

Table 3.1: *Food price increases between 2000–Q1 and 2008–Q2 (percent)*

Country Group	International Food Prices in Local Currency	Food CPI	CPI	Non-food CPI	Food CPI/Int'l Price	Food CPI/CPI CPI	Food CPI/Non-food
Eastern Europe (9)	69.1	46.4	46.4	44.7	0.87	1.00	1.04
Low-income (13)	176.7	80.6	72.6	61.8	0.65	1.05	1.12
Middle-income (33)	225.8	72.8	65.7	53.1	0.53	1.04	1.08
Island economies (10)	134.7	50.9	34.4	27.9	0.64	1.12	1.18
Industrial countries (25)	92.0	24.5	23.4	23.2	0.64	1.01	1.01
World (90)	145.7	54.9	48.2	43.0	0.63	1.05	1.08

Source: World Bank staff estimates.
Note: The table shows the changes in international prices as reflected in local currency, the food component of the CPI, and the overall CPI, along with the ratio of domestic food prices (food CPI) to international prices, overall CPI, and the non-food CPI. Numbers in parentheses are the number of countries in each sample. The averages are unweighted.

A further attenuation takes place when international food prices in local currency are passed through to domestic consumer food prices: on average for the period considered, the latter increased only 63 percent as much as the former. Again the rate of pass-through differed among groups of countries; it ranged from almost 87 percent in Eastern European countries to a low of 53 percent in middle-income countries (Table 3.1, column 5). Compared with the rise in international food prices in US dollars, then, the average increase in the food CPI was only about a third as great.

Another relationship that differs among groups of countries is the one between changes in domestic food prices and changes in other domestic prices. On average across the sample countries, and in the middle-income countries, the food CPI rose 8 percent faster than the domestic prices of non-food goods. In island economies and in low-income countries, domestic food prices rose considerably more than other prices (by 18 and 12 percent, respectively—see Table 3.1, last column). In Eastern Europe and the industrial countries, food and non-food prices both rose at about the same rate.

Eastern Europe

In the nine sample countries in Eastern Europe, a significant currency appreciation against the US dollar served to cushion the effect of international food price increases on domestic prices. Figure 3.6 clearly shows the decline in the ratio of international prices in local currency to international prices in US dollars. In their local currencies, the East European countries experienced an international food price increase of about 69 percent, compared to 146 percent for the world average in local currency and 182 percent for the international price increase in US dollars.

Food consumer prices in these countries increased by even less than the international food prices in local currency. Nonetheless, they show the influence of international price changes. They increased relatively slowly until the end of 2006, and then, pushed by international food prices, increased much faster until the end of 2008. Relative to non-food prices, they consistently declined until they began a rapid rise in 2007. By the end of 2008 they had come much closer to non-

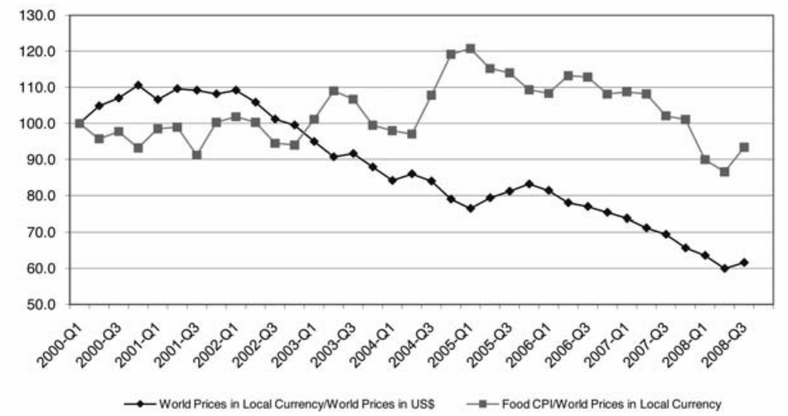

Figure 3.6: *East Europe: key food price ratios (indexes, 2000 Q1 = 100)*

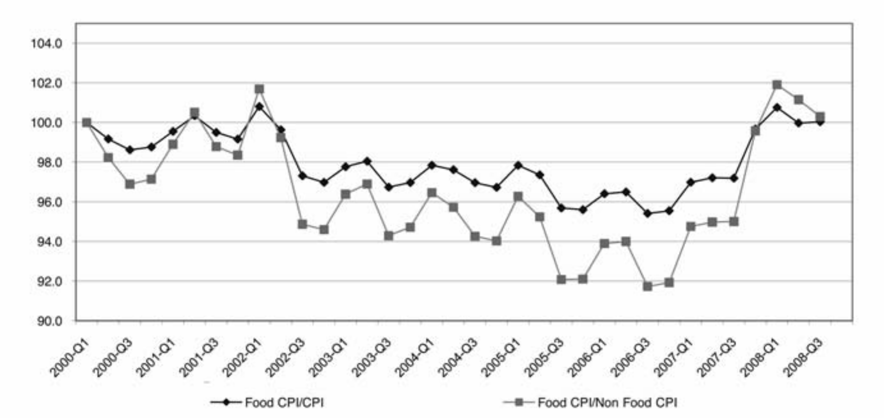

Figure 3.7: *East Europe: ratio of food prices to non-food prices and overall consumer price index (indexes, 2000 Q1 = 100)*

food prices and to the overall CPI (Figure 3.7). Their 46 percent cumulative rise to their peak level was no different from the overall rise in consumer prices, and only two percentage points greater than the rise in their non-food CPI. The share of food products in the overall CPI is 45 percent in this group of countries, ranging from 63 percent in Albania to 33 percent in the Czech Republic.

In the East European sample countries, it is hard to find a significant increase in food prices throughout the 2000–08 period considered. At the peak of the food price cycle, the relative prices of food and non-food items were at about the same level as they had been at the start of the period.

Low-income countries

In the 16 low-income countries in the sample, the international food price increases of 2005 and, more importantly, 2007 and 2008, were passed through into domestic food price increases. This was despite the fact that food makes up a very large component of the overall CPI in these countries. And unlike in other country groups, the domestic food price increases continued through the third quarter of 2008, only declining during the fourth quarter. This suggests that in low-income countries the structure of lags differs from that in other country groups.

In these countries by the end of the period—after a slight currency depreciation against the US dollar—international food prices in local currency were about the same as international food prices in US dollars (Figure 3.8). Thus, at the end of the price cycle, there was almost no exchange rate effect. Domestic food prices increased much more slowly than international food prices. Thus at the peak of the price cycle, the domestic food price was about 65 percent of the international price (Figure 3.8).

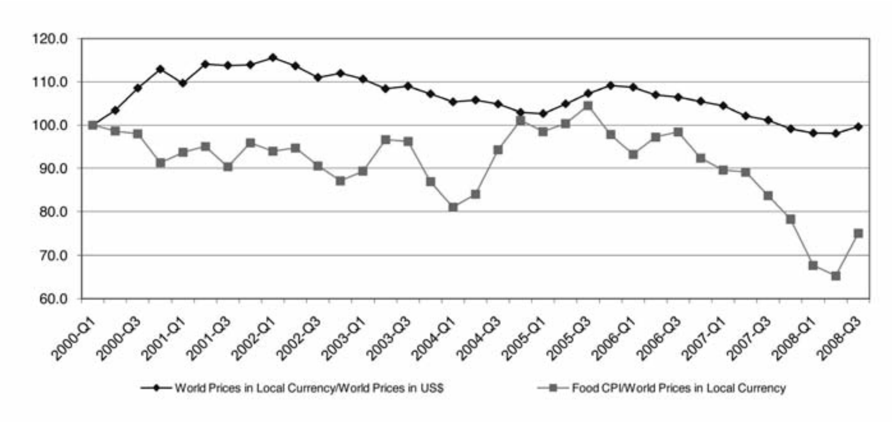

Figure 3.8: *Low-income countries: key food price ratios (indexes, 2000 Q1 = 100)*

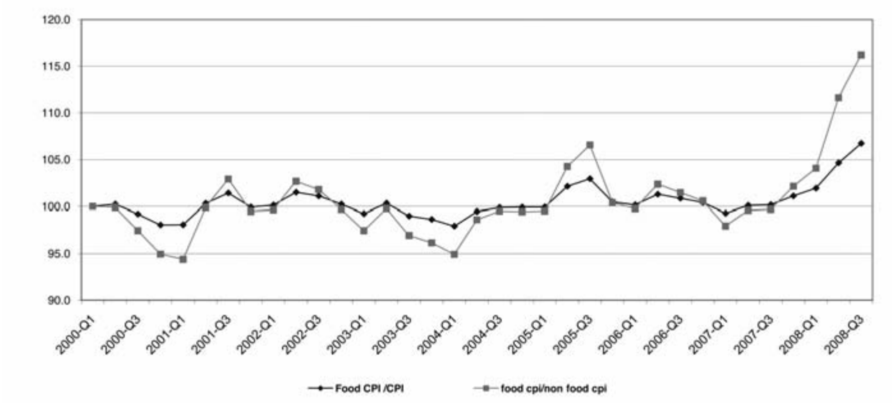

Figure 3.9: *Low-income countries: ratio of food prices to non-food prices and overall consumer price index (indexes, 2000 Q1 = 100))*

Increases in food consumer prices were higher than the increases in non-food consumer prices and in overall consumer prices (Figure 3.9). The share of food is very large in the consumption bundle of this country group, at about 59 percent. India has the biggest share of food in its consumption basket at 78 percent, followed by Sierra Leone and Nigeria at about 67 percent. Every time there was a rapid rise in food prices, the ratio of food to non-food prices increased sharply. Because of the large share of food in the consumer price index, the ratio of the food CPI to the overall CPI increased much less. We observe this during the price increases both in 2005 and after 2006.

Small island countries

For the ten small island countries in our sample, a relatively large portion of the increase in international prices was passed through into domestic food prices, which rose much faster than other domestic prices.

In these countries by the end of the period, the international food price increase in local currency terms was 135 percent, compared with the international price increase in dollar terms of 182 percent. Throughout the period, international food prices in local currency rose more slowly than the prices in US dollars, and over much of the period consumer food prices rose more slowly still (Figure 3.10).

This said, the rise in consumer food prices was substantial enough to outpace overall inflation. Looking at the comparison between domestic food and non-food prices (Figure 3.11), these countries had relatively low inflation of only 34 percent,

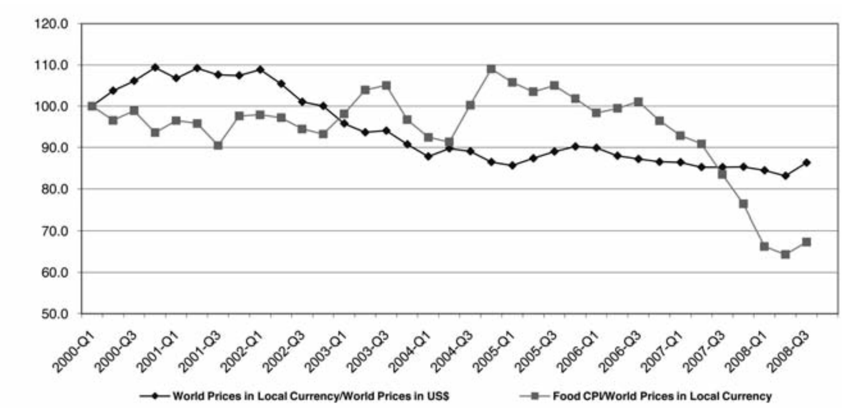

Figure 3.10: *Island states: key food price ratios (indexes, 2000 Q1 = 100)*

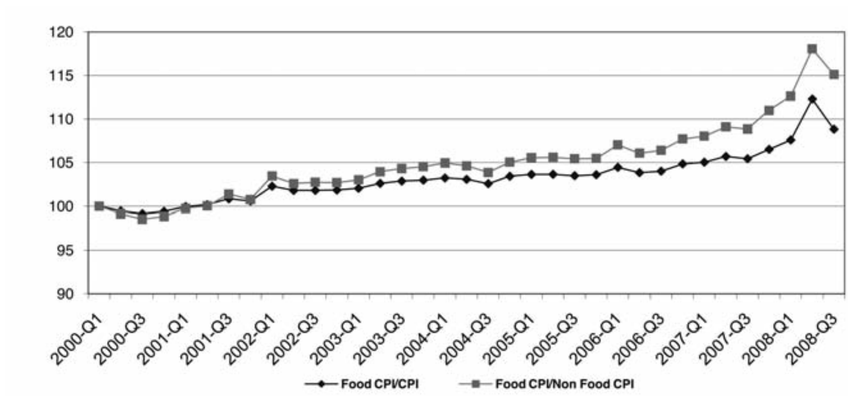

Figure 3.11: *Island states: ratio of food prices to non-food prices and overall consumer price index (indexes, 2000 Q1 = 100)*

and a much higher food price increase, of 51 percent. Thus in the small island countries the behavior of relative consumer prices differed somewhat from that in other country groups: throughout the period, a strong increase in the island countries' food prices outpaced the rate of overall inflation. The other country groups saw first a decline in relative food prices and then a rapid increase after 2006.

Middle-income countries

In these 33 countries, the biggest group in our sample, consumer food prices rose faster than other domestic prices and overall inflation, particularly during the food price spike in 2007–08.

In the middle-income countries the average exchange rate depreciated significantly against the US dollar during the 2000–08 period considered, and international food prices in local currencies increased much more than in other country groups. But domestic food prices, relative to international ones in local currencies, increased the least in this group (Figure 3.12).

Comparing food consumer prices with other domestic prices, during the food price spike the middle-income countries' food consumer prices increased much more than overall inflation (Figure 3.13). Inflation was higher in the middle-income countries than in most other country groups. The share of food in the consumption bundle is about 41 percent on average in this country group, with a wide variation among individual countries. The ratio of the food to non-food price increases went from 96 percent to more than 108 percent in a period of one year, indicating the pressure of international on domestic food prices (Figure 3.13).

Industrial countries

In this group of 25 countries[61], the impact of international food price increases on domestic food prices was quite small. Domestic food prices and overall inflation rates were very similar.

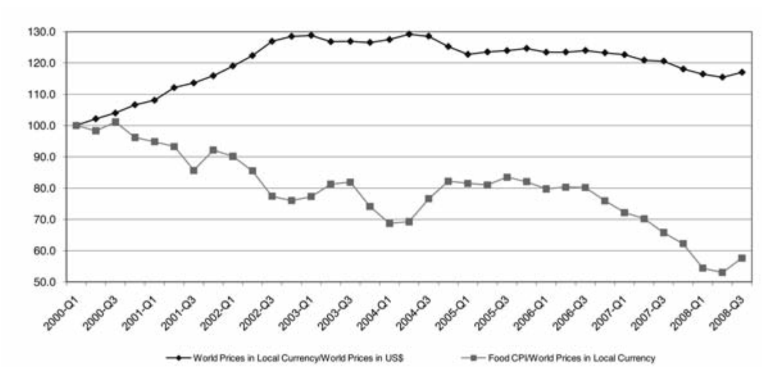

Figure 3.12: *Middle-income countries: key food price ratios (indexes, 2000 Q1 = 100)*

[61] One of the reasons for the large size of this sample is the availability for these countries of third-quarter 2008 numbers, which help us to see whether the international price increases were reflected in domestic prices.

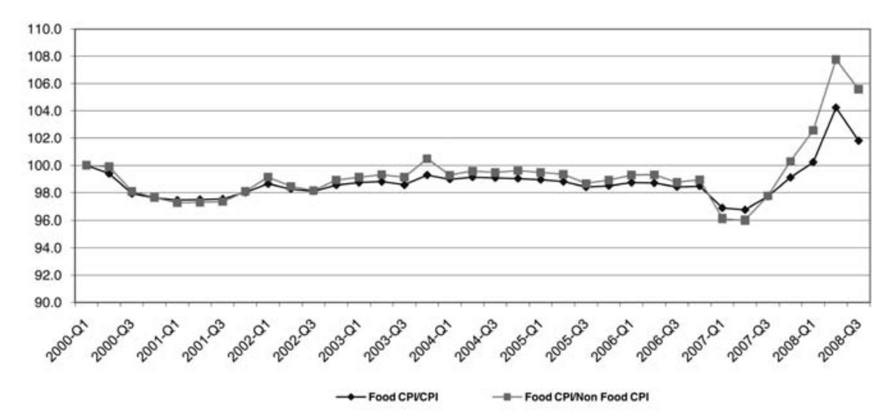

Figure 3.13: *Middle-income countries: ratio of food prices to non-food prices and overall consumer price index (indexes, 2000 Q1 = 100)*

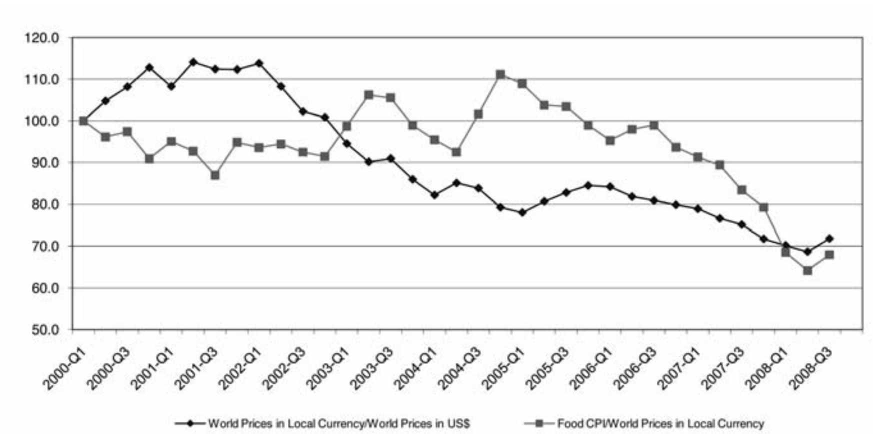

Figure 3.14: *Industrial countries: key food price ratios (indexes, 2000 Q1 = 100)*

The industrial countries are another group that has had a significant currency appreciation, on average, against the US dollar, dampening the increase in international food prices in local currency terms (Figure 3.14).

Domestic food prices moved closely in line with the non-food CPI and the overall CPI (Figure 3.15). Inflation rates were very low, and food makes up a smaller share of the consumption basket in this group than in any other group of countries; indeed, the 18 percent share in the US is the lowest in the world. Even so, one can see an impact of international prices on domestic food prices; in the last two years of the period, domestic food prices increased faster than non-food prices (Figure 3.14).

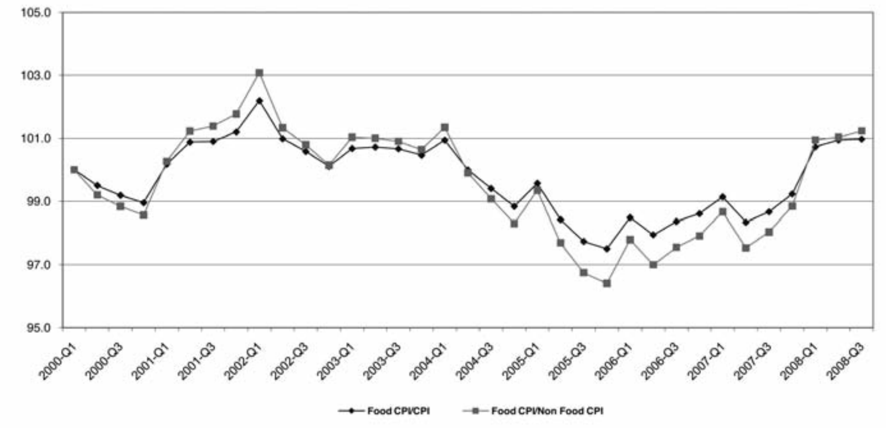

Figure 3.15: *Industrial countries: ratio of food prices to non-food prices and overall consumer price index (indexes, 2000 Q1 = 100)*

ESTIMATIONS

To further examine the effects of international food prices on domestic food and non-food prices, we carried out some preliminary estimations in which domestic food prices are regressed on international prices expressed in local currency and on the non-food CPI. The regressions were done using the world and country group averages. Given the small sample size of only 37 observations, the coefficients become very sensitive to specification and period selection. The time period (2000, first quarter, to 2008, third quarter) is too short to yield unequivocal results, and we probably need to estimate these relationships for individual countries, using cross-section and time-series panel estimations.

Despite all these caveats, we estimated the effect of international prices on domestic prices. *IP* is the international price of food expressed in local currency. To measure the impact of international prices, we use both *IP* and its value with one quarter lagged, *IP(-1)*. *NFCPI* is the non-food component of the consumer price index, *CPI*. *CPI* is used as a proxy for domestic inflation. Since we have estimated the relationships in level forms, there was serial correlation and we used first-order autoregressive correction, *AR(1)*, in our estimations. We estimated individual regressions for each of the groups of countries analyzed earlier.

The results, shown in Table 3.2, suggest that international food prices do have effects on domestic food prices. These effects usually show themselves within one or two quarters, and range from 0.5–0.15 percent of the base price. In all groups of countries and on average for the world, the coefficient of international prices regressed on the local food consumer price index is significant but small. Similarly, we find an effect from non-food prices to food prices. This probably reflects the underlying inflationary dynamics.

Table 3.2: *Estimation results*

	CONSTANT	IP	IP(-1)	NFCPI	NFCPI(-1)	AR(1)	Durbin Watson/R2
WORLD	1.52 (5.38)	0.06*** (0.02)	0.08*** (0.02)	0.39 (0.40)	0.44 (0.40)	0.63*** (0.15)	1.41/.99
East Europe	−0.59 (5.84)	0.18*** (0.06)	0.07 (0.05)	0.51 (0.57)	1.24*** (0.57)	0.42** (0.22)	1.58/.98
Low Income	−0.69 (10.96)	−0.05 (0.05)	0.27*** (0.05)	0.11 (0.29)	0.71** (0.31)	0.64*** (0.15)	1.42/.98
Middle Income	11.69 (8.00)	0.08*** (0.02)	0.05** (0.02)	0.32 (0.40)	0.39 (0.37)	0.67*** (0.18)	1.66/.99
Island Economies	−47.15*** (7.15)	0.08*** (0.02)	0 (0.02)	0.5 (0.40)	0.88** (0.40)	0.41** (0.18)	2.02/.99
Industrial Countries	−23.67*** (6.63)	0.03*** (0.01)	0.01 (0.01)	0.59*** (0.08)	0.59*** (0.08)	0.72*** (0.13)	2.18/.99

*=.90 %;, **=.95%, ***=.99%.

CONCLUSIONS

Although the analysis is descriptive at this stage, a few things stand out. First, in all groups of countries, the latest international food price spike has influenced domestic food prices. In all groups of countries, food-price inflation has accelerated, and food prices have increased by more than the overall rate of inflation.

Second, international food price changes have had very different impacts from country to country, depending on the behavior of exchange rates. Thus while international food prices in US dollars increased by 182 percent between 2000 and the peak in 2008, these prices when expressed in local currencies increased by only 146 percent on average. The increases in local currency terms ranged widely, from 69 percent in Eastern European countries to 226 percent in middle-income countries.

Given the great variation in international food prices in local currencies, local prices moved more in line with domestic inflation rates. In low- and middle-income countries, for example, domestic food prices rose by 81 and 73 percent respectively, while international prices rose by 177 and 226 percent respectively. Meanwhile, in both these country groups, non-food prices rose by no more than 62 percent. These results show the need for caution in the use of international food price data for forecasting domestic food price inflation.

If one focuses on the last two years of the period, when food prices increased much more dramatically and quickly, results are similar. Between the first quarter of 2005 and the second quarter of 2008, when food prices peaked, international food prices in local currency increased by 97 percent but domestic food prices increased by only 26 percent. Meanwhile, non-food price increases were even lower, at 17 percent. Thus in all country groups, food price increases were above the non-food price increases but much below international food price increases.

M. Ataman Aksoy has retired from the World Bank and is now undertaking research at the Development Economics Group of the World Bank in Washington, D.C as a consultant.

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APPENDIX: DATA AND COUNTRY CLASSIFICATION

Data

The CPI price series used here starts in 2000 and ends in the third quarter of 2008 for all sample countries. International food prices peaked in the second quarter of 2008 and then declined rapidly in the last two quarters of that year. It is important to include the third quarter of 2008 to see whether the large decline in international food prices got reflected in domestic consumer prices. Thus only the countries that had CPI data for the third quarter of 2008 were included in the sample, limiting the number of countries to 90. About half the countries in the sample also had data for the fourth quarter of 2008 at the time of writing. These last-quarter data are included to indicate what happened in that quarter but are not representative of all the countries and do not fully match the rest of the data.

The non-food CPI used in the analysis is generated by using the weights of purchases in the food CPI, and estimating the non-food CPI as a residual from the overall CPI series. All these data have been taken from ILO Bureau of Statistics web database http://laborsta.ilo.org/

International food prices are converted to local currency equivalents using the nominal exchange rates from IMF *International Financial Statistics* in period averages.

Country Classification

All countries = 90				
Eastern Europe (9)	Industrial Countries (25)	Small Island States (10)	Low Income (13)	Middle Income (33)
Albania	Australia	Bermuda	Bangladesh	Algeria
Croatia	Austria	Fiji	Burkina Faso	Argentina
Czech Republic	Belgium	French Guiana	Côte d'Ivoire	Belize
Estonia	Canada	French Polynesia	Ghana	Bolivia
Latvia	Cyprus	Guadeloupe	India	Brazil
Lithuania	Denmark	Isle of Man	Niger	Chile
Poland	Finland	Puerto Rico	Pakistan	China
Romania	France	Reunion	Senegal	Colombia
Slovak Republic	Germany	Seychelles	Togo	Costa Rica
	Greece	St. Vincent & Grenadines	Uganda	Dominican Republic
	Iceland		Haiti	Egypt
	Ireland		Sierra Leone	El Salvador
	Italy		Nigeria	Honduras
	Japan			Hong Kong, China
	Luxembourg			Indonesia
	Malta			Iran, I.R. of
	Netherlands			Israel
	New Zealand			Jamaica
	Norway			Jordan
	Portugal			Korea
	Spain			Malaysia
	Sweden			Mexico
	Switzerland			Morocco
	United Kingdom			Peru
	United States			Philippines
				South Africa
				Sri Lanka
				Taiwan, China
				Thailand
				Tunisia
				Turkey
				Uruguay
				Venezuela, Rep. Bol.

Source: Based on the classification of country income from World Bank, World Development Indicators 2007.

4

Household Income Structures in Low-income Countries[62]

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The impact of food price shocks on poor households depends on the relative importance of different sources of income and expenditure for these households. Net food purchases, the magnitude of farm and non-farm income, and the relationships among different sources of income for farm and non-farm households are very important in determining the impacts of food price changes and therefore the design of both global and domestic policies addressing food buyers and sellers. But in most discussions about how to react to food price changes, a lack of detailed and reasonably comparable data on farming households makes the debate less focused and specific. Many of the studies that do contain household income information are country case studies and lack comparability across countries.

This chapter presents comparable details of income sources at the household level for 15 low-income countries.[64] To be reasonably representative, we selected five countries from Asia (Bangladesh, Cambodia, Nepal, Pakistan, and Vietnam); five from Latin America (Bolivia, Ecuador, Guatemala, Nicaragua, and Peru); and five from Africa (Ethiopia, Ghana, Madagascar, Malawi, and Zambia). While all the selected countries are poor within the context of their continents, their PPP-adjusted per capita incomes vary between US$ 630 in Ethiopia and US$ 6,390 in Ecuador. The country data come from surveys that were undertaken in the late 1990s and early 2000s as part of the Living Standards Measurement Study (LSMS); nine of the surveys were analyzed by the World Bank and six are from

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[63] The findings, interpretations, and conclusions expressed in this chapter are entirely those of the authors. They do not represent the views of the World Bank, FAO, or any other individual or organization.

[64] For an analysis of income sources in rural areas, based on the RIGA database, see Davis and others (2009).

the RIGA database of FAO[65]; further details about the data are in the appendix to this chapter. The two data sets use slightly different definitions for certain variables but, when tested for the same countries, yield very similar results.[66]

We focus especially on agricultural households, and address the following questions. First, how do we define an agricultural household? Answering this question is not easy because in rural areas, and especially in low-income countries, households undertake multiple activities including agricultural ones. Different household members might allocate their time to different activities and sectors. Common definitions and measurements such as the rural-urban distinction do not reflect the diversity of income-generating activities of low-income households. Thus we compare three definitions of agricultural households, based on the rural-urban distinction; the occupational sector of the household head; and the proportion of its overall income that a household derives from agriculture. Second, we look at the components of income derived from agriculture and the sources of income of different groups of households, including food and cash crop sales. Third, we assess the importance of labor markets and wage income for different groups of households, especially in rural areas with high rates of landlessness. Last, we look at relative incomes, to investigate whether agricultural households are richer or poorer than non-agricultural households.

Two findings of our analysis with far-reaching implications for policy analysis and targeting are that (1) there are large differences among low-income countries in each of the dimensions we have tried to measure; and (2) the characteristics of "agricultural" households differ widely depending on how this group is defined. Despite these important differences, another key finding, and our strongest result, is that on all three definitions of "agricultural households," agricultural households are much poorer than non-agricultural.

Some of our results are as expected. For example, the shares of wage income in rural areas are closely related to the degree of landlessness. In countries where there is a large share of rural landless households, the share of wage income in total income is much higher. Similarly, poorer households earn a greater share of their income from agricultural wages.

On the other hand, some results are unexpected. Cash income from sales of food contributes a much larger share of rural household income than does cash income from sales of cash crops, and is among the biggest sources of cash income.[67] These results suggest that food production needs to be supported not just for self consumption and food sufficiency, but also for the commercialization of agricultural production.

[65] These data sources were not designed as agricultural surveys. Thus they have limitations for our purposes, and we had to make strong assumptions to generate some of the series in this chapter. At the same time, the detailed and almost consistent household data they provide for 15 lower-income countries give us a reasonable basis for the conclusions we have reached.

[66] We tested the different definitions on two countries for which both data sets analyzed the same surveys: Vietnam and Bangladesh. The results were within one or two percentage points.

[67] We define cash crops as the traditional export crops such as coffee, cocoa, sugarcane.

WHO ARE THE AGRICULTURAL HOUSEHOLDS?

Since policy interventions and price changes affecting food prices reallocate income from agricultural households to others and vice versa, it becomes important to define who the agricultural households are, especially when we want to measure the poverty impact of policy changes.

Alternative definitions

The most common definition of agricultural households is the rural-urban distinction, whereby rural households are treated as agricultural households. Unfortunately, the definition of what constitutes a rural or urban location varies across countries, making inter-country comparisons very difficult. In some countries, the definition of rural covers small towns and in others only villages, while in some countries the definition may use additional criteria regarding people's access to infrastructure and public services. Definitions of towns versus villages also vary across countries. In addition, not all rural households farm, while some urban households, especially in peri-urban areas, may do so.[68]

A second definition distinguishes households according to their sources of income. This measure defines farm households as those who earn income directly from farming, including livestock farming. It excludes "indirect" agricultural income, including wages earned in agricultural activities. This definition is similar to that used in OECD country studies and in the Luxemburg Income Study, and thus it can be used for comparative purposes. But though used successfully in industrial countries, it tends to be much too inclusive when used in developing countries; households who have a small amount of subsistence income but work mainly in other sectors can be erroneously identified as farmers. Among our sample countries, for example, almost 93 percent of the households in Vietnam, and 97 percent in Bolivia, have some agricultural income, and so do 41 percent of all the urban households. Thus, the criterion of earning income directly from agriculture does not really identify the farm households in developing countries.

A variation of this income-based definition uses a cutoff point of the proportion of income originating from agricultural activities. Households who earn more than a certain proportion of their income from agriculture are classified as agricultural households. Clearly, the numbers change if different cutoff points are used, and the cutoff point to use is a matter of judgment.[69] In this chapter, we shall use two cutoff points, 10 percent and 30 percent, though some other studies have used cutoff points of up to 50 percent.

[68] There is another reason to treat rural as agricultural. To the extent that markets are segmented between rural and urban areas, spillovers from agricultural production and incomes might have stronger effects on the non-agricultural rural households.

[69] An important issue here is how to treat the income from subsistence production. Since subsistence production is not traded, some observers argue it should not be included in the definition of agricultural income. Others argue that because subsistence production can increase or decrease with changes in incentives, and because households allocate labor to it as an alternative to other agricultural or other income earning activities, subsistence production should be included in the definition of income.

A third way to identify farming or agricultural households is to use the occupational information available in some household surveys. We have occupational information for 14 of the 15 sample countries. Households may have multiple working members who work in different occupations, as noted above, but the criterion we use is the occupation of the head of the household: if he/she is occupied in agriculture the household is classified as agricultural.

Table 4.1 presents the shares of rural and agricultural households in total households under the first two definitions (location- and income-based). It shows that across countries the share of rural households is about 61 percent on average, and varies from 88 percent in Malawi to 36 percent in Peru. In highly urbanized Latin America, rural households make up quite a small share of the total. Asian countries in general have the largest shares of rural households, and Africa lies in between. Table 4.1 also shows the shares of agricultural households defined on the basis of income. Comparing columns (5) and (8) of the table, using a cutoff point of 10 percent for income from agriculture eliminates most of the marginal agricultural producers from the count, reducing the estimated share of agricultural households in total households from 72 to 57 percent. Increasing the income cutoff point to 30 percent reduces this share only to 46 percent, suggesting that most of the marginal agricultural producers rely directly on agriculture for less than 10 percent of their income. This pattern is more dramatic in urban areas, where about 41 percent of urban households get *some* income directly from agriculture but only 21 percent of them get more than 10 percent from that source.

Table 4.1: *Alternative definitions of agricultural households: location- and income-based (percent)*

	GNI Per Capita (PPP) 2005	% Rural	Share of Households With Positive Agricultural Income			Share of Households With Agricultural Income Greater Than 10%			Share Of Households With Agricultural Income Greater Than 30%		
			Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Ethiopia (2000)	630	50.7	13.7	91.4	71.3	11.0	84.5	65.4	7.9	76.1	58.4
Malawi (2004)	640	88.1	39.0	95.8	89.0	31.9	92.5	85.2	21.5	85.1	77.5
Zambia (1998)	1090	47.8	33.9	93.2	70.1	20.2	87.7	61.4	11.0	78.5	52.2
Nepal (2003)	960	87.4	56.0	95.6	90.6	32.8	85.6	78.8	18.2	65.8	59.8
Ghana (1998)	1140	63.3	32.1	84.9	65.5	28.2	77.9	59.7	22.7	69.4	52.3
Cambodia (1999)	1380	60.0	49.1	92.6	86.1	42.2	87.3	80.6	35.4	78.1	71.7
Bangladesh (2000)	1120	79.7	19.1	71.9	61.3	8.3	51.7	43.0	4.3	32.3	26.7
Vietnam (1998)	2100	71.2	74.5	98.5	92.7	20.8	90.8	73.9	10.9	78.8	62.3
Madagascar (2001)	820	75.8	34.0	83.1	71.2	31.8	79.8	68.2	29.6	74.4	63.5
Nicaragua (2001)	2250	43.9	72.8	92.7	80.5	25.6	74.2	44.4	12.2	54.9	28.7
Pakistan (2001)	2280	71.0	18.8	71.1	55.9	9.9	59.3	44.9	6.3	49.9	37.3
Bolivia (2002)	3610	42.0	95.7	96.5	96.0	18.4	79.5	41.3	4.2	64.3	26.7
Guatemala (2000)	4030	56.7	43.3	90.8	70.2	18.1	69.1	47.0	9.0	48.4	31.4
Peru (2003)	6030	35.9	14.0	89.8	37.5	8.0	76.3	29.2	4.2	55.9	20.3
Ecuador (1995)	6390	37.4	21.8	80.7	43.9	9.8	64.1	30.1	4.6	45.5	19.9
Unweighted Average	2295	60.72	41.19	88.57	72.12	21.14	77.36	56.87	13.49	63.83	45.92

The results from the income-based definitions belie common assumptions that rural households farm and urban households do not. For example, using the 10 percent definition, almost 23 percent of rural households would *not* be classified as agricultural, while 21 percent of urban households earn enough agricultural income to be classified as agricultural. Even using the 30 percent definition, 13 percent of urban households would be classified as agricultural, and 37 percent of rural households would not be classified as agricultural. Again using the 30 percent definition, Cambodia and Madagascar—and to a lesser extent, Malawi and Ghana—stand out for having much larger than average shares of urban households who can be classified as farmers. This might be due to these countries' rural-urban classification systems, or to more extensive urban and peri-urban agricultural production, or to a combination of these factors.[70] Looking at the income sources of rural households, land-scarce Bangladesh stands out: only one in three of its rural households earns more than 30 percent of its income directly from agricultural production.[71]

One more definitional measure is the proportion of households who classify their occupation as agriculture and also the households that derive more than 30 percent of their total income from agriculture (Table 4.2). On average, about 46

Table 4.2: *Alternative definitions of agricultural households: location-, income-, and occupation-based (percent)*

	Percent Rural	Share of Households With Agricultural Income Greater Than 30 Percent			Share of Agricultural Households by Occupation		
		Urban	Rural	Total	Urban	Rural	Total
Ethiopia	50.74	7.94	76.07	58.43	6.69	89.37	67.95
Malawi	88.08	21.5	85.1	77.5	21.81	72.30	66.30
Zambia	47.76	11.04	78.45	52.23	5.58	75.57	48.35
Nepal	87.37	18.2	65.8	59.8	20.83	53.71	49.52
Ghana	63.34	22.7	69.4	52.3	22.71	67.23	49.65
Cambodia	59.99	35.44	78.06	71.74	n.a.	n.a.	n.a.
Bangladesh	79.73	4.34	32.32	26.71	10.50	57.63	48.18
Vietnam	71.16	10.91	78.80	62.35	11.15	76.79	60.80
Madagascar	75.75	29.56	74.39	63.52	24.12	74.56	62.33
Nicaragua	43.88	12.24	54.94	28.74	11.24	59.16	29.76
Pakistan	70.97	6.3	49.9	37.3	4.39	42.51	31.50
Bolivia	41.98	4.21	64.33	26.69	5.70	78.64	32.98
Guatemala	56.75	9.0	48.4	31.4	12.30	58.93	38.74
Peru	35.86	4.23	55.90	20.27	14.64	84.90	36.41
Ecuador	37.40	4.61	45.49	19.90	6.42	80.02	26.41
Unweighted Average	60.72	13.49	63.83	45.92	12.72	69.38	46.35

[70] See Zezza and Tasciotti (2008) for a discussion of urban agriculture issues based on a partly overlapping cross-section of countries.

[71] As will be discussed later, large numbers of Bangladeshi households rely on wage work in agriculture.

percent of agricultural households classify their occupation as agriculture, and about the same percentage of households derive more than 30 percent of their income directly from agriculture. Of course, the share of households classified as agricultural under the two definitions varies significantly for individual countries.

Implications

To sum up, about 57 percent of rural households, and 32 percent of all households, meet all three definitions of being an agricultural household: they are located in rural areas, the head of the household lists agriculture as his/her main occupation, and they earn more than 30 percent of their income directly from agricultural activities.

An important lesson is that it is misleading to simply identify rural with agricultural and urban with non-agricultural activities. An important proportion of urban households has significant agricultural incomes, especially in one third of the sample countries—Madagascar, Cambodia, Malawi, Ghana, and Nepal—and even in other countries, the proportion is higher than expected. Further, more than 12 percent of urban households identify agriculture as their main occupation. Conversely, on average almost 30 percent of rural households—and up to 50 percent in many countries—do not list agriculture as their main occupation. Between 15 and 65 percent of rural households earn no more than 30 percent of their income directly from agriculture. While many of them might be agricultural wage laborers, their numbers are large.

Hence it is a matter of judgment which definition to use in our analysis. What the data make clear is that the sets of households under different definitions are quite different, with differing physical and social characteristics, suggesting that the needs and capabilities, and responses to policy interventions, of "agricultural households" will differ depending on the definition used. Analysts need to be aware that *how* one defines an agricultural household will have far-reaching implications for the results of analysis and the targeting of policies and investments.[72]

AGRICULTURAL INCOME

Another way to measure the role of agriculture in the household economy is to estimate the share of income originating in agriculture (as above, this income is defined as income originating directly in agriculture—cropping and livestock production—and excluding wage income). Table 4.3 shows the share of agricultural income in total household income in 15 countries; it also shows the share of agricultural income that originates from subsistence production (i.e. production for the household's own consumption).

[72] This issue becomes more important when policy and investment packages are designed to improve agricultural output and incomes. Depending on the definition, different constraints and capabilities will be identified. For example, from the relative income data in Bangladesh, the average income of rural households appears to be 58 percent of that of urban households, while the income of households that state their occupation as agriculture appears to be 78 percent of that of households employed in other sectors—a big difference.

Table 4.3: *Sources of household income (percent)*

	Share of Income Directly from Agriculture			Share of Income from Subsistence Production (Own Consumption)		
	Urban	Rural	Total	Urban	Rural	Total
Ethiopia[a]	6.25	65.75	50.33	n.a.	n.a.	n.a.
Malawi	16.07	68.87	62.68	12.39	51.71	47.10
Zambia	9.42	68.52	45.53	7.36	51.65	34.42
Nepal	14.99	48.05	43.88	8.71	27.59	25.21
Ghana	27.88	60.08	48.48	16.15	40.98	32.04
Cambodia	26.92	57.48	52.95	13.44	30.10	27.62
Bangladesh	3.70	23.86	19.81	1.60	11.20	9.20
Vietnam	9.60	61.22	48.65	3.90	24.56	19.53
Madagascar	25.39	65.31	55.63	18.92	48.09	41.01
Nicaragua	11.19	44.59	24.10	6.22	18.55	10.99
Pakistan	5.15	38.31	28.72	2.09	9.67	7.48
Bolivia	7.30	45.74	21.67	6.40	26.57	13.94
Guatemala	6.76	35.29	23.04	4.95	23.73	15.66
Peru	3.44	42.64	15.58	1.24	17.35	6.23
Ecuador	2.78	35.38	15.05	1.58	16.83	7.32
Unweighted Average	11.79	50.74	37.07	7.50	28.47	21.27

Note: The table measures household income derived directly from agriculture, including subsistence production. It does not include wage income.
[a] In Ethiopia, subsistence income cannot be separated from other agricultural income.

The share of household income derived directly from agriculture varies among the countries but is generally high, at about 37 percent on average, and at more than 60 percent in rural areas of Malawi, Zambia, Ethiopia, Madagascar, and Vietnam (Table 4.3).

On average almost half the value of household agricultural income comes from subsistence production. The role of subsistence production varies widely among countries. For rural households in Madagascar, it supplies 48 percent of total income while in rural Bangladesh it supplies only 11 percent (Table 4.3, column 5). On average almost 29 percent of rural agricultural income is from subsistence production. Nationally, only about 16 percent of total household income is from agricultural activities if subsistence production is excluded from the calculation.[73]

Agriculture provides an important source of income even for urban households; its share for these households is 12 percent on average, but is more than 25 percent in urban Ghana, Cambodia, and Madagascar.[74] Most of the urban agricultural income is from subsistence production; these households should not be interpreted as agricultural or farming households.

[73] The Pakistan data on own consumption are somewhat suspect, being much lower than for any other country. In that survey the number of agricultural production and food consumption items included in the questionnaire is much smaller than in other countries, which is likely to cause agricultural income variables to be understated.

[74] As pointed out above, this is probably due to a different definition of urban in these two countries.

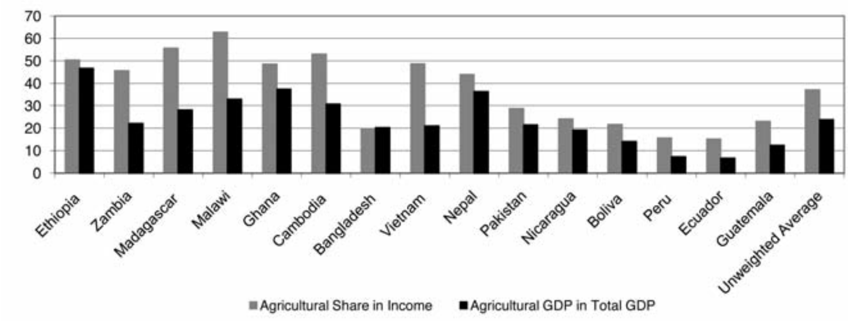
Wage work in agriculture

Though the discussion thus far has dealt only with the income arising *directly* from agricultural activities, many households work in agriculture as wage workers, as discussed in more detail later in this chapter. Data on wages can be separated between agricultural and other activities in 13 of the 15 countries.[75] In these 13 countries on average, the share of agriculture in total household income rises from 35 percent to almost 42 percent when agricultural wages are included in the calculation. (Box 4.1.)

As expected, there is very large variance among countries. Agricultural wages play only a small role in highly urbanized countries, but in Bangladesh and Guatemala they supply more than 12 percent of overall household income. In Malawi, the most agricultural of the sample countries, direct work in agriculture plus agricultural wages supplies almost 73 percent of overall household income.

Box 4.1: *Agricultural income and agricultural GDP*

Countries' shares of household income originating in agriculture are quite different from their shares of agricultural GDP in total GDP. On average the share of income from agriculture is about 37 percent, while the share of agricultural GDP in total GDP is only around 24 percent. The difference might be because input costs for agricultural sources of income are not fully accounted for, or perhaps because some of agricultural own consumption is not fully represented in national income series.



75 In the two countries where there are no separate wage data, Ethiopia and Zambia, the share of agricultural income in total income is already quite high. Since total wage income, especially in rural areas, is quite small, the estimate of agricultural income is unlikely to change much when agricultural wages are added.

In rural areas, income from agricultural wages is generally small in relation to income from direct work in agriculture. As shown in Figure 4.1, on average in the 15 countries, income directly from agriculture supplies 51 percent of rural household income while agricultural wages supply another 9 percent. Among the 13 countries with separate wage data, land-scarce Bangladesh is an outlier, with direct agricultural income supplying less than 25 percent of rural household income and agricultural wages adding another 14 percent. Bangladesh, Pakistan—another country with a high rate of rural landlessness—and highly urbanized Peru are the three countries in the sample where income from agriculture (direct and wage) supplies less than half of rural household income.

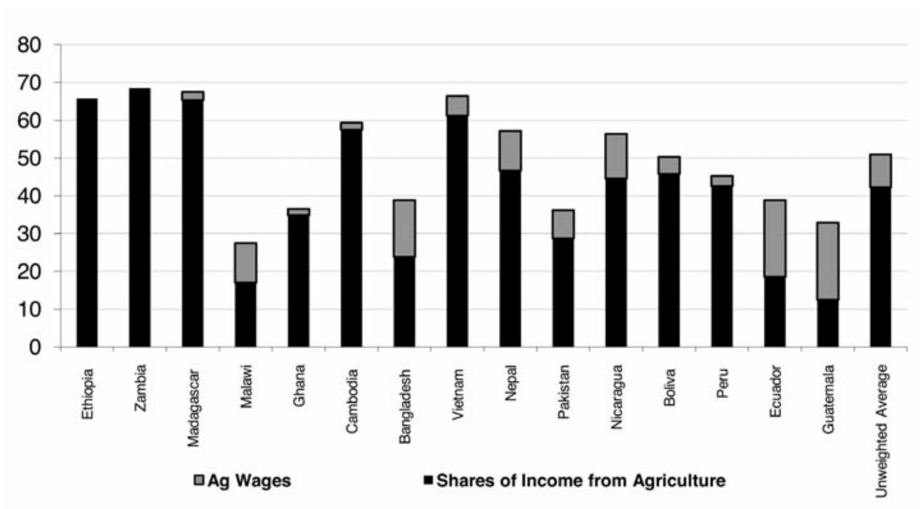


Figure 4.1: *Income from agriculture as percent of household income: rural areas*

Note: The data on agricultural income shares include the value of subsistence production.

Income sources of poor and rich households

A related issue is whether agricultural income shares differ for the rural poor and rich. We classify the households in the top 20 percent of the national income distribution as rich, and households in the bottom 40 percent of the national income distribution as poor. Figure 4.2 shows the share of income originating directly in agriculture for poor and rich rural households. It makes clear that, except in Ethiopia and Pakistan, poor rural households receive a much greater proportion of their income from agriculture than do rich households. This suggests that in most of the sample countries the richer households earn most of their income outside agriculture, while farmers are relatively poor. This is consistent with other findings that in rural areas, most of the rich are non-farmers. The relative incomes of different groups of households are further analyzed later in this chapter.

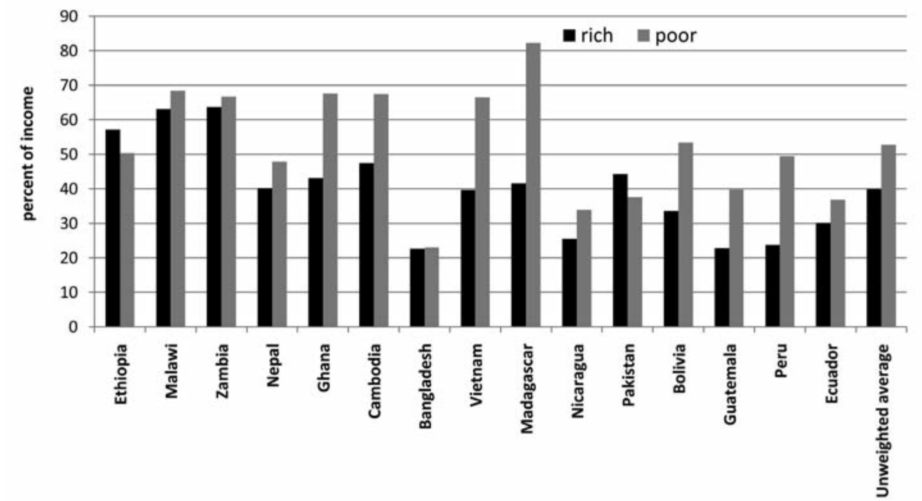


Figure 4.2: *Income from agriculture as percent of household income: rich and poor rural households*

Note: The figure measures household income derived directly from agriculture, including subsistence production. It does not include wage income.

If agricultural wages are added to the calculation illustrated in Figure 4.2, the picture does not change substantially. Again, poor households in rural areas earn a significant portion of their income from agriculture, either directly or indirectly. In Bangladesh and Nicaragua, the differences between rich and poor—narrow to begin with—become more pronounced. Again, poor households in rural areas earn a significant portion of their income from agriculture, either directly or indirectly through agricultural labor markets. For Ethiopia and Zambia we do not have the breakdown of wage income, but as pointed out earlier total wage income in rural areas for these countries is quite small and will not change the overall picture. Even in rural areas, poor households are more likely than rich households to earn a substantial part of their income from agriculture-related activities.

Structure of agricultural income shows the components of directly earned agricultural income (food crops, livestock, and cash crops) expressed as percentages of overall household income.

The data emphasize the importance of livestock and poultry production; nationally, more than 9 percent of household income comes from this source, compared with the 26 percent coming from food crops and 2.5 percent coming from cash crops. In rural areas, the proportions are higher: 35 percent originates from food crops and an additional 13 percent from animal products. In a few countries, income from animal products is close to crop income—and, in Nicaragua, it is larger.

An important issue in the agricultural development literature has been the option of cash crop production for the development of rural economies and transition from subsistence to commercial agriculture. Generally, the literature has

Table 4.4: *Structure of agricultural income (percent of total household income)*

	Food Crops			Animal or Livestock			Subsistence			Cash Crops		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Ethiopia[a]	2.9	26.6	20.5	2.0	19.0	14.6	n.a.	n.a.	n.a.	0.6	8.8	6.6
Malawi	13.4	54.4	49.6	2.0	11.6	10.4	12.4	51.7	47.1	0.7	2.9	2.7
Zambia	6.3	45.2	30.1	2.1	17.0	11.2	2.8	23.7	15.6	0.1	3.2	2.0
Nepal	8.9	28.3	25.8	5.8	18.8	17.1	8.7	27.6	25.2	0.3	1.0	0.9
Ghana	23.2	50.0	40.3	4.0	5.7	5.1	16.2	41.0	32.0	0.7	4.4	3.1
Cambodia	22.5	47.3	43.6	6.6	13.8	12.8	13.4	30.1	27.6	0.4	1.7	1.5
Bangladesh[b]	3.7	23.9	19.8	n.a.	n.a.	n.a.	1.6	11.2	9.2	n.a.	n.a.	n.a.
Vietnam	6.6	40.4	32.1	2.3	14.3	11.4	3.9	24.6	19.5	0.6	5.5	4.3
Madagascar	25.4	65.3	55.6	1.9	3.9	3.4	18.9	48.1	41.0	1.5	7.3	5.9
Nicaragua	4.6	11.4	7.0	3.5	17.2	9.0	6.2	18.6	11.0	0.7	2.7	1.5
Pakistan	2.3	22.4	16.5	2.5	11.9	9.2	2.1	9.7	7.5	0.4	4.0	3.0
Bolivia	6.3	29.2	14.9	0.9	15.4	6.3	6.4	26.6	13.9	0.1	1.2	0.5
Guatemala	5.7	29.1	19.0	0.8	4.5	2.9	5.0	23.7	15.7	0.3	1.7	1.1
Peru	2.7	25.5	9.8	1.2	18.9	6.3	1.4	18.6	6.7	0.2	1.5	0.6
Ecuador	1.6	18.1	7.8	1.1	13.8	5.9	1.6	16.8	7.3	0.1	3.6	1.4
Unweighted Average	9.1	34.5	26.2	2.6	13.3	9.0	7.2	26.6	20.0	0.5	3.5	2.5

Notes: The table measures household income derived directly from agriculture, including subsistence production. It does not include wage income. The subsistence category overlaps with the food crops and livestock categories; income from food crops and livestock includes the value of subsistence production; and the data for subsistence production cover both food crops and livestock. Though of course all commodities can be sold for cash, cash crops are defined here as the traditional export crops such as coffee, cocoa, sugarcane.

[a] There are no subsistence production data for Ethiopia.

[b] In the Bangladesh data, all agricultural income is subsumed in food crops, and there is no additional product breakdown.

tended to treat food production as basically a subsistence activity and cash crops as a way of commercialization and achieving higher agricultural incomes. Many authors find that the introduction of cash crop development schemes has helped to improve smallholder incomes, nutrition, and food security (see Van Braun and Kennedy 1994; Dorwald, Kydd, and Poulton 1998; Govereh, Jayne, and Nyoro 1999; Govereh and Jayne 2003; Barghouti, Garbus, and Umali 1992; Minten and Barret 2005; and Arwings-Kodhek, Nyambane, and Yamano, undated). Cash crops yield higher financial returns per hectare than subsistence food crops, and in many cases, participation in cash crop schemes leads not only to higher incomes but also to the intensification of food production. Finally, these authors argue that poor households essentially produce food for subsistence and meet their cash needs through cash crops and wage labor.

How important is cash crop production for the average rural household? Do sales of food for cash predominate over sales of cash crops? For 13 out of 15 countries, food sales—or the cash income from food production—can be approximated as the value of production of food crops and livestock minus the value of what is consumed by the household.[76] Before making comparisons it is important to re-emphasize that our data come from household not farm surveys; typically they would not cover the production on commercial estates, so they probably underestimate the production of cash crops nationally.

Figure 4.3, which shows the share of cash income from food production along with the share of income from cash crop sales, emphasizes how small is the share of household income arising from cash crop production. While cash crop production is probably important for certain regions and households, its contribution to cash income at the national or rural area level is very limited. Only in three of the sample countries does the share of income from cash crops exceed 5 percent of the total income of rural households.

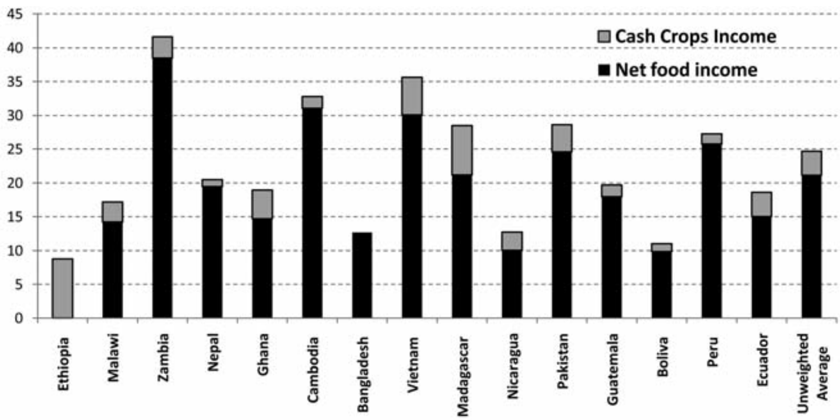


Figure 4.3: *Food and cash crop income: rural areas (percent of total household income)*

Note: The figure measures household income derived directly from agriculture; it does not include wage income.

Much larger than income from cash crops is the income from food sales, which supplies a significant portion of the cash income of rural households. On average about 29 percent of rural household cash income comes from food sales, 29 percent from wages, and only 5 percent from cash crops. Business and "other" income accounts for the other 37 percent.

These data suggest that cash crop income, while it may be useful, may not be *necessary* for commercialization of agriculture and higher food production. Food production, as well as being necessary for own consumption, provides a large part of the cash income for rural households.

[76] As noted earlier, separate subsistence data are not available for Ethiopia and separate cash crop and food production are not available for Bangladesh. This limits our sample here to 13 countries.

A related question is whether it is only rich households who sell food.[77] Figure 4.4 suggests this is not the case: poor households rely quite heavily on food sales, which supply a larger share of income for them than for the rich. On average, food sales provide about 19 percent of overall income for poor rural households and about 14 percent for rich. In ten out of thirteen countries, poor households rely more heavily on food sales than do rich households; the exceptions are Malawi, Cambodia, and Pakistan.

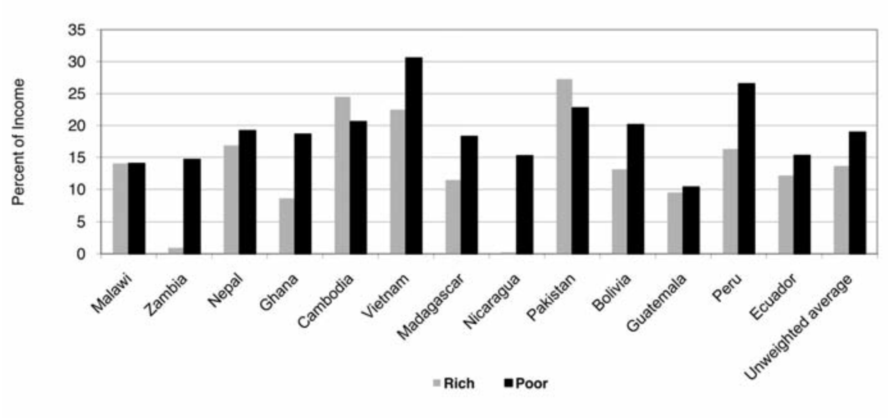


Figure 4.4: *Food sales by income group: rural households (percent of total household income)*

Note: The figure measures household income derived directly from agriculture; it does not include wage income.

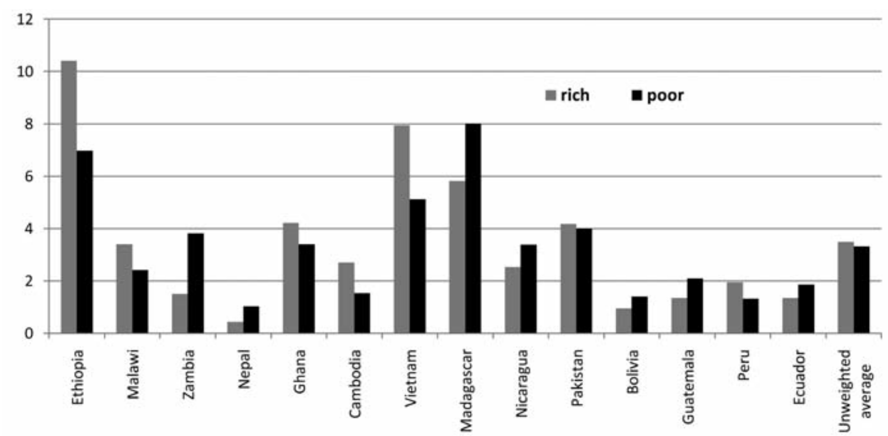


Figure 4.5: *Rural cash crop income, by income group: rural households (percent of total household income)*

Note: The figure measures household income derived directly from agriculture; it does not include wage income.

[77] We use the same definition as above, in which the bottom 40 percent of households are classified as poor and the top 20 percent of national households are classified as rich.

What about the relative importance to rich and poor families of income from cash crops? Figure 4.5 shows that unlike income from food sales, the importance of income from cash crops shows no clear pattern across the sample countries: in seven countries, the rich earn a greater proportion of their income from cash crops than do the poor, and in the other seven countries the reverse is true. This belies the common assumption that cash crop production is mainly important for rich households.

LABOR MARKETS AND RELIANCE ON WAGE INCOME

Another important source of income is work for wages. In the literature, most of the secondary adjustments to price changes are assumed to take effect through the labor markets. Therefore it is important to measure the importance and size of labor markets in rural areas.

Table 4.5 shows the wage income of rural and urban households as a percentage of household income, and its distribution between agriculture and other sources. As expected, the share of wage income in total income is much higher among urban households.

Table 4.5: *Wage income: urban and rural households (percent of total household income)*

	Wages			Agricultural Wages			Other Wages		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Ethiopia	33.09	4.85	12.17	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Malawi	53.25	17.18	21.41	9.45	10.31	10.21	43.80	6.87	11.21
Zambia	44.30	7.45	21.79	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Nepal	43.41	28.01	29.96	2.81	10.25	9.31	40.60	17.76	20.64
Ghana	27.43	9.99	16.27	1.57	1.24	1.36	25.86	8.75	14.91
Cambodia	30.84	15.37	17.66	0.94	1.88	1.74	29.91	13.50	15.92
Bangladesh	44.69	35.38	37.24	1.78	15.00	12.35	43.07	20.43	24.96
Vietnam	28.63	14.10	17.64	0.84	5.24	4.17	27.79	8.87	13.48
Madagascar	54.81	16.35	24.99	1.67	2.16	2.05	53.28	14.21	22.97
Nicaragua	50.45	35.73	44.74	2.02	11.79	5.37	48.43	23.94	39.37
Pakistan	59.47	29.42	38.11	1.11	7.55	5.69	58.36	21.87	32.42
Bolivia	44.36	15.74	33.66	9.70	4.60	5.00	34.70	11.10	28.70
Guatemala	56.77	38.02	46.07	4.85	18.64	12.71	51.93	19.38	33.36
Peru	39.03	22.12	33.79	6.01	2.55	3.50	33.02	19.57	30.28
Ecuador	54.20	37.71	47.99	3.38	20.28	9.74	50.82	17.43	38.25
Unweighted Average	44.32	21.83	29.57	3.55	8.58	6.40	41.66	15.67	25.11

Note: The table shows wages as a percentage of household income, including the value of subsistence production.

The importance of wage incomes for rural households varies widely among the sample countries, which fall roughly into three groups. In the first group—namely Bangladesh, Nicaragua, Guatemala, and Ecuador—wage income from all sources supplies more than 35 percent of rural households' total income; Pakistan comes very close, at almost 30 percent. In the second group—Malawi, Cambodia, Vietnam, Madagascar, and Bolivia—wages supply around 15 percent of household income, and in the third group—Ethiopia, Ghana, and Zambia—wages supply less than 10 percent. For two countries, Ethiopia and Zambia, the data do not differentiate between the sources of wage income, but in both, rural wage income is quite low at 5 and 7 percent of household income respectively.[78]

Even in rural areas, the bulk of wage income is from non-agricultural work. On average, non-agricultural wages supply 17 percent of rural household income, while agricultural wages contribute only 9 percent. In all countries except Ecuador, non-agricultural wage income is larger than agricultural wage income.

These findings imply that demand for services and manufacturing will have much greater effects on rural wages than will demand for agricultural products. This suggests that the demand for labor through derived demand created by consumer spending or farming inputs demand may be more important than the demand for agricultural labor for farming activities.

Table 4.5 also suggests that while rural agricultural labor markets range widely in size they are typically quite small. Agricultural wage income supplies more than 10 percent of total household income in only three countries: Guatemala, Bangladesh, and Malawi. Given their small size, rural agricultural labor markets might not generate significant secondary effects, except in a few countries.[79]

One determinant of the size of rural labor markets might be land ownership and its distribution.[80] For 14 countries with available data, Table 4.6 shows the proportion of rural households who do not cultivate any land (whether on their own farms or as tenants/sharecroppers). The table does not report on the size of land holdings so it measures only one dimension of landlessness and the need to earn income from activities other than farming. But despite its limitations, it shows some correlation between the extent of landlessness and the importance of wage income.

In five countries—Bangladesh, Nicaragua, Pakistan, Guatemala, and Ecuador—the rate of rural landlessness is above 25 percent, and is 41 percent on average; wage income contributes more than one third of rural household income in this country group. By contrast, in nine countries where rural landless rates are lower than 20 percent, and are 12 percent on average, the share of wage income in rural household income is only 16 percent.

Differences in the *agricultural* wage shares of these contrasting country groups are even more dramatic: agricultural wages contribute 15 percent of rural house-

[78] Hence the size of their agricultural wage income, which would be a fraction of these low numbers, would be quite limited and would not change any of the numbers significantly.

[79] It is interesting to note that the most important study on the second-order effects of price changes through wages was undertaken for Bangladesh (Ravallion 1989), which is an outlier in our sample of countries; in Bangladesh, agricultural wage income supplies 15 percent of rural household income (Table 4.5).

[80] Information on land ownership and land cultivation is very mixed and uneven in the surveys. Judgments and external information were used to select data on either land ownership or cultivation depending on which seemed to be more realistic.

Table 4.6: *Rural landlessness and reliance on wage income (percent)*

	Landless as % of Rural Households	Wage Income as % of Rural Household Income	
		Wages	Ag. wages
Ethiopia	n.a	4.9	n.a.
Malawi	5.0	17.2	10.3
Zambia	11.7	7.5	n.a.
Nepal	12.0	28.0	10.3
Ghana	15.9	10.0	1.2
Cambodia	18.9	15.4	1.9
Bangladesh	52.7	35.4	15.0
Vietnam	7.4	14.1	5.2
Madagascar	14.5	16.4	2.2
Nicaragua	36.6	35.7	11.8
Pakistan	57.4	29.4	7.6
Bolivia	17.6	15.7	4.6
Guatemala	29.2	38.0	18.6
Peru	7.5	22.1	2.5
Ecuador	31.1	37.7	20.3
Unweighted Average	22.7	21.8	8.6

hold income in the first country group, where landless rates are high, and only a third as much in the second country group, where landless rates are lower (Figure 4.6).

When labor markets are analyzed with respect to income levels in rural areas, no clear pattern emerges: the wage shares of the poor households are greater in seven countries while the opposite is true in eight countries (Table 4.7).

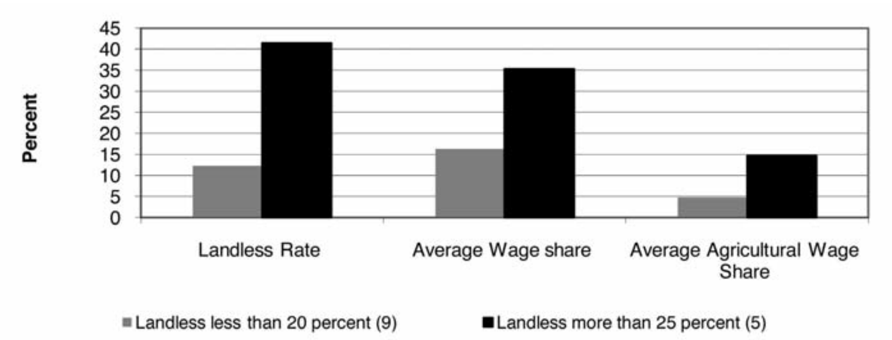


Figure 4.6: *Landless rates and wage shares in contrasting country groups: rural areas (wage shares as percent of household income)*

Table 4.7: *Structure of wage shares by income level for rural households (percent)*

	Share of Total Wage Income		Share of Each Wage Source			
			Agriculture Wage		Non-Agric Wage	
	Poor	Rich	Poor	Rich	Poor	Rich
Ethiopia	4.96	5.78	–	–	–	–
Malawi	18.56	20.34	13.57	7.88	5.00	12.46
Zambia	5.51	10.34	–	–	–	–
Nepal	30.31	20.26	12.07	2.13	18.24	18.13
Ghana	6.60	18.74	0.77	1.94	5.83	16.79
Cambodia	13.73	21.51	2.05	2.07	11.68	19.43
Bangladesh	46.09	18.63	24.75	2.03	21.34	16.76
Vietnam	15.68	11.56	7.06	2.32	8.61	9.24
Madagascar	7.83	47.59	2.46	1.78	5.37	45.86
Nicaragua	43.46	24.14	23.09	8.79	6.44	12.74
Pakistan	41.34	23.17	10.32	4.07	31.02	19.10
Bolivia	11.74	27.56	8.51	9.87	3.24	17.69
Guatemala	37.41	33.23	23.28	6.59	14.14	26.64
Peru	12.43	13.49	2.18	2.90	10.25	10.59
Ecuador	42.01	23.88	24.87	9.37	17.14	14.51
Unweighted Average	22.5	21.3	11.9	4.8	12.2	18.5

Agricultural wages, however, play a more important role for poor households than for rich: poor rural households earn 12 percent of their income from agricultural wages, versus 5 percent for the rich. Rich households tend to earn a much greater portion of their wage income outside agriculture.

RELATIVE INCOMES OF AGRICULTURAL AND NON-AGRICULTURAL HOUSEHOLDS

Lastly, we address the question of whether agricultural households are better off than non-agricultural. Again, the three definitions of agricultural households are used. Table 4.8 shows the ratios of average incomes—proxied by per capita expenditures—of rural versus urban households; farming versus non-farming households (distinguished by occupation of household head); and households who earn more than 30 percent of their income from agriculture versus households who earn less than 30 percent.

Under all definitions, agricultural households are much poorer than non-agricultural households. Out of 44 income comparisons (15 countries and three definitions), only one shows agricultural households having higher incomes than non-agricultural households.[81]

The income gaps between agricultural and non-agricultural households appear progressively larger as we move from one definition to another. To start with, rural households are much poorer than urban households; their average income

[81] That is, households having more than 30 percent of their income from agriculture in Bangladesh.

Table 4.8: *Household income ratios for alternative definitions of agricultural households (percent)*

	Rural over Urban	Agricultural over Non-agricultural	Agricultural Income Greater Than 30% over Less Than 30%
Ethiopia	67.84	78.62	80.89
Malawi	43.90	61.64	56.90
Zambia	53.09	57.61	77.11
Nepal	21.72	52.46	49.22
Ghana	53.98	92.26	55.39
Cambodia	48.98		63.87
Bangladesh	58.38	76.76	104.37
Vietnam	73.46	79.21	81.83
Madagascar	72.39	65.00	53.68
Nicaragua	57.57	61.91	80.22
Pakistan	67.91	84.92	88.70
Bolivia	61.15	65.29	72.59
Guatemala	35.97	39.98	46.07
Peru	42.91	46.99	54.59
Ecuador	53.26	60.01	65.93
Unweighted Average	59.53	67.43	74.35

is only 60 percent as large as that of urban households. Households whose occupation is agriculture have an average income 67 percent as large as that of non-agricultural households. And households who derive more than 30 percent of their income from agriculture have income 74 percent as large that of households who derive less than 30 percent of their income from agriculture. These significant differences in relative incomes suggest that the composition of the groups identified by the different definitions may differ too.

CONCLUSIONS

This chapter sheds light on some basic questions about agricultural households. One feature that dominates the conclusions is the variance of results by country, by household characteristics, and by location. For example, the share of wage income in rural household income varies from 38 percent in Guatemala to 5 percent in Ethiopia. Studies that try to measure the feedback from output and prices to wages will find very different response rates depending on such numbers. Wide variance also exists in cash income sources, the role of food production, the role of cash crops, and other characteristics. Although our emphasis is on low-income countries, there is enough variance in individual country results to be suspicious of generalizations based on individual country data.

Nonetheless, some strong patterns emerge. For example, cash income from food sales is much greater than income from cash crop sales. Poor rural households earn a much greater share of their income from food sales and agricultural wages than do rich rural households. Countries that have a large share of landless rural households tend to generate more of their income from wages. And the association of rural with agricultural might be misleading: more than 10 percent of urban households can be classified as agricultural households, and earn about 12 percent of their income from agriculture, while about 30 percent of rural households are not agricultural households. Last and most important: though in many respects it makes a big difference which definition of agricultural household is used, agricultural households are much poorer than non-agricultural ones no matter which definition is used.

These results suggest a series of policy caveats. Any policy intervention that transfers income from agricultural households to others would end up transferring income from a poorer to richer set of households. Food production needs to be supported both for food security at the household level and as a mechanism to increase the commercialization of agriculture and increase cash incomes of poor households. Finally, wage incomes are important, but direct employment in the agricultural sector seems to be much less important than the employment resulting from derived demand through consumption and production spillovers from agricultural to non-agricultural rural households.

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APPENDIX: DATA SOURCES AND DEFINITION OF INCOME SOURCES

Data sources

This study uses household data from 15 low-income countries to estimate detailed income sources and expenditure patterns. The surveys for nine of these countries were analyzed by the World Bank and six are from the RIGA database of FAO. Data for Ecuador, Ghana, Guatemala Malawi, Nepal, and Pakistan come from the RIGA database of FAO. The rest are from the World Bank. Information about the RIGA database can be found at http://www.fao.org/es/esa/riga. The details of each survey are presented below.

The **Bangladesh** data come from the 2000 Household Income and Expenditure Survey (HIES) of Bangladesh, conducted by the Bangladesh Bureau of Statistics. The survey covers 7,440 households (5,040 rural) selected through a stratified two-stage sample design and interviewed over the course of 2000. Survey data are representative at the national, urban, and rural levels in every region and include detailed data on household composition, income sources, consumption, land holdings, assets, and agricultural activities. Data from the survey are used to measure living standards, estimate budget shares for the Consumer Price Index, and update the System of National Accounts.

The data for **Bolivia** come from the 2002 Bolivian Labor Force Survey. The survey was administered by Bolivia's National Statistics Institute (Instituto Nacional de Estadística) and was part of a World Bank initiative in the region that started in 1999 to improve the surveys and measurement of living conditions (Programa de Mejoramiento de las Encuestas y Medición sobre Condiciones de Vida, MECOVI). The field work took place during November and December. The survey includes information on members of the household, non-labor migration, health, education, employment, income, consumption expenses, consumption, house, household assets and liabilities, and the business of the independent farming producer.

For **Cambodia**, data from the Cambodia Socioeconomic Survey (CSES) 1999 are used. This survey was conducted by the Cambodian National Institute of Statistics in two rounds to take into account the effect of seasonality on consumption and income, especially for rural households. Specifically, the sample was split into two sub-samples, with households in one sub-sample interviewed in January–March and the second sub-sample interviewed in June–August (Gibson 1999). The survey includes 6,000 households and is representative at the national, rural, and urban levels. It is the first attempt to collect detailed information on household incomes in Cambodia. The survey includes a core household questionnaire with information on expenditure, household composition, education, health, etc. and a special-purpose module that contains information about employment and income.

The **Ecuador** data come from the Encuesta de Condiciones de Vida, carried out in 1995–96. Following the standard Living Standards Measurement Study (LSMS) survey structure, it contains detailed information on income and consumption and both individual and dwelling characteristics. A two-stage sampling design was used for the self-representing cities and a three-stage sampling design was applied to the rest of the urban domains and to rural areas. A total of 2,532 rural households and 3,278 urban households were interviewed to create a nationally representative sample.

The data for **Ethiopia** come from two household surveys: the 1999/2000 Welfare Monitoring Survey and the 1999/2000 Household Income, Consumption, and Expenditure Survey (HICES). The HICES includes information on household composition, education, household consumption and expenditures, and household income. Both surveys are nationally representative at the regional level. They use a stratified two-stage sample design (three-stage for some areas).

The 1998 **Ghana** Living Standards Survey served as the data source for this country. Conducted from April 1998 through March 1999, the nationally representative survey interviewed 3,799 rural households and 2,199 urban households based on a multi-stage stratified sampling procedure. The survey collected information on income and consumption and individual and household characteristics, following the LSMS structure.

Data for **Guatemala** come from the nationally representative 2000 Encuesta de Condiciones de Vida (ENCOVI). The sample was drawn using a two-stage stratified sampling procedure using the 1998 Encuesta de Ingresos y Gastos Familiares as the source for the primary sampling units. The total sample of interviewed households was 7,276 (3,852 rural and 3,424 urban households). As a standard LSMS survey, detailed information was obtained on income, expenditures, and household and individual characteristics.

The **Madagascar** data come from the *Enquete Prioritaire Aupres des Menages*, undertaken by the Direction des Statistiques des Ménages of the Institut National de la Statistique during the last quarter of 2001. The survey sample consists of 5,080 households, is multi-staged, stratified, and representative at the national and regional level (*faritany*) as well as the urban/rural level within each region. It includes data on income, consumption, household characteristics, and individual characteristics.

The data for **Malawi** were obtained from the 2004 Malawi Integrated Household Survey (IHS-2). The sample for the IHS-2 was drawn using a two-stage stratified sampling procedure from a sample frame using the 1998 Population Census. The nationally representative survey collected data for 11,280 households on income, consumption, dwelling characteristics, and individual characteristics.

The **Nepal** Living Standards Survey II was administered from April 2003 to April 2004 as a follow up to the first NLSS of 1995/96. A two-stage stratified sample procedure was used to select the sample frame which was drawn from the 2001 Population Census of Nepal. A total of 1,164 urban households and 2,748 rural households were interviewed for the survey, which contains the standard LSMS survey information, including data on income, consumption, dwelling characteristics, and individual characteristics.

The 2001 **Nicaraguan** Living Standards Monitoring Survey (*Encuesta Nacional de Hogares sobre Medición Del Nivel de Vida, 2001)* is used for the Nicaragua data. 4,191 households were surveyed by the Nicaraguan National Institute for Statistics and Census (Instituto Nacional de Estadísticas y Censos) between April and August 2001. The sample is designed to be a panel with the 1998 survey collection. The survey includes detailed data on education, health, economic activity, housing, consumption, household enterprise, and agro-pastoral activities.

Data for **Pakistan** were obtained from the Pakistan Integrated Household Survey for 2001/2002. This survey, which collected detailed income and expenditure information in addition to other descriptive data on individual and dwelling characteristics, was drawn from a two-stage stratified sample. A total of 10,233 rural households and 5,949 urban households were interviewed for this nationally representative survey.

The **Peruvian** data come from the Living Conditions and Welfare Household Survey of 2003. The sample is nationally representative, stratified, and multi-staged. The field work took place between May 2003 and April 2004. The survey includes information on household composition, education, health, employment, household income, agricultural activity, household consumption, and expenditures. The reference periods are the day of the interview, last 15 days, last month, and last 12 months.

The **Vietnam** data come from the Vietnam Living Standards Survey (VLSS) for 1998. For this survey, 6,001 households were surveyed by the Vietnamese General Statistics Office between December 1997 and December 1998. The survey is stratified, multi-staged, and clustered. The sample includes a panel with the 1993 VLSS. The survey includes detailed data on household composition, education, employment, expenditure, land holdings, and agricultural activities.

The data for **Zambia** come from the 1998 Living Conditions Monitoring Survey produced by Zambia's Central Statistical Office (CSO). 16,710 households were surveyed by CSO; and the data collection took place in November and December 1998. The survey is nationally representative, stratified, and multi-staged. It includes data on household income, agricultural production, non-farm activities, economic activities, expenditures, household assets, household characteristics (demographics), health, and education.

Definition of income sources

Total household income is generated from eight major categories:

- net agricultural wage income;
- net non-agricultural wage income;
- gross business income;
- gross food crop income;
- gross cash crop income
- gross livestock income;
- subsistence income; and
- other income (transfers and other non-labor income).

Business income refers to the output generated from non-farm enterprises as well as from sales of crop by-products. Agricultural income (food crop, cash crop, and livestock) refers to the value of production from those activities. Subsistence income is the consumption of household-produced food items, as reported in the food expenditure module of the surveys.

Other aggregate categories constructed for the analysis in this chapter are (1) gross agricultural income, as the sum of food crop, cash crop, and livestock income; (2) net agricultural income, as the sum of food crop, cash crop, and livestock income minus subsistence income; and (3) total wage income, as the sum of agricultural and non-agricultural wage income.

The surveys coming from the RIGA project (Ecuador, Guatemala, Ghana, Malawi, Nepal, and Pakistan) apply slightly different definitions from those established above for certain income activities: business income is net rather than gross, and whereas the non-RIGA surveys define gross livestock income as the value of livestock production, the RIGA surveys define gross livestock income as the sum of the returns from livestock sales, livestock rented out, and livestock by-products sold. These definitional differences arise from structural differences between the RIGA project and the nine non-RIGA surveys in this chapter, the data framework for which was originally constructed for Hoekman and Olarreaga (2006). The RIGA team attempted to harmonize its methodology with that of the non-RIGA surveys, using existing variables in the RIGA database as often as possible, and seeking to minimize as much as possible the departures from the RIGA methodology.[82]

[82] Details on the RIGA project and its methodology can be found on the website of the project: www.fao.org/es/esa/riga

5

Are Low Food Prices Pro-Poor? Net Food Buyers and Sellers in Low-Income Countries[83]

M. ATAMAN AKSOY AND AYLIN ISIK-DIKMELIK[84]

Many countries have implemented trade and other policies to reverse (or slow) the recent increase in food prices, fearing the negative effect of the increase on the welfare of poor households. The policies used—including the elimination and reduction of import tariffs, export taxes and bans, and other instruments—further distort agricultural policies in industrial and developing countries. Thus, issues relating to the impact of higher food prices on the poor, which were already being discussed under the Doha round of trade negotiations, have become more important and urgent.[85] This chapter examines the common perception that lower food prices are pro-poor, by analyzing the characteristics of net food sellers and buyers in nine low-income countries.

ISSUES AND BACKGROUND

There has been broad agreement that high food prices are bad for the poor because most of the poor are net food buyers, even in rural areas (Ravallion 1989; Seshan and Umali-Deininger 2007; Byerlee, Myers, and Jayne 2006; Ivanic and Martin 2008).[86] Simulations also show that in many countries the first-round ef-

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[85] Further, a significant number of poor countries are net food importers and it is assumed that higher food prices would hurt them.

[86] Although Ravallion (1989) points out that if secondary effects of rice price increases are taken into account through labor markets, they could lead to higher incomes for the poorest after three to four years.

fects of a food price increase could hurt the poor (Hoekman and Olarreaga 2007; Ivanic and Martin 2008).[87]

Of the few studies that estimate the numbers of net food buyers and sellers and their incomes, most have shown that more poor households are net food buyers than sellers. For instance, a recent study by Christiaensen and Demery (2007) analyzed producers of staple crops in rural areas of four African countries and found that even where agriculture was the dominant activity, net buyers of food far outnumbered net sellers; this relationship held in all income quintiles and even among the poorest. Jayne and others (2001) showed that Kenyan net sellers of maize had higher incomes, were more concentrated, and were fewer in number than net buyers. Several other studies have shown that even among the poor, there are more net food buyers than sellers (Coady and others 2008; Seshan and Umali-Deininger 2007; Byerlee, Myers, and Jayne 2006; Warr 2005). Thus it seems safe to conclude that net food buyers, whether rich or poor, are much more numerous than net food sellers.[88]

A different strand of work argues that in developing countries the incidence of poverty is much higher in rural areas and that at least until recently this poverty has been partly driven by low and declining food prices. Especially in low-income countries, heavy taxation of agriculture through lower commodity prices might have contributed to extensive rural poverty (Schiff and Valdes 1992; World Bank 1986, 2003). Further, there is increasing evidence that the core poverty in developing countries is rural (World Bank 2007, 2009), and that net food sellers are very poor as well. These findings imply that a rise in food prices might reduce the extensive poverty in rural areas and among the poor food sellers.

Other studies have emphasized the links between net food buyers and sellers in rural areas and pointed to the income multipliers between agricultural and rural non-farm incomes. A large body of evidence correlates higher agricultural incomes with higher non-farm activity and incomes (see Haggblade, Hazel, and Dorosh 2007, for an extensive survey). In many low-income countries where food production is the dominant rural activity, most of the agricultural households might be net food sellers while rural non-farm households might be net food buyers. Thus, when a food price increase raises the incomes of food-producing households it might also raise the incomes of non-food-producing households through multiplier effects, even though the non-food producers now have to spend more on food.

Obviously, lowering food prices would help the poor to consume more food. But this advantage must be weighed against lower agricultural, and possibly lower rural, incomes—which would reduce food security and transfer income from

[87] Some recent studies have also emphasized the heterogeneity of net sales positions and the welfare impact of trade liberalization on the entire income distribution of poor rural households, rather than focusing more narrowly on the poverty index (see Ravallion 2006; Ravallion and Lokshin 2004; Coady and others 2008).

[88] In a sense, this is an obvious result and is part of the development process. As countries develop and agriculture becomes more productive, the number of agricultural producers shrinks, and the number and share of households who are net buyers of food increase (Schultz 1978; Hayami 2005).

(poorer) rural to (richer) urban areas. Which of the two effects predominates is an empirical question whose answer probably varies across countries and regions, depending on the income levels and income sources of the net-food-buying and -selling households.

This chapter analyzes the characteristics of net food buyers and sellers in nine low-income countries to test the common perception that lower food prices could favor the poor. After describing the analytical framework, we examine the key features of food buyers and sellers, looking at variations between rich and poor and rural and urban households, and assessing which groups of buyers are most vulnerable to the first-round effects of food price increases. Our findings raise questions about the common presumption that food price increases would hurt the poor: while more households would lose from food price increases (because net food buyers outnumber net food sellers), the losing households are on average richer than the households who gain. On average, only 8 percent of all households in the sample countries have income and food-buying characteristics that make them seriously vulnerable to food price increases. But three out of the nine countries have groups of vulnerable households who would need to be taken care of if food price increases are large and long lasting.

We then look in more detail at food buyers in rural areas, recognizing that an important dimension in measuring the full impact of food-price changes is the relationships between rural net buyers and sellers. Half of the net food buyers in rural areas are not farmers but providers of goods and services for agriculture as well as more diverse rural services. Their incomes are likely to depend at least partly on the expenditures of food sellers. A fall in food prices that lowers the incomes of net food sellers could in turn reduce the sellers' demand for labor and services provided by net-food-buyer households. This effect on the incomes of net-buyer households might outweigh the effect on their consumption from cheaper food prices. If this happens, lower food prices might reduce, instead of increasing, the real incomes of net food buyers in rural areas. The concluding section of the chapter summarizes our findings and traces the implications for policy.

DATA AND ANALYTICAL FRAMEWORK

This study uses household income and expenditure data from nine low-income countries to estimate detailed income sources and expenditure patterns for net-food-buyer and -seller households (see the data description in the appendix to this chapter). The countries studied are geographically diverse, with three in Asia (Bangladesh, Cambodia, and Vietnam) three in Latin America (Bolivia, Nicaragua, and Peru), and three in Africa (Ethiopia, Madagascar, and Zambia).[89] All nine are

[89] The selection criterion was the availability and reliability of agricultural income data in the household surveys. The work started with 15 low-income countries but six of them had to be dropped for lack of detailed agricultural information. In most countries, surveys were undertaken over a year so that seasonality in food purchases and sales is minimized. Survey details are presented in the appendix to this chapter.

poor within the context of their continents (1998 PPP-adjusted per capita incomes vary between US$ 566 for Ethiopia and US$ 4,180 for Peru), and the household surveys were carried out between 1998 and 2003. All these countries have significant rural populations, Peru being the most urban and Bangladesh the most rural.[90]

We define net buyers (sellers) as the households whose purchases (sales) of defined food products are greater than their sales (purchases) of similar products.[91] Data on household spending on food are obtained from the expenditure modules of the household surveys, while data on sales are drawn from the income modules of the surveys. In most of the surveys the expenditure and income levels are not identical, but in all the surveys expenditures are believed to be more carefully measured than incomes, and are reported in more detail.

We use two definitions of food to link the international trade dimension with the agricultural policy dimension of food and to make our results more relevant for poverty assessment. In trade analyses and trade negotiations, tariff and subsidy decisions are made at the detailed commodity level. Most of the food policy debates in developing countries are also undertaken at the level of individual basic staples such as rice or wheat. But for poverty analyses a focus on individual commodities is less useful, because of the high degree of substitutability among different food groups in consumption and (somewhat less so) in production. Having hundreds of individual food products makes it very difficult to measure impacts and even to identify net buyers and sellers of food. To balance these conflicting analytical needs, we define food as comprising those of the main staples in each country that are also staples in international trade (rice, wheat, etc.). This approach allows the definition of food to partially link the literature on trade and agricultural policy with that on food security and poverty concerns. For the definition of staple crops used in text tables to define net sellers and net buyers, see the appendix to this chapter.

We also use a second definition, derived from data on total expenditures on food and total sales of food; the results using this definition are presented in the appendix to this chapter.[92] These tables can be used to highlight food security issues.

To measure the potential impact of food price changes on overall welfare, urban populations need to be considered, so both rural and urban households are analyzed in this study.[93] Though many of the earlier studies of food sellers and buy-

[90] The definitions of rural and urban differ among countries. That is why the information is presented separately for national averages in addition to rural and urban.

[91] Of course, for modeling and simulations, the whole distribution of food buyers and sellers should be used. But for the purposes of this chapter, discrete variables are necessary to show the shares of different groups.

[92] In the expenditure module of the surveys the food items listed are much more numerous than in the income module. Furthermore, sales and purchases of major staples are better recorded. Thus the results from using the all-food definition probably overstate net food purchases. That is why we have chosen to present them in the appendix rather than the main text.

[93] There are some problems in using urban data along with rural. Of the nine sample countries only five—Bangladesh, Bolivia, Madagascar, Nicaragua, and Vietnam—have separate regional deflators. For countries without these deflators, the income levels of rural households may be biased downwards, if the cost of living is lower in rural areas.

ers have been limited to rural households, changes in the relative price of food will alter the income distribution between rural and urban households, as well as between net sellers and buyers within rural areas. Since, on average, urban households are richer than rural households and are predominantly net food buyers, increases in food prices could be pro-poor. In addition, even in urban areas in low-income countries, a significant part of household income originates in agricultural activities, and there are net food sellers in urban areas as well.

A final consideration in defining net food sellers and buyers is our choice of a single period to classify households as net food sellers or buyers, as is typical of earlier studies. It is not uncommon for rural households to shift their status from net buying to net selling from year to year, depending on crop yields, crop prices, cropping patterns, etc., and a point estimate of net buyers and net sellers might not capture this dynamic. (Urban households would be expected to be mostly net buyers with little opportunity to become net sellers unless they are directly engaged in agricultural production.) Unfortunately, a lack of consistent panel data makes such year-to-year shifts difficult to estimate. Vietnam is one of the few countries where consistent panel data are available, and Isik-Dikmelik (2006) and Aksoy, Beverinotti, Isik-Dikmelik in Chapter 8 in this volume have shown that between 1993 and 1998 almost 21 percent of all households switched between being net sellers and net buyers of food.[94] These are very large shifts within a five-year period and one in which food output increased significantly. The results for Vietnam raise caution that designating households as food net buyers or net sellers even within a given period could be misleading. Thus, one needs to be careful interpreting the data presented here and in other studies on this subject, and to give close attention to panel data where available.

FINDINGS: CHARACTERISTICS OF NET SELLERS AND BUYERS OF FOOD

Share of households who are net sellers and buyers of food

The proportion of households who are net food sellers in rural and urban areas in the nine low-income countries is given in Table 5.1 for the main-staples definition of food. (Table A5.2 gives the same information for the definition that includes all foods, and shows that 25 percent of all households and 35 percent of rural households are net food sellers.)

[94] They also found that 15 percent of net-food-buying households (8.7 percent of all households) shifted to being net sellers and 29 percent of net selling households (12.2 percent of all households) shifted to being net buyers. In rural areas, the shifts were even larger: 21 percent of rural net–food-buyer households in 1993 became net food sellers in 1998 and 29 percent of rural net seller households became net food buying households. Not all the households who switched from net buyers to sellers were marginal buyers. Of the net buyer households whose net purchases were more than 10 percent of their expenditures, 15 percent switched from net buyer to net seller. The pattern was similar in the case of net sellers.

Table 5.1: *Net food seller households as percentage of all households*[a]

Country, Date of HH Survey	GDP Per Capita (PPP) 1998	Percent Rural	Percent of Households[b]		
			Urban	Rural	All
Ethiopia, 2000	566	50.74	6.32	27.26	23.07
Zambia, 1998	678	47.76	2.75	29.56	19.10
Cambodia, 1999	1246	59.99	15.13	43.84	39.58
Bangladesh, 2000	1407	79.73	3.68	22.94	19.04
Vietnam, 1998	1689	71.16	6.55	48.22	38.08
Madagascar, 2001	1741	75.75	13.17	37.64	31.71
Nicaragua, 2001	1896	43.88	3.77	38.67	17.26
Bolivia, 2002	2205	41.98	1.23	24.61	9.97
Peru, 2003	4180	35.86	2.89	15.47	6.73
Unweighted Average	1734.2	56.32	6.17	32.02	22.73

[a] Food is defined as the main staple crops in each country (see Table A5.1).
[b] Share of urban, rural, and national households respectively.

We find that on average only 23 percent of all households and 32 percent of rural households are net food sellers.[95] As expected, the share of households who are net sellers tends to increase with the share of rural households. Even in rural areas, however, the majority of households are net food buyers in each of the sample countries. This is especially the case in the two Latin American countries Bolivia and Peru, whose rural populations are relatively small; in those two countries, net food buyers constitute more than 80 percent of all households. Even in Bangladesh and Zambia, both of which are much more rural, a large proportion of all households are net buyers.

The countries where net sellers make up the largest proportions of total households are Cambodia, Vietnam, and Madagascar, but even in these countries they constitute only about a third of households.

Given that net food sellers constitute the minority of households, a related question is whether they are predominantly rich or poor. The general presumption has been that they are relatively well-to-do households with larger farms, while the net buyers are poor laborers or small farmers.

To examine this presumption we distinguish rich households from poor. The poor are defined as households in the lowest four deciles of the national income distribution (per capita income is proxied by per capita total household expenditures), and the rich are defined as households in the top two deciles of the income distribution.[96] Table 5.2 shows the proportions of net seller households in the top 20 percent and in the lowest 40 percent of the national income distribution.

[95] It is interesting to note that in Cambodia and Madagascar more than 10 percent of urban households are net food sellers.

[96] Another way to distinguish rich and the poor is to use a universal yardstick such as a dollar a day of income. Since the PPP per capita incomes vary significantly among the sample countries, we preferred to use the relative poverty measures for each country.

Table 5.2: *Percentage of net food-seller households who are rich and poor*[a]

	National		Rural		Urban	
	Poor[b]	Rich[c]	Poor	Rich	Poor	Rich
Ethiopia	21.78	23.32	24.34	31.36	6.0	7.2
Zambia	23.89	12.98	28.08	29.05	2.7	2.7
Cambodia	43.73	21.66	45.41	30.68	23.1	8.5
Bangladesh	13.46	19.90	14.71	33.63	0.3	3.5
Vietnam	43.33	12.44	45.38	36.86	12.2	2.2
Madagascar	41.02	13.95	42.72	22.65	28.2	3.6
Nicaragua	27.25	8.64	39.35	32.26	7.5	1.6
Bolivia	17.02	3.90	27.11	19.01	1.4	0.8
Peru	11.92	1.85	15.51	17.53	6.2	1.1
Unweighted Average	27.04	13.18	31.40	28.12	9.74	3.46

[a] Food is defined as main staple crops.
[b] Poor households are those in the bottom 40 percent of the population by per capita income.
[c] Rich households are those in the top 20 percent of the population by per capita income.

In most of the countries individually, poor households are more likely than rich ones to be net sellers, but the differences among the two income groups are not large, indicating that net sellers are distributed reasonably equally across the income distribution. On average across the sample countries, about 27 percent of poor households versus about 13 percent of rich households are net food sellers. Only in Cambodia are more than a fifth of rich households net food sellers, and this share shrinks to 2 percent in Peru.

In rural areas, the picture is similar: only about a third of the poor households and fewer than a third of the rich households are net food sellers[97], and the great majority of the rich are net food buyers. Thus, Table 5.2 shows that the category of the rural rich is not dominated by food sellers.

Could the mean values be dominated by a few households who have either very high or very low incomes? To see whether these outliers are present, we look at the distribution of buyer and seller households across the income deciles. Our data show that net buyer (or seller) households are distributed heterogeneously across income deciles (see Figures A5.1 and A5.2 for results at the national level and for rural areas respectively). In most countries, the share of net sellers is biggest among the poor and gradually declines as household income rises. At higher incomes, most of the households are net food buyers. These results hold at both the national level and in rural areas.[98]

Given that in Vietnam we observe that people commonly switch between net food selling and buying, the point estimates of net food sellers might be misleading. The number of households who produce and sell staple food crops might give some indication of the potential for households to shift from one status to another.

[97] The similarity of rural and national distributions of households indicates that the absence of regional deflators in some countries might not be a very serious problem.

[98] For urban areas, the number of observations on net sellers is insufficient for similar analysis by income level.

Table 5.3 shows the importance of staple food crop production and sales. On average, almost 45 percent of all households in the sample countries produce staple food crops and almost 30 percent sell some staples. In rural areas, these numbers are much higher, with about 64 percent of households producing staple food crops and 42 percent selling them. Even in urban areas, close to 15 percent of households produce staple food crops and 8 percent sell them.[99] Thus slight changes in crop yields, prices, or production could change the shares of net food sellers and buyers, especially in rural areas. Further, given data problems in measuring food sales and purchases, the number of sellers and buyers might change significantly. These results also show why the large shifts between net sellers and buyers observed in Vietnam might not be unusual.

Table 5.3: *Percentage of households who produce and sell staple food crops*

	Production of Food[a]			Sales of Food[b]		
	Urban	Rural	All	Urban	Rural	All
Ethiopia	9.34	71.46	55.37	4.70	36.86	28.52
Zambia	12.93	69.47	47.48	7.40	42.47	28.83
Cambodia	34.50	78.58	72.03	22.65	53.77	49.15
Bangladesh	8.75	51.64	42.94	5.38	33.49	27.79
Vietnam	11.50	81.30	64.30	8.31	54.33	43.12
Madagascar	28.93	75.67	64.36	14.61	41.67	35.10
Nicaragua	11.14	58.43	29.42	5.34	54.25	24.24
Bolivia	5.12	36.53	16.86	1.65	32.84	13.31
Peru	6.63	52.50	20.63	4.45	25.89	10.99
Unweighted Average	14.31	63.95	45.93	8.28	41.73	29.01

[a] Percent of households with positive food production.
[b] Percent of households with positive food sales.

Assessing vulnerability: marginal and significant food buyers

The definition of net food buyers and sellers used here and in other studies does not discriminate between marginal and significant food buyers, i.e. food buyers whose net purchases take only a small portion of their incomes (as measured by expenditure) versus buyers whose food purchases take a significant share of their incomes. Households in this latter category are vulnerable to large price shocks. Marginal food buyers could be rich households for whom food purchases constitute a small share of income and who are not vulnerable, or they could be households who are close to being self-sufficient and purchase only small amounts of food.

Since we are interested in the poverty impact of food price changes, a more important group to focus on would be households who spend a significant share of their income on food and thus are vulnerable to increases in food prices. Thus we

[99] If the total foods definition is used (Table A5.3), then almost 70 percent of households produce some food and 50 percent sell some food. This shows the importance of food production and sales for households in low-income countries.

look below in greater detail at vulnerable net food buyers, and at the income sources of these vulnerable net food buyers and sellers in rural areas.

Staple crops are used as our basic definition of food, and the impact of price increases for staple foods will depend on the share of the staples in the food basket as well as the share of overall food in the household's consumption basket.[100] In countries where staples constitute a major portion of food consumption, the impact of a price change for staples will be more significant than where households have multiple food sources.

To measure vulnerability, households' net purchases of food staples are expressed as a percentage of their total expenditures (as a proxy for their income). For simplicity, we define two groups of net food buyers. Marginal net food buyers are households who use less than 10 percent of their total expenditures for food staples.[101] Vulnerable households are defined as households who use more than 30 percent of their total expenditure for food staples. Table 5.4 shows the share of households in each buyer category as a percentage of all and of rural and urban households.

Table 5.4: *Intensity of net food purchases among net-food-buyer households[a] (percent of households)*

	Marginal Food Buyers[b]			Vulnerable Food Buyers[c]		
	Urban	Rural	All	Urban	Rural	All
Ethiopia	39.0	18.0	22.2	12.4	20.0	18.5
Zambia	58.1	18.5	40.3	8.0	10.8	12.5
Cambodia	40.9	22.1	25.0	4.9	3.8	4.0
Bangladesh	28.2	11.6	14.9	9.6	22.1	19.6
Vietnam	39.4	22.0	26.3	3.4	4.4	4.2
Madagascar	44.7	20.0	26.2	0.1	0.6	0.5
Nicaragua	89.1	40.3	69.8	0.3	2.0	1.0
Bolivia	95.0	63.9	86.1	0.2	0.1	0.2
Peru	61.0	49.2	57.5	0.0	0.0	0.0
Unweighted Average	55.0	29.5	40.9	4.2	9.2	7.9

a Food is defined as staple foods.
b Households with net food purchases less than 10 percent of expenditures.
c Households with net food purchases greater than 30 percent of expenditures.

The proportion of households who are marginal net food buyers varies widely among the nine countries: from less than 15 percent of the population in Bangladesh to more than 22 percent in Ethiopia, and to more than 86 percent in Bolivia (Table 5.4). On average, about 41 percent of all households are marginal food buyers. Combined with the fact that, on average, 77 percent of the house-

[100] We thank E. Sadoulet for pointing this out. See Box 4.7 in *World Development Report 2008* (World Bank, 2007), which presents the share of staple foods in food consumption of the poor households in these countries and was derived using this database.

[101] Here we use a cutoff point of 10 percent, but other cutoff points less than 10 percent do not change the picture across countries.

holds are net food buyers, this means that more than half of net food buyers spend less than 10 percent of their income on staple commodities. For those households, the impact of staple food price changes will be small.

Among vulnerable food buyers, however, an increase in food prices of 10-20 percent will have significant impacts; in the absence of second-order adjustments, it will lower their real incomes by more than 3-6 percent. On average, only 8 percent of households in the sample countries are vulnerable food buyers. In six of the nine countries, vulnerable households are a very small percentage of all households, and assisting them could be easier than assisting a larger population. The highest vulnerability rates are in Ethiopia and Bangladesh, in both of which about 19 percent of households fall in the vulnerable group; both these countries have large food aid programs where a portion of food is imported from other countries. Zambia, with 13 percent of its households in the vulnerable group, comes a distant third. By contrast, other poor countries such as Cambodia, Vietnam, and the two Latin American countries have very small vulnerable populations. Thus vulnerability is low in countries where incomes are higher, such as the two Latin American countries, and in countries where the proportion of net food buyers is small, such as Cambodia and Vietnam.[102]

Looking separately at urban and rural areas, we find that in all the sample countries except Ethiopia, less than 10 percent of the urban population falls in the vulnerable group. In rural areas, vulnerable households constitute a larger proportion of households. Again, Ethiopia, Bangladesh, and Zambia are the countries with the largest proportions of vulnerable households, who will be significantly affected by food price changes.

Relative incomes of net sellers and buyers

Are net food sellers poorer than net food buyers? Using expenditure as a proxy for income, Table 5.5 shows that this is the case in all the sample countries except Bangladesh.[103] In Vietnam, while net sellers are poorer, the differences are statistically significant only at the 90 percent level.

Other things equal, a rise in food prices would transfer income from food buyers to sellers and thereby on average from richer to poorer households. In this sense, the impact of higher food prices can be interpreted as pro-poor. Protection of food crops would have the same first-round effect—that is, it would transfer income from a relatively richer group to a relatively poorer one.

[102] The proportions of households who are vulnerable are much higher under the all-foods definition, as shown in Table A5.5: in four countries, more than 50 percent of all households are classified as vulnerable, and on average almost 45 percent of all households are vulnerable. Thus, price increases for all food products simultaneously will have a very adverse effect on the welfare of a significant section of the households in these countries. On the other hand, there is some validity in thinking that a part of this high number is a statistical artifact, created by the low coverage of income from other food sales.

[103] Expenditures have been used in the income comparisons because they are more accurately measured.

Table 5.5: *Ratio of average expenditures of net sellers and net buyers*

	National			Rural		
	All	Poor	Rich	All	Poor	Rich
Ethiopia	0.91**	1.01	0.82***	0.99	1.03	1.02
Zambia	0.75***	0.91**	0.95	0.97	0.97	0.91
Cambodia	0.78***	1.1***	0.66***	0.97***	1.1***	0.8**
Bangladesh	1.25***	1.34***	1.10	1.49***	1.36***	1.27***
Vietnam	0.95*	1.16***	1.04	1.11***	1.16***	1.02
Madagascar	0.72***	1.24***	0.83	0.79	1.29***	0.88
Nicaragua	0.72***	0.88***	0.7***	1.07	1.02	1.05
Bolivia	0.74***	1.00	0.84	0.98	1.06**	1.00
Peru	0.70***	1.18***	0.68***	1.26***	1.28	1.06
Unweighted Average	0.84	1.09	0.85	1.07	1.14	1.00

Notes: Unweighted average is calculated as the average expenditure of seller households divided by the average expenditure of buyer households. The significance tests in the table are the tests of difference of mean expenditure of the two groups.
* Significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

Part of the likely impact of food price increases would be to transfer income from urban to rural areas. Since rural incomes are on average lower than urban, these transfers would be on average from richer to poorer households.[104]

Within rural areas, we find that the picture is mixed[105], and the basic presumption that net food buyers are the poorer households is not correct for six out of nine countries. Rural net food sellers have higher average incomes (as measured by expenditure) than rural net buyers in three of the nine countries (Bangladesh, Peru, and Vietnam). In rural Cambodia, by contrast, net food sellers are poorer than net buyers, and in the other five countries, the difference in mean incomes of the two groups is not statistically significant.

A second question is whether these relationships hold separately for rich and poor households. Again, we define rich and poor as households in the top two and bottom four deciles of the national income distribution respectively. Among poor households in five of the nine countries, net-food-seller households have higher incomes than net buyers; in two countries the reverse is true; and in the remaining two countries the incomes of the two groups of households are not statistically different. This pattern is similar among the rural poor as well. So, among the poor households, net buyers are poorer, and the price increases would hurt the poorer of the two groups. Among the rich households, net sellers are poorer in four countries and there is no statistically significant difference in five countries.

These findings raise questions about the general conclusion that food price increases would hurt the poor. While more households would lose from food price

[104] This may be disputed because the difference might be attributed to the absence of regional deflators, but income differences are still significant in half of the countries in the sample where there are separate deflators for rural and urban households.

[105] The number of urban net staple food seller households is quite limited and the samples are not representative. That is why they are not presented separately.

increases (because net food buyers outnumber net food sellers), the losing households are on average richer than the households who gain. Food price declines would transfer income from food sellers to relatively better off net food buyers. Richer households would be the greatest beneficiaries of the food price declines, because more of the rich households than of the poor households are net buyers (see Table 5.2 above).

Finally, it should be stressed that one might reach very different conclusions by selecting different household groups for comparison. Table 5.5 shows that the relative incomes of net food buyers and sellers differ quite widely, depending on which group of households (rich/poor; rural/urban) is selected for comparison. Thus future studies need to be very precise about which groups to compare and why. Our preference in this chapter thus far has been to rely on national-level comparisons, because food price increases affect all groups and lead to redistribution of income and adjustments for both rural and urban households.

In the following section, we focus on rural households, because the output adjustment to a food price change will mainly take place in rural areas and also because poverty is extensive in these areas.

NET FOOD BUYERS IN RURAL AREAS: A MORE DETAILED LOOK

As mentioned above, an important dimension in measuring the full impact of food price changes is the relationships between net buyers and sellers in rural areas. Studies that focus on the first-round effects of food price changes generally assume that the incomes of buyers and sellers are independent of each other (as is done in the case studies in Hoekman and Olarreaga, 2007). Nonetheless, in rural areas and even in small towns, many non-farm jobs depend on links with farm activities. Non-agricultural households supply agricultural inputs and consumer goods to the agriculturalists; and more importantly they supply diverse services to the rural (and more specifically agricultural) community.[106] The literature shows that these local linkages and multipliers are important (Mellor 1976; Haggblade and Hazell 1989; Delgado and others 1998; Block 1999; Datt and Ravallion 1998; Rock 2002; Foster and Rosenzweig 2004; also see Haggblade, Hazel, and Dorosh 2007 for an extensive survey). In rural areas where there is little cash-crop income and little income independent of farm activity, most of the income of net food buyers might depend on activities related to food production. Net buyers' incomes would be mainly business income earned through supplying services and labor to predominantly food producing households. In such cases, the indirect impact of changes in food prices on the incomes of food-buying rural households—both through labor markets and through consumption and input and output trade linkages—might be stronger than the direct impact on consumption.

[106] Since food is defined as main staples in this study, they might be producing other food crops.

In other cases, the first-round effects of changes in food prices will be dominant. For example, some non-farm jobs might be independent of the rural economy; these would include rural industrial jobs filled only by local workers, and jobs that owe their origin to incomes that originate outside the local area. However, in the rural areas of most low-income countries, such independent manufacturing jobs are few. Within agriculture, an important non-food income source is cash crops. Thus, if the net food buyers receive a significant part of their income directly from cash crops, or from wage income earned from working in cash-crop production, or receive their income from external remittances and transfers, then the income effect of changes in food prices will have little impact on the incomes of the net food buyers.[107]

To observe these broad relationships, we compare the sources of income of net food buyers and sellers in rural areas. We distinguish the following sources: food production (including for subsistence); livestock; cash crops; wages from agriculture and non-agriculture; business; and other.[108] (We distinguish the livestock income because the net staple food buyers might be pastoralists who earn livestock income.) Finally, we use data on the occupation of the household head to roughly separate the households into agricultural and non-agricultural households. Table 5.6 shows the structure of incomes for rural net food buyers and sellers, and also shows the primary sector of activity of the head of household.

Unfortunately, not all information is available in all countries. The breakdown of wage income was not available in Ethiopia and Zambia; business income could not be separated from other income in Madagascar and Cambodia; and the occupation of household heads was not available in Cambodia. In Bangladesh, cash-crop income was very low and was subsumed into income from food in the original data.

Despite the gaps in the data, several features stand out. As expected, the income sources of the net buyers and net sellers are very different. First, only about half of the net buyer households report agriculture (including livestock) as their main occupation, while almost 90 percent of the net-food-seller households do so. Second, for net sellers, crops supply almost 56 percent of incomes (mostly from subsistence production), versus about 26 percent for net buyers.

Third, the hypothesis that rural net food buyers get most of their income from cash-crop production is not correct for this group of countries. Among the rural net food buyers, the share of cash-crop income is about 12 percent in Ethiopia and about 7 percent in Vietnam, and in the other countries it is less than 4 percent.[109] Fourth, labor market income is much more important for net food buyers than sellers: overall wages supply about 29 percent of income for net

[107] Chapter 3 of this volume shows that cash income from food sales is among the largest sources of income in 15 low-income countries and that cash crop sales account for very little.

[108] Ideally this analysis should be carried out at the local community level. It might be possible to undertake such a study in countries with better regional and community level information as a follow up to this study.

[109] It would have been desirable to find out what part of agricultural wages originates in food versus cash crops. Unfortunately, this distinction does not exist in our data sets.

Table 5.6: *Income sources of rural net buyers and sellers*[a] *(staple crops, percent of household income)*

		Food Crops	Animal or Livestock	Cash Crops	Wages	Ag Wages	Other Wages	Business	Other	Percent Household Heads in Agriculture
Ethiopia	Buyers	16.26	22.65	11.86	5.59	–	–	14.80	28.73	57.26
	Sellers	58.86	9.62	6.12	1.53	–	–	5.42	18.46	90.91
Zambia	Buyers	34.97	17.06	3.27	11.33	–	–	23.03	10.34	34.66
	Sellers	58.75	16.96	3.03	1.88	–	–	13.06	6.32	86.70
Cambodia	Buyers	33.57	12.95	2.05	22.10	3.66	18.74	–	29.32	–
	Sellers	62.56	15.97	1.27	7.30	0.02	7.28	–	12.87	–
Bangladesh	Buyers	13.42	–	–	42.61	18.49	24.17	32.51	11.37	46.96
	Sellers	56.19	–	–	12.96	4.17	8.82	22.57	8.04	81.77
Vietnam	Buyers	30.32	12.79	7.37	17.41	7.21	10.20	20.68	11.45	45.85
	Sellers	44.18	16.03	3.60	10.62	3.13	7.49	14.90	10.73	85.06
Madagascar	Buyers	50.80	5.32	7.69	27.63	3.45	24.22	–	8.50	49.32
	Sellers	86.56	2.16	4.87	2.54	0.67	1.86	–	3.88	92.02
Nicaragua	Buyers	11.12	21.90	1.08	47.69	8.65	39.04	14.13	4.04	45.89
	Sellers	49.94	23.32	3.56	18.24	9.35	8.89	0.60	4.34	81.96
Bolivia	Buyers	23.76	15.32	1.26	19.61	5.39	14.22	38.22	1.83	77.78
	Sellers	43.89	16.56	0.54	4.63	0.53	4.10	33.11	1.27	96.79
Peru	Buyers	20.82	20.55	1.39	22.89	3.51	19.38	10.25	24.10	35.53
	Sellers	42.45	14.22	2.33	12.37	1.29	11.08	8.07	20.57	90.13
Unweighted Average	Buyers	26.12	16.07	4.50	24.10[a]	7.19[a]	21.42[a]	17.80	13.68	49.16
	Sellers	55.93	14.36	3.16	8.01[a]	2.74[a]	7.07[a]	11.15	9.31	88.17

[a] The overall average for all wages is calculated using data for all the countries while the overall averages for agricultural wages and "other" wages are calculated using data for only seven countries (for lack of data on Ethiopia and Zambia). Hence, the overall average shares of agricultural and other wages do not add up to the overall average share of all wages.

food-buyer households and only 8 percent for net sellers. Both groups earn the bulk of their wage income outside agriculture. Agricultural wages are important only in Bangladesh and Nicaragua. On average across countries, rural net-food-buyer households earn their incomes primarily from non-agricultural wages and from business income. [110]

Though net sellers can be characterized as stereotypical smallholders and farmers, earning most of their income from food crops coupled with either business or wage income[111], net buyers fall into different subgroups depending on the country and probably the region. Net food buyers have a range of combinations of income sources. For example, in Ethiopia they are cash-crop producers, livestock herders, and business people earning very little wage income. In Bangladesh and Nicaragua, their main source of non-subsistence income is wages, suggesting they have strong labor market interactions. In Vietnam, they rely on live-

[110] These businesses are mostly services. In countries where business income is separated into manufacturing and services, almost all of this income originates in services. This is also true for non-agricultural wages, most of which also originate in services.

[111] If livestock income is added to food-crop income, then the income of net sellers becomes predominantly income from food sources.

stock, cash crops, and wages, and in Peru, livestock and wages. Again, cash-crop income is much more limited nationwide than wage or business income.

Although the links between different types of households are not fully articulated, the partial evidence presented suggests that net buyers are mainly business people and workers who sell their services to the rural community. The absence of significant cash-crop income and, typically, of rural manufacturing activity in low-income countries also suggests that the demand for their services might depend on net food sellers. Thus, it is possible that policies that reduce food prices and the incomes of net food sellers might also reduce the incomes of at least some of the net food buyers through the income effect.

Unfortunately, not enough evidence is available to show the extent and magnitude of the relationships among different types of households. Simulations that use simple relationships focusing mainly on labor markets do not show large second-order effects of price changes. But Klytchnikova and Diop (2006 and Chapter 10 of this volume) and Isik-Dikmelik (2006 and Chapter 9 of this volume), analyzing income changes in Bangladesh and Vietnam after big rice price changes, found that the changes in business incomes of rural households were as large as the changes in agricultural incomes—suggesting that secondary effects through consumption and trade linkages might be as important as the direct effects through agricultural incomes. Bussolo and others (2006 and Chapter 11 of this volume) reached similar findings from observing the impact of coffee price changes on non-coffee producing households in Uganda: in coffee-growing regions the incomes of non-coffee households also increased, probably pushed up by derived demand for their goods and services. But while these findings are illuminating, these data sets do not allow income changes to be precisely attributed to commodity price changes. Our results suggest that the detailed analysis of rural households should be carried out using data specific to rural localities, that might illustrate the links between net food seller and buyer households more precisely.

Finally, these simple statistics give no indication about the degree of substitution among food crops, labor incomes, and agricultural product mix. Porto (2005 and Chapter 7 of this volume) estimates the elasticity with respect to maize price changes of consumption and income in Mexico through a model where the status of the household as either a net seller or net buyer is endogenously determined. Using these full model elasticities, Porto shows that if the household response to a maize price change is large enough, net buyers can become net sellers and gain from maize price increases.

CONCLUSIONS AND POLICY IMPLICATIONS

It has often been argued that higher food prices will hurt the poor (Coady and others 2008; Byerlee, Myers, and Jayne 2006; Christiaensen and Demery 2007; Ivanic and Martin 2008; Warr 2005; Hoekman and Olarreaga 2007). This argument is based on the observation that more of the poor households are net food buyers than sellers and that higher food prices would lower their real incomes and thus worsen their poverty.

Many studies estimating the impact of unilateral trade policies in developing countries and global trade policy reforms have been shaped by this argument. Reducing agricultural protection in developing, especially low-income, countries is said to be pro-poor because lower protection, other things equal, would lower food prices and benefit the poor, who are predominantly net food buyers.

This argument could lead to the extreme conclusion that to benefit the poor, food prices should stay low and that industrial (and some middle-income) countries should continue to subsidize and protect their agricultural sectors—which would contribute to food surpluses and lower prices—while poor developing countries should eliminate or reduce their protection of foodstuffs and import food.

Given the controversies and limited evidence to support both sides and the political problems in advocating the pure "trade" solutions, the literature offers some ad hoc and some more qualified policy recommendations. For example, in analyzing the implications of trade reforms in the case of Morocco, Ravallion and Lokshin (2004) point out the need to find solutions for large pockets of poor cereal producers if unilateral trade reforms are undertaken. In the case of Indonesia, McCulloch and others (forthcoming) view low tariffs on rice as "reasonable" despite the fact that most poor households are net food buyers. In the case of Madagascar, Coady and others (2008) go one step further and show that while tariff reductions for rice can substantially benefit poor net consumers of rice, they could have significant adverse effects on poor net sellers of rice, and provide the biggest gains to the higher-income households.

Based on household surveys from nine countries, the findings in this chapter shed some additional light on this debate. First, although there are more poor net food buyers than sellers, about half the poor net-food-buyer households are *marginal* net food buyers, so food price increases will have only a small effect on their welfare. However, there are pockets of vulnerable households in three out of the nine sample countries that would need to be taken care of if food price increases are large and long lasting.

Second, in eight of the nine countries the average incomes of net food buyers are higher than the average incomes of net food sellers. Thus higher food prices will, on average, transfer income from richer to poorer households, and be pro-poor. If the comparison is made only among poor households, however, net buyers are poorer than net sellers, on average, and the price increases would hurt the poorer of the two poor groups.[112] However, among the rich, the opposite is true: the net food buyers are richer.

Most crucially, what would happen to the incomes of net food buyers in rural areas if the incomes of food producers changed significantly? If the income sources of buyers and sellers are fully independent, then the first-round effects of food price changes presented here and elsewhere will hold. If, on the other hand, the income sources of the two groups are interdependent, then the impact of an income change for the net food sellers might indirectly affect the incomes

[112] Net food buyers are poorer in five countries and richer in only one; a similar pattern holds among the rural poor as well.

of the net food buyers.[113] Half of the net food buyers in rural areas in our sample of nine countries are not farmers. Their incomes come mainly from wages and business and are likely to depend on the expenditures of net food sellers, especially in rural areas where the primary economic activity is food production. Hence, lower food prices could lower the incomes of net food sellers, and in turn reduce the sellers' demand for labor and services supplied by net-food-buyer households. If this effect dominates, lower food prices might reduce, instead of increasing, the real incomes of net food buyers in rural areas.

This chapter has been a first attempt to shed light on some of the characteristics of the net sellers and net buyers. Their different characteristics point to the fact that the impact of food price changes on the poor (or on households in general) will be heterogeneous and will depend on the mixture of net-seller and net-buyer households in the income distribution and on the relationships among their income sources. More detailed data and more studies are needed, to try to measure the distributional impacts of price changes over time, and also to try to capture the second- or third-order effects fully, especially taking into account the potential linkages between household incomes in rural and to some degree in urban areas. We hope this study has raised enough questions to spur more detailed analysis of these issues.

Finally, policies that reduce food prices might help the poor but will also transfer income from rural areas to better-off urban households. There are pressures to adopt policies to try to reverse the recent increases in the profitability of food production. One of the problems faced by food producers in developing countries has been the large support to agriculture within industrial countries, which has led to very low international food prices and reduced the returns to agriculture in places where the main agricultural activity is food production.[114] Thus one has to be careful in designing policies in response to the—possibly temporary—food price increases. Policies that would lower food prices in developing countries could repeat the historical mistake of taxing the rural sector in developing countries. We now understand that such policies have led to the underdevelopment of this sector and contributed to extensive rural poverty.

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[113] See Porto (2005 and Chapter 7 of this volume); using a model that emphasizes second-order agricultural wage effects and substitution in consumption, he shows that poor net food buyers might gain from maize price increases in rural Mexico.

[114] Keeping food prices low to help accelerate industrial growth has also contributed to the taxation of the agricultural sector (Schiff and Valdes 1992). Earlier work highlighted the taxation of export crops through export taxes. The new emphasis on eliminating poverty could end up taxing food crops through lowering their prices below the costs of production.

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APPENDIX: STATISTICAL TABLES AND DATA SOURCES

Table A5.1: *Crops used in the definition of net sellers/buyers of staple crops*

	Staple Crops
Ethiopia	Wheat, Maize
Zambia	Rice, Maize, Groundnut, Beans
Cambodia	Rice, Maize
Bangladesh	Rice
Vietnam	Rice, Maize
Madagascar	Rice, Maize
Nicaragua	Bean, Maize
Bolivia	Rice, Maize,
Peru	Rice ,Maize, Beans

Results using all-food definition of net sellers/buyers

Table A5.2: *Net food seller households as percentage of all households*[a]

	GDP Per Capita (PPP) 1998	Percent Rural	Share of Households[b]		
			Urban	Rural	All
Ethiopia	566	50.74	4.11	53.20	40.55
Zambia	678	47.76	0.52	12.55	7.87
Cambodia	1246	59.99	20.74	57.74	52.25
Bangladesh	1407	79.73	2.30	15.10	12.50
Vietnam	1689	71.16	8.58	57.26	45.39
Madagascar	1741	75.75	17.23	49.12	41.39
Nicaragua	1896	43.88	1.48	18.43	8.03
Bolivia	2205	41.98	0.69	26.52	10.35
Peru	4180	35.86	3.06	28.78	10.91
Unweighted Average	1734.2	56.32	6.52	35.41	25.47

[a] Food is defined as all food products.
[b] Share of urban, rural, and national households.

Table A5.3: *Percentage of net-food-seller households who are poor and rich*[a]

	Poor [b]			Rich [c]		
	Urban	Rural	All	Urban	Rural	All
Ethiopia	5.82	51.45	44.29	2.58	54.68	31.07
Zambia	0.88	12.46	10.55	0.38	11.00	4.54
Cambodia	38.14	63.88	61.94	10.85	37.23	26.51
Bangladesh	0.59	10.66	9.78	2.24	19.74	11.77
Vietnam	13.66	56.18	53.56	4.10	46.15	16.53
Madagascar	41.62	56.15	54.46	4.42	26.22	16.24
Nicaragua	1.67	18.02	11.80	1.27	15.97	4.66
Bolivia	0.66	31.31	19.28	0.41	20.53	3.80
Peru	6.97	30.47	21.46	1.26	25.44	2.31
Unweighted average	12.22	36.73	31.90	3.06	28.55	13.05

[a] Food is defined as all food products.
[b] Poor households are those in the bottom 40% of the population by per capita income.
[c] Rich households are those in the top 20% of the population by per capita income.

Table A5.4: *Percentage of households who produce and sell food*[a]

	Production of Food[b]			Sales of Food[c]		
	Urban	Rural	All	Urban	Rural	All
Ethiopia	24.00	96.95	78.06	12.66	87.90	68.41
Zambia	30.52	89.36	66.47	9.59	53.87	36.65
Cambodia	44.50	88.09	81.62	37.67	78.89	72.78
Bangladesh	32.22	87.39	76.21	13.59	61.33	51.66
Vietnam	23.81	92.00	75.40	21.32	81.23	66.65
Madagascar	34.04	83.13	71.23	25.44	68.52	58.07
Nicaragua	72.30	92.72	80.20	59.06	79.22	66.85
Bolivia	16.10	84.77	41.78	4.37	70.30	20.03
Peru	13.41	87.98	36.17	10.87	76.34	30.86
Unweighted average	32.32	89.15	67.46	21.62	73.07	52.44

[a] Food is defined as all food products.
[b] Percent of households with positive food production.
[c] Percent of households with positive food sales.

Table A5.5: *Intensity of net food purchases among all households*[a] *(percent of households)*

	Marginal Food Buyers[b]			Vulnerable Food Buyers[c]		
	Urban	Rural	All	Urban	Rural	All
Ethiopia	0.88	6.21	4.83	89.22	29.11	44.68
Zambia	1.83	20.48	13.23	84.69	38.44	56.43
Cambodia	8.16	9.84	9.59	34.38	17.41	19.93
Bangladesh	0.84	4.78	3.98	87.08	57.13	63.20
Vietnam	3.56	12.00	9.94	56.63	13.42	23.94
Madagascar	5.16	6.41	6.11	31.57	16.67	20.29
Nicaragua	2.91	6.70	4.38	82.75	55.03	72.04
Bolivia	0.91	12.44	5.22	84.47	35.84	66.28
Peru	1.84	22.64	9.26	47.87	15.99	36.87
Unweighted average	2.90	11.28	7.39	66.52	31.00	44.85

[a] Food is defined as all food products.
[b] Defined as net purchases less than 10 percent of expenditures.
[c] Defined as net purchases greater than 30 percent of expenditures.

Distribution of net buyer and net seller households

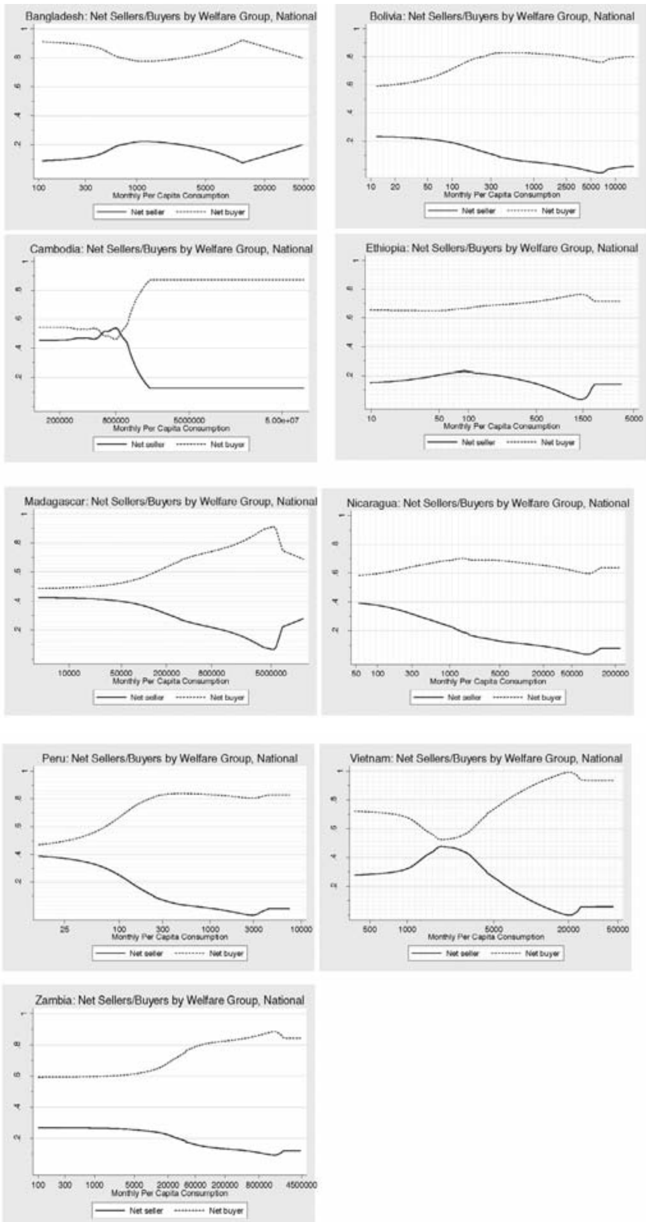

Figure A5.1: *Distribution of net sellers/buyers of staple crops by income level, all households*

Note: Proportion of net buyers and sellers of staple crops by average decile of monthly per capita consumption (applying lowest smoother to average decile data) using household weights.

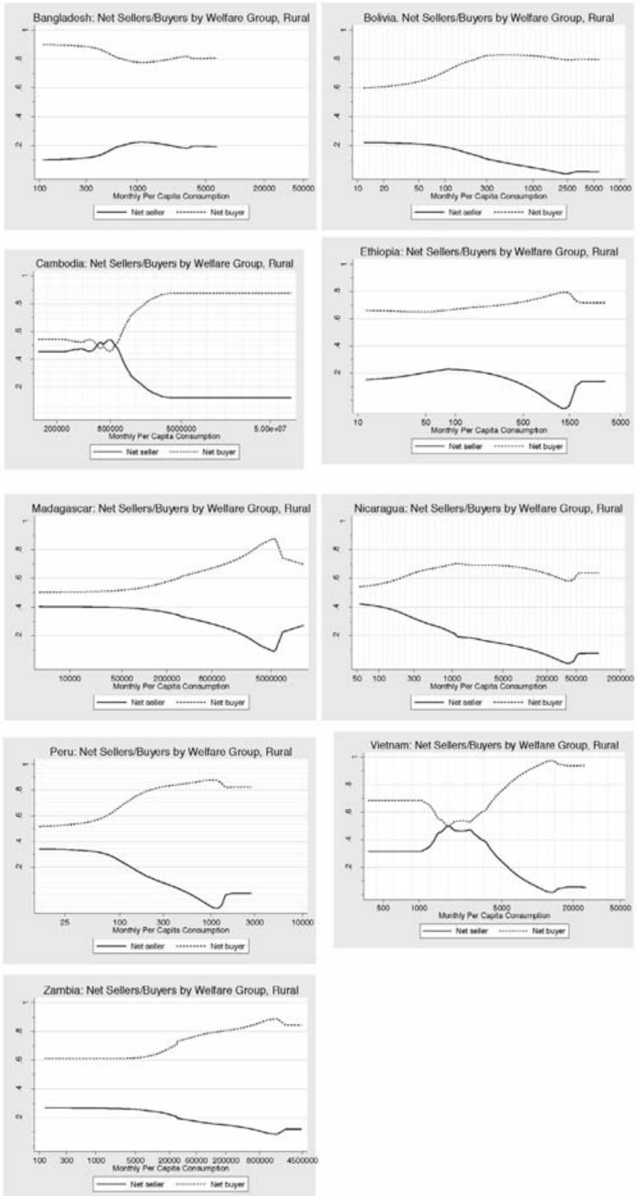

Figure A5.2: *Distribution of net sellers/buyers of staple crops by income level, rural households*

Note: Proportion of net buyers and sellers of staple crops by average decile of monthly per capita consumption (applying lowest smoother to average decile data) using household weights..

Data sources

This study uses household data from nine low-income countries to estimate detailed income sources and expenditure patterns for net food buyer and seller households. To be reasonably representative, three low-income countries from Asia (Bangladesh, Cambodia, and Vietnam), three from Latin America (Bolivia, Nicaragua, and Peru), and three from Africa (Ethiopia, Madagascar, and Zambia) were selected. The details of each survey are presented below.

The **Bangladesh** data come from the 2000 Household Income and Expenditure Survey (HIES) of Bangladesh, conducted by the Bangladesh Bureau of Statistics. The survey includes 7,440 households (5,040 rural) selected through a stratified two-stage sample design and interviewed over the course of 2000. Survey data are representative at the national, urban, rural levels in every region and include detailed data on household composition, income sources, consumption, land holdings, assets, and agricultural activities. Data from the survey are used to measure living standards, estimate budget shares for the Consumer Price Index (CPI) and to update the System of National Accounts.

The data for **Bolivia** come from the 2002 Bolivian Labor Force Survey. The survey was administered by the Bolivia National Statistics Institute (Instituto Nacional de Estadística) and was part of a World Bank initiative in the region that started in 1999 to improve the surveys and measurement of living conditions (Programa de Mejoramiento de las Encuestas y Medición sobre Condiciones de Vida, MECOVI). The field work took place during November and December. The survey includes information on members of the home, non-labor migration, health, education, employment, income, expenses in consumption, house, assets, and loans of the home and business of the independent farming producer.

For **Cambodia**, data from the Cambodia Socioeconomic Survey (CSES) 1999 are used. This survey was conducted by the Cambodian National Institute of Statistics in two rounds to take into account the effect of seasonality on consumption and income, especially for rural households. Specifically, the sample was split into two sub-samples, with households in one sub-sample interviewed in January–March and the second sub-sample interviewed in June–August (Gibson 1999). The survey includes 6,000 households and is representative at the national, rural, and urban levels. It is the first attempt to collect detailed information on household incomes in Cambodia. The survey includes a core household questionnaire with information on expenditure, household composition, education, health, and etc. and a special-purpose module that contains information about employment and income.

The data for **Ethiopia** come from two household surveys: the 1999/2000 Welfare Monitoring Survey (WMS) and the 1999/2000 Household Income, Consumption, and Expenditure Survey (HICES). The HICES includes information on household composition, education, household consumption, and expenditures, and household income. Both surveys are nationally representative at the regional level. They use a stratified two-stage sample design (three-stage for some areas).

The **Madagascar** data are from *Enquete Prioritaire Aupres des Menages* (EPM), undertaken by the Direction des Statistiques des Ménages (DSM) of the Institut National de la Statistique (INSTAT) during the last quarter of 2001. The survey sample consists of 5,080 households, is multi-staged, stratified, and representative at the national and regional level (*faritany*) as well as the urban/rural level within each region. It includes data on income, consumption, household characteristics, and individual characteristics.

The 2001 **Nicaraguan** Living Standards Monitoring Survey (*Encuesta Nacional de Hogares sobre Medición Del Nivel de Vida*, *2001)* is used for the Nicaragua data. 4,191 households were surveyed by the Nicaraguan National Institute for Statistics and census (Instituto Nacional de Estadísticas y Censos) between April and August 2001. The sample is designed to be a panel with the 1998 survey collection. The survey includes detailed data on education, health, economic activity, housing, consumption, household enterprise, and agro-pastoral activities.

The **Peruvian** data come from Living Conditions and Welfare Household Survey of 2003. The sample is nationally representative, stratified, and multi-staged. The field work took place between May 2003 and April 2004. The survey includes information on household composition, education, health, employment, household income, agricultural activity, household consumption, and expenditures. The reference periods are the day of the interview, last 15 days, last month, and last 12 months.

The **Vietnam** data come from the Vietnam Living Standards Survey (VLSS) for 1998. For this survey, 6,001 households were surveyed by the Vietnamese General Statistics Office between December 1997 and December 1998. The survey is stratified, multi-staged, and clustered. The sample includes a panel with the 1993 VLSS. The survey includes detailed data on household composition, education, employment, expenditure, land holdings, and agricultural activities.

The data for **Zambia** come from the 1998 Living Conditions Monitoring Survey produced by the Central Statistical Office (CSO) in Zambia. 16,710 households were surveyed by CSO; and the data collection took place between November1998 to December 1998. The survey is nationally representative, stratified, and multistaged. It includes data on household income, agricultural production, non-farm activities, economic activities, expenditures, household assets, household characteristics (demographics), health, and education.

6

Net Food Importing Countries: The Impact of Recent Price Increases

FRANCIS NG AND M. ATAMAN AKSOY[115]

Understanding the links between trade policy reforms, food prices, and food security is of vital concern to many developing countries. Recent increases in prices of food and other commodities have raised questions that have been debated under the global trade talks over the last decade. Are higher food prices good or bad for the poor? Should governments intervene to reduce food prices, or should they allow higher food prices, to induce greater output from farmers? What should the international community do to help poor countries (households) that are major food importers (buyers)?

The purpose of this chapter is to improve understanding of the impact of food price increases on food importing countries. Recent price increases create an excellent opportunity to measure this impact: 2000/01 was a period of very low agricultural and food prices; after that, food prices started increasing, and reached a peak in 2008.[116] Looking at the period 2000/01 to 2006/07 (the latest year for which suitable data are available), we estimate the changes that took place in the net food-importing status of importing countries, using different definitions of food and distinguishing sub-groups of countries according to their income level, whether or not they are in conflict, and whether or not they export oil.[117] Most important, we measure the relative importance of net food imports in the import basket and the GDP of different groups of countries. We also present separate tables for Sub-Saharan African countries, which have been identified as vulnerable to food price increases and are large food importers.

BACKGROUND

Many studies have been designed to show how trade and associated economic policy reforms have affected the agriculture sector and food production in a range of developing countries. Their approach is primarily to project the presumed con-

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[116] See Chapters 2 and 3 of this volume for the details of price movements.

[117] As explained further below, countries in conflict have needs that are independent of their net trading status and need to be treated differently. We picked oil as an extreme case of dependence on mineral exports. One could use other definitions or classifications.

sequences of reforms, through models of economic behavior (McCalla and Nash 2007; Hertel and others 2007; Anderson and Martin 2006; Thomas 2006; Ingco and Nash 2004).

One of the main arguments against global agricultural trade reform has been the prediction that food prices would increase as a result of such reform and that that would harm low-income countries, many of which are net food importers. Anecdotal evidence of food riots and food shortages in many countries has reinforced this fear. Compared to other commodities, food products receive significant support—whether through tariffs or direct subsidies. This support is very high in industrial and some middle-income countries (Aksoy 2005), while tropical export commodities such as coffee or tea receive almost no support and face lower tariffs. Elimination of global subsidies and protection could lead to supply reductions and price increases, mostly for foodstuffs.[118] These risks are heightened by the use of food products for fuel, which has reduced the availability of food for human consumption.

The risk that global agricultural trade reform could hurt poor countries was acknowledged during the Uruguay Round Negotiations, leading to a 1994 Ministerial Decision that special measures should be taken to minimize the negative effects of global reforms on food-importing developing countries and least-developed countries. This Decision recognized that "while the progressive implementation of the results of the Uruguay Round as a whole will generate increasing opportunities for trade expansion and economic growth to the benefit of all Members, during the reform program least-developed countries and net food-importing developing countries may experience negative effects in terms of the availability of adequate supplies of basic foodstuffs from external sources on reasonable terms and conditions, including short-term difficulties in financing normal levels of commercial imports of basic foodstuffs" (WTO 1994). In the same vein, an FAO report on Trade Liberalization and Food Security (FAO 2002) notes that the majority of low-income countries, especially least-developed countries, are net food importers. The same point is also made by Panagariya (2006), who argues that global reforms would hurt these poor countries, especially the low-income countries in Sub-Saharan Africa, as well as poor rural households in the poorest countries.

Evidence for these conclusions relies primarily on analysis by Valdes and McCalla (1999). These authors show that the majority of developing countries are net food importers. But they also show that developing countries' food and agricultural trade status varies. "While two thirds (105) of the 148 developing countries are net food importers, two fifths are net agricultural exporters, including 33 low-income countries.... at least 28 of the low-income food deficit countries are in fact net agricultural exporters" (McCalla 2001: 171).

Ng and Aksoy (2008a) show that, while very important, the fear that global agricultural trade reform would hurt poor countries and consumers has been

[118] For example, Aksoy and Beghin (2005), using multiple sources, show that rice prices would increase by an average of 33 percent with some varieties almost doubling in price. In other food items such as sugar, dairy products, and wheat, price estimates show increases of 40, 20–40, and 5–10 percent respectively. Econometric and other modeling exercises that use general equilibrium frameworks find slightly lower but still significant price increases, especially for foodstuffs.

somewhat exaggerated. They analyze the food and agriculture trade balances of different groups of countries for the period after 1980. To minimize the effects of yearly fluctuations, they use two-year averages for the years 1980/01, 1990/01, 2000/01, and 2004/05 (the last year of comprehensive trade data), and report primarily on the trade balances in 2004/05.

Their results show that the low-income countries with larger food deficits tend to be either oil exporters or countries in conflict, and that the remaining low-income countries, as a group, have a trade surplus in food. If trade balances are measured on the basis of agricultural commodities broadly defined, rather than merely food commodities, then low-income countries, including the low-income countries in SSA, have a large agricultural trade surplus. Further, most low-income countries' food deficits are not a very large percentage of their imports.[119] This said, a group of countries experiencing civil conflicts are large importers of food. These countries cannot easily adjust their production and meet their basic needs, and they also need special assistance to distribute food within their boundaries.

Ng and Aksoy (2008b) measure the changes that took place in net food importing and exporting status between 2000/01 and 2004/05. They find that among middle-income countries, food exports grew much faster than food imports. Among low-income countries, by contrast, food imports increased faster than food exports, and a small deterioration took place in food trade balances. The low-income countries' agricultural trade balances deteriorated as a percentage of their imports and of their GDP. Most important, these countries had much slower agricultural GDP growth rates than middle-income countries, meaning that their supply responses to food price increases were not as positive as those of the middle-income countries. These results suggest that, in low-income countries, the answers to food vulnerability should probably be sought in the context of incentives for agricultural production.

DEFINITIONS AND DATA

For the analysis in this chapter we use two definitions of food. The first category is termed "raw food" and covers meats and dairy products, grains, and fruits and vegetables. The second category, termed "all agriculture," is raw food plus "cash crops and feeds," which we define as tropical foodstuffs (coffee, tea, cocoa, spices), nuts, and feeds, and agricultural raw materials such as cotton.[120] The detailed SITC classification of the different food groups is given in the appendix to this chapter.

[119] Only six low-income countries were found to have food deficits (food defined narrowly) that amounted to more than 10 percent of their imports. Of these six, one is a large oil exporter and two are in conflict. The other three—Benin, Guinea-Bissau, and Senegal—export other agricultural products. Benin exports cotton, Guinea-Bissau has a large trade surplus in nuts, and Senegal exports peanut oil. Of these three, only Senegal has an agricultural trade deficit.

[120] There is a third category of agriculture-related products such as processed foods and seafood, called "other food," which we do not cover in this analysis. Even the classification we have adopted is not problem-free. In excluding processed foods, we have excluded items such as refined sugars, peanut oil, cocoa oil and paste. The form in which products are exported makes a big difference in estimating the net trade balance. For example, Senegal exports peanut oil, which is in the category of processed foods and is not included in our accounting of the agriculture trade balance.

Most of the earlier work on food prices and trade focuses on major staples, especially grains, as the main group representing food. Part of the reason is that support to agriculture in industrial countries is concentrated in grains, meats, and dairy products. Further, the debates on protection and trade policy usually pertain to individual staples such as rice or maize. Other food items such as fruits and vegetables now constitute the largest part of developing countries' food exports, but they are usually assumed not to be supported to the same extent as staple food categories, so their prices are not expected to change as much with global reforms.[121] However, these products are highly substitutable with the "raw" foods.

The use of very narrow definitions of food is questioned even in the original work by Valdes and McCalla (1999), since farmers who produce tropical products or agricultural raw materials could shift into food crops if relative prices change sufficiently.

Recognizing such substitution possibilities within agriculture, we analyze trade in raw foods and in "all agriculture" products separately. This allows us to assess whether particular countries and country groupings have scope for substitution in response to price changes, and therefore to better appreciate their vulnerability to global agricultural reform.

We define country groups not just by income and region, as has been done previously, but more narrowly, distinguishing three other subcategories of developing countries: oil exporters, countries in conflict, and small island states (see the appendix to this chapter). *Oil exporters* are defined as countries for which oil constituted more than 40 percent of exports between 2000 and 2005. *Civil conflict states* are defined as countries in which serious conflict in 2004/05 made it difficult to achieve "normal" food production. The conflict-affected countries should not be confused with "normal" developing countries. While they are vulnerable to higher food prices, solutions to their problems lie beyond reforms in global trade regimes; their needs for food and for food distribution within conflict areas need to be addressed using other mechanisms. *Small island states* usually sell services and import most of their needs, including some food. Also, they lack the resources to respond to food price increases and hence we distinguish them analytically from other groups of countries. Although they are numerous, their trade is very small, along with their populations.

We estimate net food imports over time to observe how the net food balance has evolved for these groups of countries. The latest year for which there are annual trade data is 2007. To minimize yearly fluctuations, we need to use at least two-year averages, and thus the latest trade data that can be used are for 2006/07. As noted above, we focus on the impact of changes between 2000/01 and 2006/07: a period that started with food prices at their lowest since 1980, and finished with food prices among the highest ever. The global food price index was 102 for 2000/01, 166 for 2006/07, and 185 for 2007. Thus while the period we

[121] Diop and Jaffee (2005) question this assumption and show that there is significant protection for fruits and vegetables especially in the EU. There are numerous other cases of support and protection for individual fruits and vegetables in other countries. Thus, one can expect some price changes in fruits and vegetables as a result of global trade reforms.

cover does not include the price increases of 2008, it does include a cumulative price increase of 66 percent—the largest food price increase since the mid-1970s and much larger than any that could be generated by reforms.

To measure the relative importance of food imports, and hence to measure the potential impact of food price changes on these economies, we estimate the share of their net food imports in their total imports. While many countries might have net imports of food, the important question is whether these imports are large enough to significantly alter the balance of payments of these countries. We use merchandise imports rather than merchandise exports because many countries export services and labor that are not captured in merchandise exports data; hence data on imports give a more accurate measure of how the imports of these countries might respond to a food price change. We also use the share of net food imports in GDP to measure the potential impact of food-price changes on incomes.

We analyze the case of Sub-Saharan Africa (SSA) separately, because that continent has significant net food imports and because the food deficits of SSA countries have been cited in many arguments against global reforms. This is also a region that has a significant agricultural trade surplus.

We use the same country classification and coverage for 2000/01 and for 2006/07. The country classification differs from that used in Ng and Aksoy (2008a and b), because many countries have now moved from the low-income category into the middle-income category, and because some countries lack the GDP and other data that we now require for use in conjunction with the trade information. We have consistent data for 185 countries (fewer than the 196-country sample used in Ng and Aksoy 2008a). There are now 45 low-income countries (fewer than the 58 in our earlier study), and the coverage of middle-income countries differs somewhat from that in the earlier study.

Finally, the international trade data base has some gaps, especially in measuring intra-developing country trade. If the trade flows are with other developing—and especially with low-income—countries, trade statistics tend to underestimate them. For this study, we did not use individual-country information other than what is available in the international trade database.

NET FOOD BALANCE: RAW FOOD

Table 6.1 shows the distribution of countries in terms of their income status and their net food balances for the “raw food” definition for 2000/01 and 2006/07.

Most of the world’s countries are net food importers. This ratio—123 out of 185 in 2006/07—is typical of any product group in which the exporters tend to be more specialized than the importers. Sixty eight middle-income countries out of 107, and 34 low-income countries out of 45, are net food importers. Of the 34 low-income countries that are net food importers, 2 are oil exporters and 6 are conflict countries.[122]

[122] Most of the island economies are middle-income countries, but three of them are low-income. For simplicity, throughout the chapter we treat all of them as middle-income.

Table 6.1: *Country classification by raw food trade, 2000s*

Country Group	No. of Net Food Exporters		No. of Net Food Importers		Total No. of Countries
	2000/01	2006/07	2000/01	2006/07	
Industrial Countries	11	12	22	21	33
Middle-income, all	35	39	72	68	107
Oil exporters	5	4	20	21	25
Civil conflict states	0	1	5	4	5
Small island states	5	5	18	18	23
Other middle-income	25	29	29	25	54
Low-income, all	15	11	30	34	45
Oil exporters	0	0	2	2	2
Civil conflict states	0	0	6	6	6
Other low-income	15	11	22	26	37
Total	61	62	124	123	185

Source: Based on mirror data from UN COMTRADE Statistics.
Notes: Food is defined as raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, but excluding cash crops and feeds, processed food, and seafood.
The classification by country income group is based on 2007 per capita GNI from the World Bank WDI.
Civil conflict countries are drawn from countries with recent serious war outbreaks as reported in Collier (2007).
Small island states are those small economies with independent or autonomous administration, excluding colonized or dependent territories.
Data are computed as two-year averages of trade values in SITC Revision 3.

Over the period studied, more low-income countries became net food importers and more middle-income countries became net food exporters. Thus the economic and price changes seem to have benefited the middle-income countries. In 2000/01, the proportion of countries that were net food exporters was very similar between low and middle-income countries, but by 2006/07 a “normal” middle-income country was much more likely than a “normal” low-income country to be a net food exporter. By 2006/07, 36 percent of industrial countries, 36 percent of middle-income countries, and 24 percent of low-income countries were net food exporters. If we exclude oil exporters, countries in conflict, and island states, these ratios increase to almost 54 percent (from 46 percent in 2000/01) for the middle-income countries but decrease to 24 percent (from 41 percent) for low-income countries.

Table 6.2 shows the average net exports of raw food and the average ratio of net export balances to their total imports for the country groups that were defined in Table 6.1.

The table emphasizes that industrial and middle-income countries are net food exporters, though their surpluses only equate to a small percentage of their total imports. Industrial countries’ food export surplus has declined from US$ 12 billion to US$ 10 billion and decreased as a percentage of their total imports and GDP, despite increases in food prices. The decline in the industrial countries’ sur-

Table 6.2: *Trade balance in raw food, by country income group, 2000s*

Country Group (No. of Countries)	Net Food Exports (US$ million) 2000/01	2006/07	Net Food Exports as % Total Imports 2000/01	2006/07	Net Food Exports as % of GDP 2000/01	2006/07
Industrial Countries (33)	12,268	9,893	0.90	0.55	0.13	0.04
Middle-income, all (107)	24	2,747	0.12	0.15	0.07	0.20
Oil exporters (25)	−6,966	−17,330	−1.33	−1.80	−0.27	−0.46
Civil conflict states (5)	−597	−719	−6.04	−4.89	−1.30	−1.54
Small island states (23)	−120	−305	−1.63	−3.00	−0.73	−1.47
Other middle-income (54)	7,706	21,100	2.10	2.26	0.41	0.58
Low-income, all (45)	−793	−3,267	−2.27	−2.88	−0.85	−1.39
Oil exporters (2)	−813	−1,577	−8.20	−6.46	−1.98	−1.88
Civil conflict states (6)	−296	−569	−8.06	−6.06	−2.74	−3.35
Other low-income (37)	316	−1,121	1.02	−2.18	−0.48	−1.04

Source: Based on mirror data from UN COMTRADE Statistics.
Notes: Food is defined as raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, but excluding cash crops and feeds, processed food, and seafood.
Number of countries is shown in parenthesis, based on countries reporting GDP data.
Data are computed as two-year averages of trade values in SITC Revision 3.
Trade shares are based on simple averages of all countries in the group.

plus has been offset by a rapid rise in that of middle-income countries, from US$ 24 million to almost US$ 3 billion. This change was driven by the non-oil and non-conflict middle-income countries, whose food exports increased much more rapidly than their food imports. While the middle-income countries' surplus has increased as a percentage of their total imports and GDP, it still constitutes only a very small share of their economies and trade.

For middle-income countries, the group average masks large net food imports by oil exporters, and large net food exports by the "other" middle-income country group. Middle-income oil exporters are the largest net food importers and their net food imports have increased significantly, but their trade volume and their GDP have increased even more. Middle-income countries in conflict have a deficit in their food account; though this is only about US$ 700 million it is significant as a percentage of their imports and GDP, at 5 and 1.5 percent respectively. Similarly, the group of small island states includes many countries that have food deficits; only five of them have positive net food trade. The island states' average food deficit has doubled, to more than US$ 300 million, and now constitutes about 2 percent of their total imports and 1.5 percent of their GDP. "Other" middle-income countries—excluding the oil exporters, countries in conflict, and small island economies—have a large export surplus. This is a highly heterogeneous group. Its largest five net importers of food are Korea, Hong Kong, Taiwan, Singapore, and Malaysia—none of which is likely to be significantly affected by food price changes.

Low-income countries have a significant and increasing food trade deficit. The growth in their deficit has taken place not only among oil exporting and conflict low-income countries but also among the "other" or "normal" low-income countries. This finding is contrary to that in Ng and Aksoy (2008a), which showed that the low-income countries as a group had a food trade surplus. One reason for the difference is the rise in food prices. The other is a change in country classification, whereby many of the better performing countries now appear in the middle-income category. In particular, India, with a significant food trade surplus, has moved into the middle-income category, making a big difference in the group results.

NET FOOD BALANCE: ALL AGRICULTURE

As noted above, using a limited number of products to measure the food trade balance, and using this balance to infer the potential impact of price changes, assumes that countries facing a major change in relative prices cannot switch production from one group of agricultural commodities to another. In practice, farmers in most cases can substitute across a wide range of agricultural products, even though not every product can be efficiently and economically substituted. Thus it might be important to assess the agricultural capacity of countries by measuring their overall agricultural ("all agriculture") exports and imports. For this purpose we add tropical crops, feeds, and agricultural raw materials to the commodities covered by the "raw food" definition.

Table 6.3 shows the agricultural trade status of the same groups of countries introduced in Table 6.1. As expected, addition of the non-raw-food-agricultural commodities changes the picture significantly: using the raw food definition, only 39 developing countries are net food exporters, but using the broader all-agriculture definition, 46 developing countries are net agricultural exporters.

Among middle-income countries, the changes are minimal. Excluding the oil-exporting, small island, and conflict countries, the number of middle-income countries that are net agricultural exporters increases only from 29 to 31.

The change among low-income countries, however, is very significant. Only eleven of the 45 low-income countries are net exporters under the narrow definition of food, but under the broader definition, 28, or more than half, are net exporters. If the oil exporters and conflict countries are excluded, then 27 of 37 low-income countries are net exporters of agricultural commodities.

Looking at the changes that took place over time, the number of net agricultural exporting countries decreased even during this period of rapidly rising agricultural prices. This contrasts with the pattern for raw food exports, where as seen above the number of food exporting countries stayed about the same.[123]

Table 6.4 shows the trade balances of the same groups of countries in broad agricultural trade. For industrial and middle-income countries, net trade balances do not change significantly with the all-agriculture definition. For middle-income oil, conflict, and island countries, deficits increase but they decline as a percentage of total imports. For other middle-income countries, the surplus increases in dollar terms but stays about the same as a percentage of imports and GDP.

[123] Increases in food and in all-agriculture prices were very similar during the period. Cotton, whose price did not increase, is an exception.

Table 6.3: *Country classification by all agricultural trade, 2000s*

Country Group	No. of Net Agricultural Exporters 2000/01	No. of Net Agricultural Exporters 2006/07	No. of Net Agricultural Importers 2000/01	No. of Net Agricultural Importers 2006/07	Total No. of Countries
Industrial countries	16	14	17	19	33
Middle-income, all	52	46	55	61	107
Oil exporters	9	7	16	18	25
Civil conflict states	1	1	4	4	5
Small island states	11	7	12	16	23
Other middle-income	31	31	23	23	54
Low-income, all	31	28	14	17	45
Oil exporters	0	0	2	2	2
Civil conflict states	1	1	5	5	6
Other low-income	30	27	7	10	37
Total	99	88	86	97	185

Source: Based on mirror data from UN COMTRADE Statistics.
Notes: All agriculture is defined as all raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, cash crops and feeds, and agric raw materials, but excluding processed food and seafood.
The classification by income group is based on 2007 per capita GNI from the World Bank WDI.
Civil conflict countries are drawn from countries with recent serious war outbreaks as reported in Collier (2007).
Small island states are those small economies with independent or autonomous administration, excluding colonized or dependent territories.
Data are computed as two-year averages of trade values in SITC Revision 3.

The most dramatic change is in low-income countries. Instead of a deficit, this group now has a significant surplus. Their agricultural surplus in 2006/07 is more than US$ 10 billion and equivalent to 8 percent of their total imports. Low-income oil exporters and conflict countries are still net agricultural importers, and their agricultural imports are now higher as a percentage of their total imports and larger as a percentage of their GDP. But the 37 “other” low-income countries now have an agricultural trade surplus, equivalent to 11 percent of their total imports.

Thus the low-income countries as a group are significant agricultural exporters, implying that if they marginally substitute production of raw food products for other agricultural products, they could gain from global trade reforms.

Over the period studied, however, the agricultural surplus of low-income countries declined significantly, from almost 16 percent of their total imports and 4 percent of their GDP to 8 and 3 percent respectively. The change was more dramatic among the “other” low-income countries, whose agricultural trade surplus declined from 21 percent of their total imports to 11 percent. Similarly, these countries’ ratio of export surplus to GDP declined from 4.7 to 3.3 percent.

Changes in trade balances could be caused by changes in either imports or exports. Figure 6.1, which shows the percentage changes that took place in food ex-

Table 6.4: *Trade balance in all agriculture, by country income group, 2000s*

Country Group (No. of Countries)	Net Agricultural Exports (US$ million)		Net Agricultural Exports as % All Imports		Net Agricultural Exports as % GDP	
	2000/01	2006–07	2000/01	2006/07	2000/01	2006/07
Industrial Countries (33)	13,258	5,375	2.08	0.97	0.60	0.14
Middle-income, all (107)	14,276	17,970	5.15	2.84	1.36	0.83
Oil Exporters (25)	–4,066	–13,331	6.43	2.09	–1.13	–0.20
Civil Conflict States (5)	–328	–638	–3.28	–3.01	–0.54	–0.97
Small Island States (23)	61	–184	4.41	–0.95	1.28	–0.42
Other Middle-income (54)	18,608	32,122	5.65	5.35	1.68	1.83
Low-income, all (45)	7,788	8,740	15.96	8.14	4.08	2.97
Oil Exporters (2)	–586	–1,451	–7.61	–6.87	–1.91	–2.11
Civil Conflict States (6)	–113	–212	–7.20	–4.57	–2.40	–2.74
Other Low-income (37)	8,487	10,403	21.00	11.02	4.67	3.29

Source: Based on mirror data from UN COMTRADE Statistics.
Notes: Agriculture is defined as all raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, cash crops and feeds, and agricultural raw materials, but excluding processed food and seafood.
Number of countries is shown in parenthesis, based on countries reporting GDP data.
Data are computed as two-year averages of trade values in SITC Revision 3.
Trade shares are based on simple average of all countries in the group.

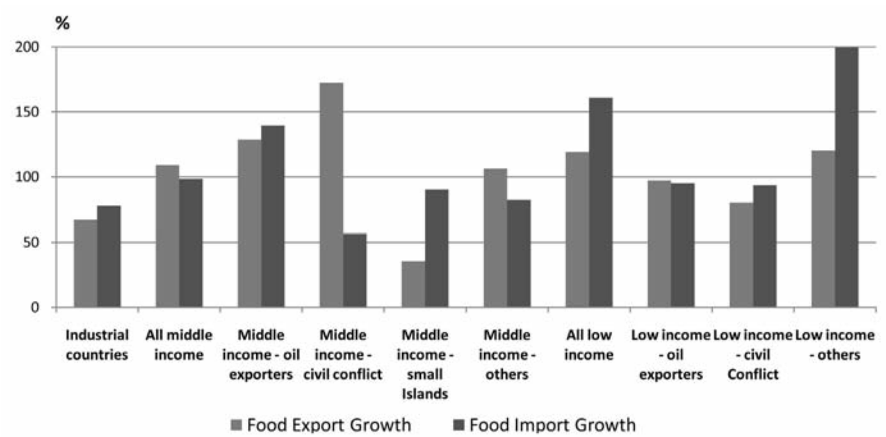

Figure 6.1: *Food export and import growth, by country income group, 2001/01–2006/07*

Note: Food is defined as raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, but excluding cash crops and feeds, processed food, and seafood.

ports and imports for major groups of countries over the period 2000/01 to 2006/07, points to a clear difference between the middle- and low-income countries. Middle-income countries, excluding small island states and oil exporters, achieved higher growth in food exports than food imports, while for low-income countries except conflict countries, the reverse was true.

Thus, higher food prices positively affected the food trade balances of middle-income countries and negatively affected those of low-income countries along with island economies.

Changes in a country's food trade balance could also be caused by changes in the agricultural product mix. Low-income countries, many of which are tropical, might have switched to non-food commodities, while the opposite might have happened in middle-income countries. Exports and imports of non-food agricultural products might have behaved differently from those of food products.

In practice, however, trade in the two groups of products behaved very similarly. Figure 6.2 shows the growth of agricultural GDP and of exports and imports of food and of all agricultural commodities for three groups of "normal," or "other" countries: middle-income countries excluding oil exporters and countries in conflict; low-income countries excluding oil exporters and conflict countries; and small island states. In the group of low-income countries, and in small island economies, exports grew more slowly than imports both in food and all agricultural commodities. The opposite happened in the group of middle-income countries: exports of both food and all agricultural commodities grew faster than imports.

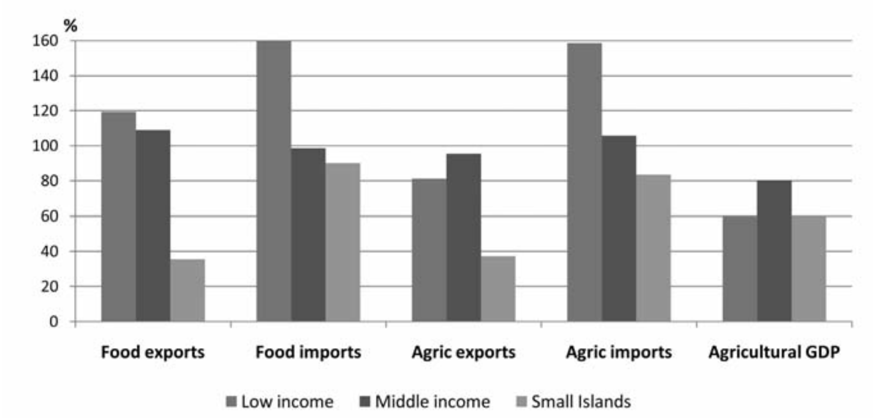

Figure 6.2: *Food, agriculture, and agricultural GDP growth, by selected country income group, 2000/01–2006/07*

Note: The country groups shown exclude oil exporters and conflict states.

Further, faster increases in imports could be associated with slower increases in domestic supply. Figure 6.2 also shows that the group of low-income countries had much slower agricultural GDP growth than the group of middle-income countries. Thus the agricultural performance of these 37 low-income countries was much worse than that of the other groups of "normal" countries, and could be a reason for their increased vulnerability to food deficits. In 2000/01, only seven of these low-income countries had deficits in their agricultural trade, but by 2006/07 ten did. Just as in food products, the agricultural trade surplus of the group declined—from 21 percent of total imports and 4.7 percent of GDP to 11 and 3.3 percent respectively.

These results suggest the need for emphasis not just on meeting the short-run food needs of low-income countries, but on implementing a more systemic approach to speed up the growth of agricultural output in these countries. Since most of the population in low-income countries works in agriculture, this would also help in alleviating these countries' extensive poverty.

SUB-SAHARAN AFRICA: A SPECIAL CASE?

It is often argued that Sub-Saharan Africa has many countries that are significant net food importers and that global trade reforms would particularly hurt this continent. Below we repeat for the SSA countries the same exercise we described above for all countries.

Table 6.5 clearly illustrates why SSA has been treated as special. Only nine of the forty six SSA countries are net exporters of raw food. Even if conflict and oil-exporting countries are excluded, only four of the twenty five "other" low-income African countries are net food exporters. The rest are net food importers. These ratios are much lower than those for the "other" low-income countries that were shown in Table 6.1.

This picture does not, however, mean that SSA would definitely lose under global agricultural reforms. The continent is a significant agricultural exporter that tends to import mainly grains and export other agricultural products. While only nine of the 46 SSA countries are net exporters of raw food (Table 6.5), 30 of the 46 are net exporters of agricultural commodities (Table 6.6). And, if the oil exporters and conflict countries are excluded, then 19 of the 25 "other" low-income SSA countries are net agricultural exporters.

Similarly, looking at trade balances in all agricultural commodities, rather than in raw food only, changes the picture dramatically. In raw food (Table 6.7), Sub-Saharan African countries as a group have a trade deficit that is slightly more than 1 percent of imports. On average, middle-income SSA countries have a food surplus, but low-income SSA countries are net food importers.

But in agricultural commodities more broadly (Table 6.8), SSA countries have a sizeable export surplus, which equates to almost 10 percent of their total imports. Unlike other low-income countries globally, in SSA even the oil exporters and countries in conflict have agricultural surpluses. "Other" SSA low-income countries—that is, excluding low-income oil-exporting and conflict countries—

Table 6.5: *Sub-Saharan Africa: country classification by raw food trade, 2000s*

Country Group	No. of Net Food Exporters		No. of Net Food Importers		Total No. of Countries
	2000/01	2006/07	2000/01	2006/07	
Middle-income, all	6	5	11	12	17
Oil exporters	2	1	5	6	7
Small island states	0	0	4	4	4
Other middle-income	4	4	2	2	6
Low-income, all	8	4	21	25	29
Civil conflict states	0	0	4	4	4
Other low-income	8	4	17	21	25
Sub-Saharan Africa, total	14	9	32	37	46

Source: Based on mirror data from UN COMTRADE Statistics.
Notes: Food is defined as raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, but excluding cash crops and feeds, processed food, and seafood.
The classification by income group is based on 2007 per capita GNI from the World Bank WDI.
Civil conflict countries are drawn from countries with recent serious war outbreaks as reported in Collier (2007).
Small island states are those small economies with independent or autonomous administration, excluding colonized or dependent territories.
Data are computed as two-year averages of trade values in SITC Revision 3.
Nigeria, the only oil exporter in the low-income group, is included here in the middle-income oil exporting group.

Table 6.6: *Sub-Saharan Africa: country classification by all agricultural trade, 2000s*

Country Group	No. of Net Agricultural Exporters		No. of Net Agricultural Importers		Total No. of Countries
	2000/01	2006/07	2000/01	2006/07	
Middle-income, all	12	10	5	7	17
Oil exporters	5	4	2	3	7
Small island states	2	1	2	3	4
Other middle-income	5	5	1	1	6
Low-income, all	21	20	8	9	29
Civil conflict states	1	1	3	3	4
Other low-income	20	19	5	6	25
Sub-Saharan Africa, total	33	30	13	16	46

Source: Based on mirror data from UN COMTRADE Statistics.
Notes: Agriculture is defined as raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, cash crops and feeds, and raw agricultural materials but excluding processed food and seafood.
The classification by income group is based on 2007 per capita GNI from the World Bank WDI.
Civil conflict countries are drawn from countries with recent serious war outbreaks as reported in Collier (2007).
Small island states are those small economies with independent or autonomous administration, excluding colonized or dependent territories.
Data are computed as two-year averages of trade values in SITC Revision 3.
Nigeria, the only oil exporter in the low-income group, is included here in the middle-income oil exporting group.

Table 6.7: *Sub-Saharan Africa: trade balance in raw food, by country income group, 2000s*

Country Group	Net Food Exports (US$ million)		Net Food Exports as % Total Imports		Net Exports as % of GDP	
(No. of Countries)	2000/01	2006/07	2000/01	2006/07	2000/01	2006/07
Sub-Saharan Africa, total (46)	73	−2,301	−1.37	−2.42	−0.86	−1.53
Middle-income, all (17)	546	−269	0.47	−0.94	−0.60	−0.88
Oil exporters (7)	−611	−1,608	−1.96	−2.42	−0.57	−0.57
Small island states (4)	−30	−78	−5.67	−7.00	−2.35	−3.09
Other middle-income (6)	1,187	1,418	7.39	4.83	0.54	0.23
Low-income, all (29)	−473	−2,032	−2.45	−3.29	−1.01	−1.91
Civil conflict states (4)	−115	−274	−6.86	−4.99	−2.72	−3.87
Other low-income (25)	−358	−1,758	−1.74	−3.02	−0.74	−1.59

Source: Based on mirror data from UN COMTRADE Statistics.
Notes: Food is defined as raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, but excluding cash crops and feeds, processed food, and seafood.
Number of countries is shown in parenthesis, based on countries reporting GDP data.
Data are computed as two-year averages of trade values in SITC Revision 3.
Trade shares are based on simple average of all countries in the group.
Nigeria, the only oil exporter in the low-income group, is included here in the middle-income oil exporting group.

Table 6.8: *Sub-Saharan Africa: trade balance in all agriculture, by country income group, 2000s*

Country Group	Net Agricultural Exports (US$ million)		Net Agricultural Exports as % All Imports		Net Agricultural Exports as % GDP	
(No. of Countries)	2000/01	2006/07	2000/01	2006/07	2000/01	2006/07
Sub-Saharan Africa, Total (46)	9,671	11,417	18.05	9.53	4.11	2.74
Middle-income, all (17)	3,689	3,499	13.77	5.99	2.62	1.04
Oil exporters (7)	1,274	971	23.44	11.76	3.74	2.06
Small island states (4)	−14	−82	4.40	−4.16	1.08	−2.16
Other middle-income (6)	2,429	2,611	8.74	6.01	2.35	1.97
Low-income, all (29)	5,982	7,918	20.56	11.60	4.98	3.74
Civil conflict states (4)	83	101	−5.30	−2.26	5.06	5.39
Other low-income (25)	5,899	7,817	24.70	13.82	4.96	3.48

Source: Based on mirror data from UN COMTRADE Statistics.
Notes: Agriculture is defined as all raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, cash crops and feeds, and agricultural raw materials, but excluding processed food and seafood.
Number of countries is shown in parenthesis, based on countries reporting GDP data.
Data are computed as two-year averages of trade values in SITC Revision 3.
Trade shares are based on simple average of all countries in the group.
Nigeria, the only oil exporter in the low-income group, is included here in the middle-income oil exporting group.

have a massive export surplus equal to almost 14 percent of their imports. Thus for most SSA countries, small changes in their agricultural production mix could in principle generate enough food for their citizens and turn most of them into net exporters of raw food products.

These prospects notwithstanding, during the period studied agricultural trade deteriorated for SSA countries; just as in food trade, export surpluses decreased.

VULNERABILITY TO FOOD PRICE CHANGES

The results described above could be caused by a few large countries dominating the averages. Further, many countries could in practice be less vulnerable than the results suggest, if they expand other products and sectors.

Thus in this section we focus on vulnerable countries, to see how the very significant food price increases have affected them.

It is not obvious what criterion one should use to define a vulnerable country. Ng and Aksoy (2008a) identified vulnerable countries as those with large food trade deficits; for such countries, paying high prices for imported food might jeopardize their ability to buy other imports. Following this approach, here we use two cut-off points for trade vulnerability: net food imports that constitute (i) more than 5 percent and (ii) more than 10 percent of total imports. The 5 percent cut-off means that a 20 percent increase in food prices would have an impact equivalent to about 1 percent of the country's total imports, while the 10 percent cut-off would have an impact of about 2 percent of total imports.[124]

Another distinguishing feature of vulnerable countries is that net imports of food are much larger as a proportion of GDP than in the average country, so food price increases will have a larger impact on their incomes. Thus we also use a second criterion for vulnerability: the share of net food imports in GDP, as a means to gauge the impact of food price changes on country income. We consider countries with net food deficits greater than 2 percent of their GDP as vulnerable. This ratio implies that a 50 percent increase in food prices will have an impact equivalent to 1 percent of GDP, assuming no adjustment is made.

We find that ten out of eleven conflict countries and twenty three out of twenty seven oil exporting countries had food deficits during the period studied, and that for many of them these deficits were significant. Among the eleven conflict-affected countries, food deficits exceeded 5 percent of total imports in seven. Three of these seven had an improving trade balance over the period and two had a worsening balance. Four of the seven—Timor-Leste, Haiti, Liberia, and Sierra Leone—also had food deficits greater than 2 percent of their GDP. For these four countries, looking at their agricultural trade balances rather than raw food trade balances does not change the picture significantly. Out of the 27 oil exporting countries (25 middle-income and 2 low-income), 12 began the period with food

[124] Shocks of these magnitudes should be easily manageable. But we should point out that these price changes are much less than the food price volatility observed in global or domestic markets (Mitchell and Hoppe 2006).

deficits greater than 5 percent of imports, but by 2006/07 this number had fallen to 5, and only Iraq and Yemen had deficits greater than 2 percent of GDP.

Four of the middle-income countries (other than oil exporters and countries in conflict) had food deficits that exceeded 5 percent of their total imports at the start of the period: Egypt, Albania, Jordan, and Georgia.[125] By 2006/07, two of these countries—Albania and Georgia—had seen an increase in their trade deficit and the other two had seen a decline; only Georgia ended up with a food trade deficit of more than 2 percent of its GDP.

If we exclude the oil exporters and countries in conflict, two main groups of countries turn out to be food importers. The first group is the small island states, among which 18 of 23 are net importers—many of them on a large scale. The second group comprises many of the low-income countries, mainly in SSA. Before discussing these two groups in turn, we should note that most of the low-income countries outside SSA have a food trade surplus. This was US$ 42 million in 2000/01 and had increased to US$ 637 million by 2006/07. So the food-deficit problem of low-income countries can also be seen as a problem of SSA countries.

Small island states

While most of the small island economies are classified as middle-income, they are vulnerable to food price increases because they have limited ability to respond by increasing their food supplies. They have limited agricultural output and have large deficits in their agricultural trade as well.

Small island states have become more vulnerable to world food price changes in terms of both trade and income (Figure 6.3). Between 2000/01 and 2006/07 their food exports increased by 21 percent (from US$ 133 to 161 million) but their food imports increased by 85 percent (from US$ 262 to 465 million). The average ratio (unweighted by country) of their net food imports to their total imports increased from –1.6 percent to –3.0 percent, and their net food imports as a percentage of their GDP also deteriorated, from –0.7 percent to –1.5 percent. By 2006/07, only five out of the twenty three small island countries had a positive food trade balance, and this number had not changed since 2000/01. Countries that had food trade surpluses saw their surpluses decrease.

By 2006/07, six of the small island states had food trade deficits of more than 5 percent of their total imports—up from four in 2000/01. The small island food-deficit countries also have deficits in their all-agricultural trade, so their ability to substitute between crops in response to food price increases is much more limited than in many of the low-income countries.

By 2006/07, eight of the small island states had net food imports greater than 2 percent of their GDP—down from ten at the start of the period. In 2000/01 these eight countries' food exports were US$ 1 million, on average, and their imports

[125] Egypt is an oil exporter but its oil exports are smaller than the limit we are using to identify oil exporters.

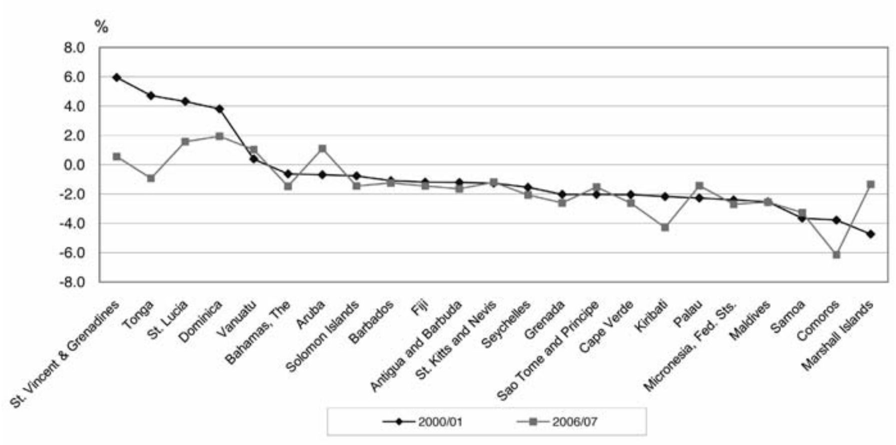

Figure 6.3: *Small island states: net food imports as percentage of GDP, 2000/01 and 2006/07*

were US$ 90 million, but by 2006/07 their food exports and imports were US$ 2 million and US$ 143 million, respectively.

Low-income countries

Low-income countries have fared much worse than other groups of countries. Among them the number of net food exporting countries has declined, and food deficits have increased. There is a significant overlap between low-income countries in general and low-income SSA countries in particular. Of the total of 45 low-income countries studied, 29 or more than two thirds are in SSA, and within the "normal" or "other" low-income country group, 25 out of 37 (67 percent) are in SSA.

In 2000/01, three of the low-income countries had a food trade deficit of more than 10 percent of their total imports. These were Yemen, an oil exporter, and Eritrea and Haiti, which are conflict countries. Despite the food price increases, only Haiti had a trade deficit of more than 10 percent in 2006/07.

Among low-income countries other than oil exporters and countries in conflict, vulnerability worsened over the period studied. In this group in 2000/01, the unweighted average food trade deficit was -1.0 percent of total imports and –0.5 percent of GDP. By 2006/07 these ratios had roughly doubled, to –2.2 and –1.0 percent respectively, reflecting the food price increases.

Net food imports amounted to more than 5 percent of total imports in five low-income countries at the start of the period, rising to nine by the end. Food trade deficits were more than 2 percent of GDP in four countries at the start of the period, also rising to nine by the end. Bangladesh's food trade deficit was almost 8 percent of its total imports but much smaller as a percentage of its GDP; the same pattern held for Nepal and Burundi. By contrast, the food trade deficits of Togo, Gambia, and Zimbabwe were more than 2 percent of their incomes but less than 5 percent of their total imports.

Five low-income countries, all in Africa, are doubly vulnerable, with food trade deficits in 2006/07 that were both greater than 5 percent of their imports and greater than 2 percent of their GDP: Benin, Guinea, Guinea-Bissau, Mauritania, Mozambique, and Senegal.

As pointed out above, using a narrow definition of food to measure the potential impact of global price changes assumes that there is no substitution among agricultural products. Yet when we analyze the broader agricultural rather than the raw food balance in low-income countries, the general picture does not change dramatically. Among the deficit countries, Burundi, Guinea-Bissau, Togo, and Zimbabwe have large agricultural trade surpluses. Mozambique also has an agricultural trade surplus, but a very small one.

To sum up, recent food price increases have increased the number of vulnerable countries and their vulnerability. Particularly for most low-income countries, increases in food prices have led to rising net food imports and greater vulnerability. Of the 37 “other” low-income countries that are non-oil exporting and non-conflict, nine saw an improvement in their net food imports as a percentage of their GDP while 28 experienced a deterioration during the period studied (Figure 6.4). And 28 countries also saw a deterioration in their food trade balances as a percentage of their imports. The agricultural trade balances of low-income countries also deteriorated during this period.

Are Sub-Saharan African countries especially vulnerable?

All of the five doubly vulnerable countries are in SSA. So are ten of the twelve low-income countries that are vulnerable in terms either of imports or GDP. In

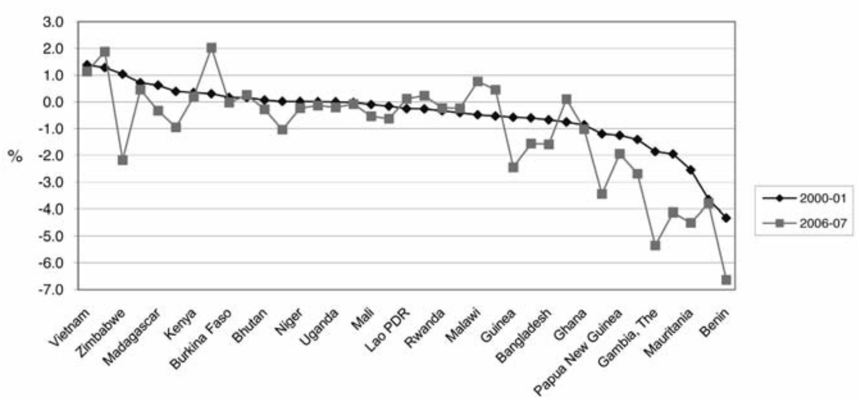

Figure 6.4: *Low-income countries: net food imports as percentage of GDP, 2000/01 and 2006/07*

Note: Food is defined as raw food products, including meats and dairy products, grains and cereals, fruits and vegetables, but excluding cash crops and feeds, processed food, and seafood.

this section we investigate whether low-income SSA countries have behaved differently from other low-income countries.

We find that food deficits have evolved less well in SSA low-income countries than in similar countries outside Africa (Table 6.9). While non-SSA low-income countries started the period with a surplus in their food trade, SSA low-income countries had a large deficit. As a share of total imports, food deficits increased in both groups of countries but much more so in SSA countries. As a percentage of GDP, these deficits (surpluses) did not change over time in non-SSA countries, but they deteriorated by almost 1 percentage point in SSA countries.

Table 6.9: *Sub-Saharan and other countries: food deficit as share of GDP and total imports*

	Food Deficit as % of GDP		Food Deficit as % of Imports	
Group	2000/01	2006/07	2000/01	2006/07
SSA	–0.7	–1.6	–1.7	–3.0
Non-SSA	0.1	0.1	0.5	–0.4

Table 6.10 shows the growth of food and agricultural trade for both groups of low-income countries, and separately for all SSA and middle-income countries. In both food and all-agricultural trade, export and import growth were much lower in SSA than in other low-income countries.

Table 6.10: *Food, agriculture, and agricultural GDP growth rates (%), 2000/01–2006/07*

	Low-income			All SSA	Middle-income
Product	All	SSA	Non-SSA		
Food exports	108.0	78.2	123.9	73.3	101.2
Food imports	195.6	173.5	225.8	159.7	79.5
Agric exports	74.1	55.8	102.4	55.3	91.5
Agric imports	168.6	122.3	206.3	129.9	96.6
Agric-GDP	52.3	73.1	39.1	84.6	67.3

Source: Based on mirror data from UN COMTRADE Statistics and World Bank WDI database.

CONCLUSIONS

In this chapter we analyzed what happened to food trade balances in response to a 66 percent food price rise during the period 2000/01 and 2006/07. The response of different groups of countries to this price rise might shed light on the adjustments and outcomes that followed when food prices subsequently peaked, in 2008.

Our results show a deterioration in the food trade balances of low-income countries. These countries' food imports increased faster than their food exports. For middle-income countries, the opposite is true. The agricultural trade balances of low-income countries also deteriorated, as a percentage of both their total imports and their GDP. Most important, low-income countries had much slower agricultural GDP growth than middle-income countries.

Thus the responses of low-income countries to food price increases have not been as positive as those of middle-income countries. These results suggest that the answers to food vulnerability should probably be sought in the context of incentives for agricultural production in low-income countries.

Even though low-income countries have become more vulnerable than at the start of the decade, our results do not indicate a very serious situation. The deterioration is about half a percent of GDP, on average, and relatively few countries are really vulnerable. The results suggest that attention should be placed first on countries in conflict, followed by small island economies and a few especially vulnerable low-income countries. At the country level, it is mostly the very small economies that are vulnerable. Thus beyond systemic efforts to improve agricultural performance, small amounts of food aid would ease the problems significantly.

Countries experiencing civil conflicts are large importers of food, and cannot easily adjust their production and meet their basic needs. They also need special assistance in distributing food within their boundaries. Therefore, the 1994 WTO Ministerial Decision (WTO 1994) should be modified to focus on these conflict countries. Agreement should be sought for establishing a mechanism to ensure that the implementation of the Doha Round Negotiations on agricultural trade liberalization does not adversely affect the availability of food aid to conflict countries, especially those that are also poor.

This study is just a first step in trying to understand the impact of food price changes on developing countries. Further work needs to be undertaken using price data for individual commodities and breaking trade data down into price and quantity effects. An understanding of these changes could then be linked to physical production changes in similar commodities in these countries. Further work will also be important in identifying the links between international and domestic prices, thus helping to measure the responses more accurately.

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APPENDIX: STATISTICAL TABLES

Table A6.1: *Classification of raw food and agricultural products in SITC Revision 3*

All Agriculture (0+1+2+4–27–28)		SITC	Product Name
Raw Food	Meats and Dairy Products	00	Live animals chiefly for food
		011	Beef, fresh, chilled or frozen
		012	Other meats, fresh, chilled or frozen
		0221	Milk & cream, fresh, not concentrated or unsweetened
		0251	Eggs in shell
	Grains and Cereals	041	Wheat and meslin
		042	Rice
		043	Barley, unmilled
		044	Maize (corn), unmilled
		045	Cereals, unmilled, others, rye, oats etc.
	Vegetables and Fruits	054	Vegetables, fresh, chilled or frozen
		0571 to 0575	Fruits, citrus etc.
		0579	Other fresh or dried fruits nes
Cash Crops	Figs and Nuts	0576	Figs, fresh or dried
		0577	Nuts, edible, fresh or dried
	Tropical Products	0611	Sugars, beet and cane, raw, solid
		0616	Natural honey
		0711	Coffee, green, roasted or sub
		0721	Cocoa beans, whole or broken, raw or roasted
		074	Tea and mate
		075	Spices
	Feeds, Oilseeds and Tobacco	0811	Hay and fodder, green or dry
		121	Tobacco, unmanufactured; tobacco refuse
		22	Oil seeds and oleaginous fruits
Other Food	Processed Food	016	Meat & edible offal, salted, smoked
		017	Meat & edible offal, prep. & preserved
		0222 to 0224	Milk & cream, preserved, concentrated
		023	Butter
		024	Cheese and curd
		0252 to 0253	Eggs not in shell
		046 to 048	Meals and flour of wheat, other cereal preps. nes
		056	Vegetable, roots & tubers, prepared or presv.
		058	Fruit, preserved and fruit preparation
		059	Fruit & vegetable juices
		0612	Refined sugars and other products
		0615	Molasses
		0619	Other sugars, sugar syrups, artificial
		062	Sugar confectionery and other sugar prep.
		0712 to 0713	Coffee roasted or extracts, essences/concentrated
		0722 to 0725	Cocoa powder, paste, butter, or wastes
		073	Chocolate & other food prep. products
		0812 to 0819	Bran, oil cake, meal fodder and other food wastes
		09	Misc. edible products and preparation
		111	Non alcoholic beverages nes
		112	Alcoholic beverages
		122	Tobacco manufactured
		41 to 43	Animal/vegetable oils and fats, processed

All Agriculture (0+1+2+4–27–28)		SITC	Product Name
Other Food	Seafood	034	Fish, fresh (live or dead), chilled, frozen
		035	Fish, dried, salted or in brine ; smoked
		036	Crustaceans and mollusks, fresh, chilled
		037	Fish, crustaceans and mollusks, prep.
Non-Food	Agricultural Raw Materials	21	Hides, skins and furskins, raw
		23	Crude rubber, crude, synthetic
		24 to 25	Cork, wood, pulp and waste paper
		26	Textile fibers, silk, cotton, jute etc.
		29	Crude animal and vegetable materials

Table A6.2: *Classification of country groups*

Country	Industrial Group (33)	Low-income Group (37)	Middle-income Group (54)	
Income	Australia	Bangladesh	Albania	Korea, Rep.
Group	Austria	Benin	Argentina	Lesotho
(124)	Belgium	Bhutan	Armenia	Macao, China
	Canada	Burkina Faso	Belarus	Macedonia, FYR
	Cyprus	Burundi	Belize	Malaysia
	Czech Republic	Cambodia	Bolivia	Mauritius
	Denmark	Central African Republic	Botswana	Mexico
	Estonia	Chad	Brazil	Moldova
	Finland	Cote d'Ivoire	Bulgaria	Mongolia
	France	Ethiopia	Chile	Morocco
	Germany	Gambia, The	China	Namibia
	Greece	Ghana	Colombia	Panama
	Hungary	Guinea	Costa Rica	Paraguay
	Iceland	Guinea-Bissau	Croatia	Peru
	Ireland	Kenya	Djibouti	Philippines
	Italy	Kyrgyz Republic	Dominican Republic	Romania
	Japan	Lao PDR	Egypt, Arab Rep.	Singapore
	Latvia	Madagascar	Georgia	South Africa
	Lithuania	Malawi	Guatemala	Sri Lanka
	Luxembourg	Mali	Guyana	Suriname
	Malta	Mauritania	Honduras	Swaziland
	Netherlands	Mozambique	Hong Kong, China	Taiwan, China
	New Zealand	Nepal	India	Thailand
	Poland	Nicaragua	Indonesia	Tunisia
	Portugal	Niger	Israel	Turkey
	Spain	Pakistan	Jamaica	Ukraine
	Slovak Republic	Papua New Guinea	Jordan	Uruguay
	Slovenia	Rwanda		
	Sweden	Senegal		
	Switzerland	Tajikistan		
	United Kingdom	Tanzania		
	United States	Togo		
		Uganda		
		Uzbekistan		
		Vietnam		
		Zambia		
		Zimbabwe		

Country	Industrial Group (33)	Low-income Group (37)	Middle-income Group (54)	
Oil	Norway *	Nigeria	Angola	Kuwait
Exporters		Yemen Rep.	Algeria	Libya
(27)			Azerbaijan	Oman
			Bahrain	Qatar
			Brunei	Russian Federation
			Cameroon	Saudi Arabia
			Congo, Rep.	Sudan
			Ecuador	Syrian Arab Republic
			Equatorial Guinea	Trinidad and Tobago
			Gabon	Turkmenistan
			Iran, Islamic Rep.	United Arab Emirates
			Iraq	Venezuela
			Kazakhstan	
Conflict		Afghanistan	Bosnia and Herzegovina	
Countries		Congo, Dem. Rep.	El Salvador	
(11)		Eritrea	Lebanon	
		Haiti	Serbia and Montenegro	
		Liberia	Timor-Leste	
		Sierra Leone		
Small		Comoros **	Antigua and Barbuda	Marshall Islands
Island States		Sao Tome and Principe **	Aruba	Micronesia, Fed. Sts.
(23)		Solomon Islands **	Bahamas, The	Palau
			Barbados	Samoa
			Cape Verde	Seychelles
			Dominica	St. Kitts and Nevis
			Fiji	St. Lucia
			Grenada	St. Vincent & Grenadines
			Kiribati	Tonga
			Maldives	Vanuatu

Sources: World Bank World Development Indicators database and UN COMTRADE Statistics.
Notes: The classification of income groups is based on 2007 GNI per capita from World Bank World Development Indicators, where low-income = US$ 935 or less, middle-income = US$ 936 – US$ 11,455; and high-income = US$ 11,456 or more.
Industrial country group is based on traditional high-income 23 OECD members and new EU-10 countries.
Oil exporters are based on at least 40 percent of fuels in total merchandise exports as reported in UN COMTRADE Statistics.
Small island states are those small economies with independent or autonomous administration, excluding colonized or dependent territories.
Civil conflict countries are drawn from countries with recent serious war outbreaks, as reported in Collier (2007).
* Excluded from oil exporter group.
** Included in the middle-income small islander group.

Table A6.3: *Classification of Sub-Saharan African countries*

All Sub-Saharan Africa (46)					
Middle-income (17)			Low-income (29)*		
Other Middle-income (6)	Oil Exporters (7)	Small Islands (4)	Other Low-income (25)		Civil Conflict (4)
Botswana	Angola	Cape Verde	Benin	Madagascar	Congo, Dem. Rep.
Lesotho	Cameroon	Comoros	Burkina Faso	Malawi	Eritrea
Mauritius	Congo, Rep.	Sao Tome and Principe	Burundi	Mali	Liberia
Namibia	Equatorial				
Guinea	Seychelles	Central African Rep.	Mauritania	Sierra Leone	
South Africa	Gabon		Chad	Mozambique	
Swaziland	Nigeria *		Cote d'Ivoire	Niger	
	Sudan		Ethiopia	Rwanda	
			Gambia, The	Senegal	
			Ghana	Tanzania	
			Guinea	Togo	
			Guinea-Bissau	Uganda	
			Kenya	Zambia	
				Zimbabwe	

Source: World Bank World Development Indicators 2008.
* Nigeria is the only low-income oil exporter; it is included in middle-income oil exporting group.

PART II
Case Studies

7

Food Prices: Household Responses and Spillovers

GUIDO G. PORTO[126]

Interest in the analysis of the poverty impacts of trade liberalization, in general, and of food prices, in particular, has been strong in the recent literature. The pioneering work of Deaton (1989) provided a useful framework—subsequently adopted by numerous researchers—to investigate the first-order impacts of price changes. One of the major concerns with this approach, however, has been the modeling of household responses. From the introduction of the framework to date, the profession has noticed the need to improve upon the static model of the first-order approximation to allow for household responses. This need has become even more obvious with the skyrocketing of food prices of the last few years. The reason is that while the first-order approximation can provide reasonable estimates of the impacts of the moderate-to-small price changes typically generated by trade reforms, such a static model misses important effects when price changes are large, as they have been recently for food.

In this chapter, my objective is to list a number of household responses that have proved important in my own research on the topic. I will distinguish three different economic phenomena. The first is household adjustment in production and consumption. When the price of good *i* changes, households are affected both as consumers and as income earners. Consumers ordinarily will consume less of the more expensive goods and more of the cheaper ones. Producers may change their supply and input decisions, and workers may reassess their labor supply. Conceptually, these responses are fairly intuitive. Technically, their estimation requires a full set of elasticities of demand and supply that can be used to improve the approximation to the welfare impact.

The second, related, phenomenon is intra-household spillovers, whereby the change in the price of good *i* can have sizeable externalities to other activities of the household, including perhaps those that are not traded. For instance, when the price of a key cash crop increases, it may be possible for a farmer to overcome potential credit constraints and thus afford upgraded investments not only in cash cropping but also in food cropping for home consumption. The issues in-

[126] Email: guido.g.porto@gmail.com. I thank Ataman Aksoy for encouraging me to write this chapter. I assume full responsibility for all errors and omissions.

volved here are conceptually similar to the more standard supply and demand elasticities—they are just additional behavioral changes of the household. However, the economics, and the econometrics, needed to measure them are much more complicated, not least because of the need to model the factors that can generate those intra-household spillovers.

The last economic phenomenon that I want to explore is inter-household spillovers. When we think about the impacts of price changes in the Deaton model, we allow price impacts to affect only pre-shock producers and consumers. However, if a price change in good i affects the local demand for labor or other local non-traded goods, then there will be inter-household or, more precisely, inter-sector, spillovers with potential repercussions on the local economy, including households who were non-producers before the shock.

When prices change as much as food prices have in the recent past, measuring only first-order approximations and neglecting some of these phenomena related to household adjustment can lead to severe biases in the assessment of the poverty/welfare impacts. In this chapter, I exemplify some of these biases by looking at two case studies. One involves food prices, consumption responses (section 2), and labor market spillovers (section 3) in Mexico. The other reviews intra-household spillovers in aquaculture among Mekong farmers in Vietnam (section 4).[127] The final section briefly summarizes the findings.

CONSUMPTION RESPONSES: DEMAND ELASTICITIES IN MEXICO

Arguably, the most natural responses to begin our investigation of household adjustments are consumption responses. When prices change, consumers purchase more of the cheaper goods and less of the more expensive ones. To assess these consumption responses, one needs to estimate a system of demand elasticities. Angus Deaton wrote extensively on this, and his seminal papers provide all the necessary discussion (Deaton, 1987, 1988, 1990, and his summary in Deaton, 1997). In practice, the estimation of a full system of demand is not trivial. Tedious data preparation work is needed, and the formulas for the estimators are complicated and require special coding. The interested reader should consult Deaton's work. Here, I give a brief overview based on Porto (2008).

For simplicity, I begin with a single-good model (that is, the household consumes only one good) and later elaborate on how to extend it. The demand for this good is modeled with an equation characterizing the budget share s_{hc} spent by household h in cluster c:

$$s_{hc}=\alpha_0+\beta_0\ln x_{hc}+\gamma_0'\mathbf{z}_{hc}+\theta\ln\pi_c+f_c+u^0_{hc}, \tag{1}$$

[127] The Mexico case study is based on Porto (2008), and the Vietnam case study on Brambilla, Porto, and Tarozzi (2008).

where x_{hc} is total household expenditure, and z_{hc} are household demographic characteristics, such as number of members and demographic composition. π_c is a price level that is assumed to be the same for all households in cluster c; this price is unobservable. f_cc is a cluster fixed effect and u^0_{hc} is a standard error term, with zero mean (for a large number of households in each cluster).

Typically, we do not observe prices but rather unit values, which are part price and part quality. This is because changes in prices and in total expenditure will cause consumers to respond partly by modifying quantities and partly by modifying quality. To model unit values, I assume that

$$\ln v_{hc} = \alpha_1 + \beta_1 \ln x_{hc} + \gamma_1' \mathbf{z}_{hc} + \psi \ln \pi_c + u^1_{hc}. \tag{2}$$

Here, unit values v_{hc} are affected by prices and by household expenditure x_{hc}. The parameter ψ captures the shading of quality to price changes, and the parameter β_1 is called the "quality elasticity" or the "expenditure elasticity of quality"; $\beta_1$would be zero if there were no quality shading, in which case $\psi = 1$. Demographics z_{hc} determine unit values, too. The error term u^1_{hc} has mean zero (for a large number of h in cluster c).

The demand model in (1) is close to the AIDS model of Deaton and Muellbauer (1980), but is not a full AIDS model. In other words, equations (1) and (2) are a representation of the regression functions of budget shares and unit values. It is not possible to be sure that these functional forms are derived from some preferences (and thus that the structural preference parameters are identified), but it is enough for (trade) policy evaluation to know the demand parameters, like price elasticities, and these are identified under the linearity assumption of the model.

Equations (1) and (2) comprise the building blocks of Deaton's model. To extend the model to a full model of demand, one needs to add equations for budget shares and unit values for each of the goods actually consumed by the household. This multi-good model of demand is quite complex and, since here I am interested mainly in the conceptual issues, I refer the reader to Deaton (1997) for the details.

In short, the estimation proceeds in two stages. The identification assumption is that every household in cluster c faces the same prices. In the first stage, thus, cluster dummies absorb the unobserved prices. In the second stage, the elasticities are estimated using the information on prices contained in the residuals from the first stage. Since the model can only identify the ratio θ/ψ , a restriction is needed to separate these two coefficients. Deaton assumes group separability in consumer preferences and adopts a definition of quality whereby more expensive goods are higher quality goods (total expenditure is the product of price, quantity, $\varepsilon_p\beta_1/\varepsilon_x$ and quality). In consequence, unit values are the product of price and quality and the response of unit values to prices, ψ, is one plus the quality shading term , which in turn depends on the quality elasticity, ε_1, the price elasticity ε_p and the income elasticity, ε_x. If $\beta_1 = 0$ or $\varepsilon_p = 0$, then there is no quality shading and ψ=1. When there is quality shading to prices, ψ<1.

To illustrate how the model works, I review results from Porto (2008), which uses data for Mexico from the Household Income and Expenditure National Surveys, ENIGH (Encuesta Nacional de Ingresos y Gastos de los Hogares). Table 7.1 reports some summary statistics for the rural modules for the 1996, 1998, and 2000 rounds. A cluster c is defined as a province-week pair: there are 720 clusters in the pooled sample, with approximately 275 in each ENIGH round. The number of households interviewed in each cluster—at least 20—is larger than typical of other surveys. There are between 3,306 and 4,684 rural households in the samples.

Table 7.1: *Summary statistics: Mexico*

	1996	1998	2000
Sample Sizes			
households	4,684	3,925	3,306
clusters	269	277	274
Corn			
avg. budget share	10.8	9.5	6.4
avg. log unit value	0.82	1.18	1.40
number of obs. in eq (3)	3,127	2,693	2,364
Wheat			
avg. budget share	3.5	3.1	2.4
avg. log unit value	2.24	2.38	2.54
number of obs. in eq (3)	3,415	2,816	2,491
Dairy products			
avg. budget share	3.6	3.8	3.1
avg. log unit value	2.01	2.38	2.54
number of obs. in eq (3)	2,254	1,947	1,881
Oils and fats			
avg. budget share	2.5	2.2	1.4
avg. log unit value	2.23	2.30	2.31
number of obs. in eq (3)	2,681	1,911	1,710
Meat			
avg. budget share	6.8	6.9	5.6
avg. log unit value	2.91	3.22	3.33
number of obs. in eq (3)	2,905	2,436	2,330
Fruits and vegetables avg. budget share	12.1	13.2	9.1
avg. log unit value	1.66	2.11	2.10
number of obs. in eq (3)	4,222	3,435	2,950
Agricultural wages avg. (log)	6.41	6.44	6.45
share of total income	61.1	62.3	59.2
number of obs. in eq (4)	2,597	1,937	1,607
Avg. per capita expend. (log)	6.21	6.14	6.54
Household size	5.2	4.7	4.6
Males	50.2	50.1	50.1
16 yrs.	38.5	35.5	34.9
> 16 and 60 yrs.	49.4	49.7	49.8
> 60 yrs.	12.1	14.9	15.2
Years of education	3.5	3.4	3.5

Note: Based on Porto (2008). Calculations based on the Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH).

On the consumption side, the expenditure data cover food and non-food items. Food products, which are the focus of my investigation here, comprise corn, wheat, dairy products, oils and fats, meat, and fruits and vegetables. Following Deaton and Grimard (1992), unit values are computed using market purchases only, but budget shares are calculated using all expenditure (purchases plus home production). Fruits and vegetables, corn, and meat are the major categories of food expenses in the sample. Notice that average unit values for all these food products increased in real terms from 1996 to 2000.[128] As a result, budget shares declined over time.

Household characteristics include the size of the family, the demographic composition, and age, gender, marital status, and educational level. These are the controls that I include in the estimation of the first stage (which also includes year dummies).

Results from the standard Deaton model are reported in columns (1) and (2) of Table 7.2. I only report own-price elasticities. As expected, all the demand elasticities are negative and statistically significant. For example, in the case of corn (on which my experiments below are based), a one percent increase in price reduces the compensated demand by 0.88 percent.[129]

Table 7.2: *Demand and wage elasticities in Mexico*

	Own-price Elasticity Deaton Model		Wage Elasticity	Own-price Elasticity Full Model	
	Uncompensated	Compensated		Uncompensated	Compensated
	(1)	(2)	(3)	(4)	(5)
Corn	−0.92	−0.88	0.40	−0.65	−0.61
	(0.05)	(0.05)	(0.19)	(0.09)	(0.09)
Wheat	−1.34	−1.32	−0.28	−1.44	−1.43
	(0.09)	(0.09)	(0.19)	(0.13)	(0.13)
Dairy Products	−1.28	−1.24	−1.10	−2.29	−2.28
	(0.12)	(0.12)	(0.18)	(0.24)	(0.24)
Oils and Fats	−0.77	−0.76	−0.48	−1.07	−1.07
	(0.34)	(0.34)	(0.65)	(0.63)	(0.63)
Meat	−1.35	−1.28	−0.45	−1.46	−1.42
	(0.22)	(0.22)	(0.27)	(0.24)	(0.25)
Fruits & Vegetables	−0.90	−0.83	1.29	−0.12	−0.01
	(0.13)	(0.13)	(0.47)	(0.30)	(0.31)

Note: Based on Porto (2008). The Deaton model is the standard model of demand as in Deaton (1987), (1988), and (1990). The full model allows for labor market responses.

[128] All data on expenditures and wages are expressed in 2002 constant prices using regional price deflators constructed by the Mexican statistical office. In Table 7.2, the definition of corn excludes “tortillas.”

[129] There are also cross-price elasticities that measure how the consumption of all the other goods would react to changes in corn prices. See Porto (2008).

CONSUMPTION ADJUSTMENTS: IMPLICATIONS

Here, I address the implications of allowing for household responses in consumption in the investigation of the welfare impact of price changes. For practical purposes, I look at the impacts of changes in the price of corn, which is one of the most important food products consumed in rural Mexico. Following the usual practice in this literature (Deaton 1989, 1997), I define the welfare effects of the price change as the compensating variation expressed as a share of total household expenditure. I work with an exogenous increase in the price of corn of 20 percent. The first-order effects of such a price increase on the consumption side (i.e. without allowing for responses at the household level) can be estimated with the product of the share of corn expenditure in total expenditure and the price change of corn. It is standard to assess distributional impacts by estimating the average welfare effects across the entire income distribution. These averages are estimated non-parametrically with locally (kernel) weighted regressions.

Figure 7.1 plots various average welfare impacts. The solid line corresponds to the first-order impact (as in Deaton 1989). Clearly, all households face consumption losses when prices rise. In the case of corn, the poor consume relatively more corn than the rich and thus they tend to suffer higher losses. For example, the losses at the bottom of the income distribution are equivalent to around 3–4 percent of household expenditure, while the losses at the top tend to be smaller than 1 percent (and actually vanish at the very top, where households consume very little corn).

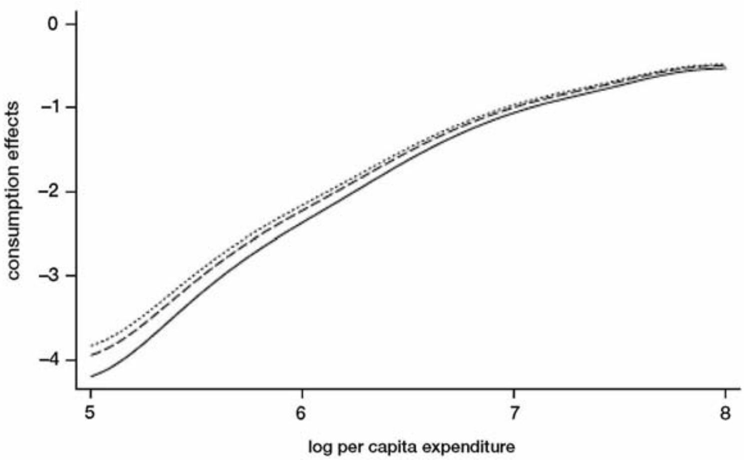

Figure 7.1: *Welfare effects with consumption adjustments: corn in rural Mexico*

Note: Based on Porto (2008). The lines represent the average welfare effects (compensating variations) as a percentage of household expenditure. The averages are estimated with non-parametric locally weighted regression using a Gaussian kernel and a bandwidth equal to 0.5. The solid line displays the first-order effects given by the product of budget shares and the price changes. The dotted line displays first- and second-order effects using the elasticities from Deaton's model of demand, while the long-dash line is based instead on the elasticities of the full model, as discussed later in this chapter.

To account for consumption responses, I need to add the second-order impacts using the own-price elasticity estimated above. Let the household expenditure function be given by $e(\mathbf{p},u)$, for prices $\mathbf{p}$ and required utility u. When the price of corn changes, a second-order Taylor expansion of e gives the following compensating variation (expressed as a share of initial expenditure):

$$cv = s_c d\ln p_c + (1/2)\varepsilon_{cc} s_c (d\ln p_c)^2, \tag{3}$$

where s_c is the budget shares and ε_{cc} is the own-price elasticity (for simplicity, cross-price effects are omitted). The average welfare effects are plotted in Figure 7.1 with a short-dotted line. It is clear that allowing for consumption responses makes the losses lower, because consumers respond to the higher corn prices by consuming less corn. Notice also that the adjustment of consumption generates larger reductions in the initial losses at the bottom of the income distribution, again because corn takes a larger share of the household budgets of the poor than of the rich.

LABOR MARKET SPILLOVERS

When the prices of agricultural goods change, the income of the household changes, especially in rural areas. To see this more formally, let a_h denote the agricultural wage income of the household. This income arises from all sorts of agricultural activities: household members may work on local farms in exchange for a wage, may work on their own farms, or may work in activities such as providing services or selling inputs to agriculture. Wages or other incomes earned in *non*-agricultural activities are denoted by i_h; for simplicity, I assume that this income i_h is exogenous. Thus, total household income x_h is given by

$$x_h = a_h + i_h.$$

My aim here is to discuss how a_h is affected by a change in agricultural prices. I assume that there are two types of agricultural activities: ag^1 are cropping activities; ag^1 are livestock activities such as animal husbandry or dairy production. There are three differentiated labor inputs in rural areas: agricultural labor of type 1 (for cropping, with total supply L^1); agricultural labor of type 2 (for livestock, with supply L^2); and mobile labor (for both cropping and livestock, with supply L^m). L^1 covers labor in activities that require agrarian skills—for planting, weeding, harvesting, and so forth of, say, corn, fruits, or vegetables. I assume there are many agricultural activities ag_g^1 of type 1; the common feature of these activities g is that they use L^1 intensively. Labor of type 2, similarly, works in several activities k such as animal husbandry, dairy production, or veterinary services. The activities of type 2 labor are denoted ag_k^2. Activities of both types 1 and 2 share mobile labor L^m. Notice that since labor types L^1, L^2, and L^m are differentiated inputs, their wages may differ. I also assume that there is a certain degree of labor immobility across regions. This is possible if there are relocation costs of rural labor. In the end, thus, labor supply in region c is given by L_c^1, L_c^2, and L_c^m, and agricultural wages will vary by region.

Figure 7.2 plots the equilibrium in a standard specific-factor framework. The horizontal size of the box measures L^m, the total labor supply of mobile labor. The curve labeled l^1 is the value of the marginal product of mobile labor in agricultural activities of type 1. As drawn, there are two such activities, say corn (good g) and fruits and vegetables (good g'). The curve l^2 represents the demand for mobile labor in agricultural activities of type 2. For simplicity, there is only one activity in sector 2, namely dairy products.

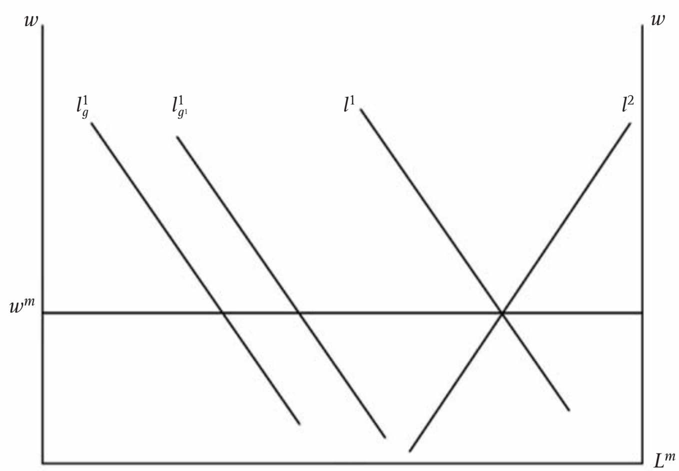

Figure 7.2: *Rural agricultural labor markets*

Note: Based on Porto (2008). The length of the horizontal box is the supply of mobile labor L^m; its wage is w^m. The curves l_g^1 and l_g^1 represent the labor demand in activities of type 1 (which use specific labor L^1). The total demand for this specific labor is l^1. The total labor demand in activities of type 2 is l^2.

In Figure 7.2, I have purposely assumed a much larger demand for labor in activities of type 1 than in those of type 2. Accordingly, an increase in prices π_g or $\pi_{g'}$ (the prices of corn or of fruits and vegetables) would shift l^1 up, causing w^m to increase. In addition, while w^1 would increase as well, w^2 would decline. In contrast, an increase in π_k (the price of dairy products) would cause w^m and w^2 to increase, but w^1 to decline.

In consequence, the situation plotted in Figure 7.2 suggests that increases in the prices of corn or fruits and vegetables would most likely cause average wage income to increase, but that increases in the price of dairy products would most likely cause wage income to decline. It is clear that, at least in theory, anything can happen and that wage income can increase or decrease.

To estimate these labor market responses, jointly with the demand elasticities, I need to add an equation to the demand model in (1) and (2). In Porto (2008), I assume that:

$$\ln a_{hc} = \alpha_2 + \gamma_2' \mathbf{m}_{hc} + \lambda \ln \pi_c + u_{hc}^2, \tag{4}$$

where $\mathbf{m}_{hc}$ are household characteristics that affect wage agricultural income. Some elements of $\mathbf{m}_{hc}$, such as education, are different from the determinants of the budget shares and unit values. u_{hc}^2 is a standard error term. The coefficient λ measures the wage-price elasticity. The estimation is as before: in the first stage, I purge unobserved prices from budget shares, unit values, and agricultural wage income and, in the second stage, I use the price information in the residuals (together with the separability restriction) to extract the elasticities of interest.

In the estimation using the rural data for Mexico (from the ENIGH), a_h is defined as wage income in agricultural activities (farm employment) plus self-employment income earned in agriculture. It includes, first, total income from the sale of production of corn, wheat, and other crops. (Unfortunately, the data do not identify the value of sales of different crops, but just the total income from all agricultural activities). It also includes wages related to agricultural activities, including wage labor on local farms, although we do not know whether these wages are earned in corn, wheat, or dairy production. Summary statistics are in Table 6.1 above. Overall, agricultural wages as defined above account for around 60 percent of the total income of rural families. Notice that real wages did not change much from 1996 to 2000.

The wage-price elasticities λ_g are shown in column (3) of Table 7.2. The prices of corn and fruits and vegetables are positively and significantly associated with household agricultural wage income: the elasticity of the corn price is 0.40, and that of the fruits and vegetables price, 1.29. In contrast, the price of dairy products is negatively associated with agricultural income, with an elasticity of –1.10. There is no statistically significant effect of the prices of wheat, oils and fats, or meat.

The "profit effect"

When income responds to prices, the estimation of the demand system needs to be revised because the demand elasticities themselves change. To see this, denote $\mathbf{c}_h$ as the vector of household consumption. Demands are given by $\mathbf{c}^h = \mathbf{c}^h(\mathbf{p}, x^h)$. Typically, total expenditure x_h is considered exogenous (both economically and statistically). In household production models like the one above, at least part of expenditure can be endogenous. In consequence, a decline, say, in prices has two sources of income effects: the usual income effect, whereby real income increases at constant relative prices, and the change in nominal income caused by the responses of agricultural wage income. In the development literature, this effect has been labeled the "profit effect" in the work of Barnum and Squire (1979) and Singh, Squire, and Strauss (1986).

The full model in the system (1), (2), and (4) delivers demand elasticities that account for this "profit effect." The own-price elasticities are reported in columns (4) and (5) of Table 7.2 above. As before, all the own-price elasticities are negative and statistically significant. Comparing Deaton's model with the full model, there are significant differences in the own-price elasticities for corn, dairy products, and fruits and vegetables. For wheat, oils and fats, and meat, the corrections suggested here are less important. In the case of corn, the corrections of the full model decrease the estimated elasticity; in the case of dairy products, they instead drive the elasticity up to –2.29. Intuitively, an increase in the price of dairy products (which reduces consumption) reduces agricultural wage income (with an elasticity of –1.1, as shown in column (3)) and causes a negative income effect that pulls the consumption of dairy products further down. An interesting case is that of fruits and vegetables, where the profit effect renders the demand elasticity statistically insignificant. This is because the increase in the price of fruits and vegetables has a strong wage effect and thus a strong positive income effect.

Implications for the welfare impacts of price changes

Allowing for labor market adjustments and spillovers has two implications for the welfare impacts of price changes. First, the compensated demand elasticities—and hence the impacts on welfare—may differ from those identified by the Deaton model, and second, household income adjusts as well.

The role of the correction of the demand elasticities is shown in Figure 7.1 above. There I plot, with long dashes, the average welfare effects of an increase of 20 percent in the price of corn with first- and second-order responses (using the compensated demand elasticity from the full model—that is, using the estimates from column (5) of Table 7.2). Since the compensated elasticity from the full model is smaller (in absolute value) than the elasticity from Deaton's model, losses are slightly larger (compare the long-dash line with the dotted line). On the consumption side these corrections imply only minor changes to the overall welfare impacts.

The introduction of the income effects raises a number of interesting issues. In the recent literature on food prices, it is often argued that net consumers will be hurt by higher prices while net producers will benefit. I argue here that this prediction may be misleading in a dynamic setting where households can adjust their income. In this case, if household responses are large enough, it is possible for some net consumers to become net producers and actually benefit from the price increase.

I illustrate this in Figure 7.3. I plot the static impacts of an increase in the price of corn with a solid line. This is the net consumer – net producer position calculated as the difference between expenditure shares and income shares (multiplied by the price change). Households at the bottom of the income distribution are net consumers and households at the top are net producers of corn. In consequence, a price increase hurts the poor but benefits the rich.

To see the role of income responses, I plot the corresponding average welfare effects with a broken line. Here, consumption choices change as indicated by the

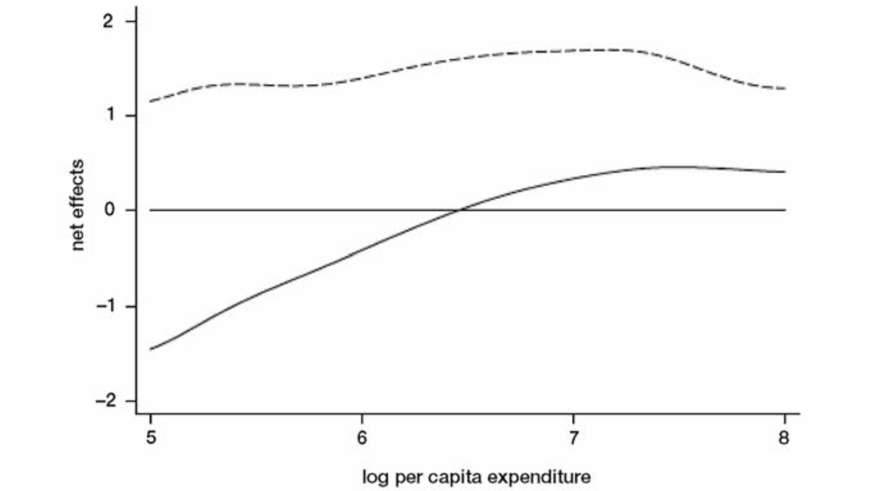

Figure 7.3: *Welfare effects with consumption adjustment and labor market spillovers: corn in rural Mexico*

Note: Based on Porto (2008). The lines represent the average welfare effects (compensating variations) as a share of household expenditure. The averages are estimated with non-parametric locally weighted regression using a Gaussian kernel and a bandwidth equal to 0.5. The solid line displays the first-order effects given by the difference between corn budget shares and corn income shares. The broken line allows for income responses and consumption responses.

own-price elasticity of the full model. In this example, the agricultural wage income of the household, including from corn production and wages from local agricultural markets, reacts to the increase in the price of corn. This response is characterized by the income shares of agricultural wages a_h and the wage-price elasticity with respect to corn prices, which was estimated at 0.4 (Table 7.2 above).

Figure 7.3 reveals that, in this scenario, an increase in corn prices would benefit households across the entire income distribution, even in the presence of sizeable consumption losses. For instance, households at the bottom of the distribution would gain around 1 percent (with consumption losses of 4 percent, their income gain is around 5 percent). The richest households would now gain around 1 percent, too (with vanishing consumption losses, the income gains are thus approximately 1 percent themselves). This is because all agricultural income and agricultural wages are responding to the price increase. Naturally, the gains will be smaller (and may become even losses for some households) when alternative definitions of wage agricultural income are used (see Porto 2008).

INTRA-HOUSEHOLD SPILLOVERS

In developing countries, there are various additional reasons (on top of consumption and labor responses) why the first-order approximation—that is, measuring welfare impacts without allowing for adjustments—may be unrealistic. Here, I want to highlight two. First, there can be sizeable costs of adjustment, which arise when the reallocation of resources from one activity to another (following a price change for instance) is costly (and involves a loss of resources). For example, know-how and other production inputs may be activity-specific, while start-up financing costs coupled with imperfections in credit markets may limit the ability to change the input allocation. Second, there may be market imperfections that generate intra-household spillovers, which occur when a change in prices affects the behavior of the household not only in that activity but also in other household activities through externalities. For instance, if cash income earned from the sale of a product is needed to finance investment, and if credit markets are imperfect, changes in prices may affect input choices and then restrict the production possibilities in one or more seasons following the price shock.

To see how these factors affect the welfare evaluation of price changes, assume that households are engaged in two economic activities, *c* and *a*, and earn incomes y^c and y^a. For simplicity, assume also that, in the initial situation, each household is endowed with fixed quantities of production factors that cannot be traded. In this case, utility maximization requires revenue maximization.[130] Figure 7.4 presents a schematic representation of the equilibrium in household production. The production possibility frontier—determined by the amount of fixed household resources—is given by the curve *ca*. For given prices, efficiency in production requires tangency between the relative prices and the slope of this frontier. At the initial prices p^1, the optimal production allocation is q^1.

In Figure 7.4, if the price of good *c* declines to p^2, production allocation will shift to q^2. To see these changes in the presence of spillovers, I assume that the production frontier shrinks after the decline in prices.[131] In Figure 7.4, the frontier shifts to *c'a'* and, at changed prices p^2, the optimal allocation point q^2 is not feasible. With adjustment costs and intra-household spillovers, the equilibrium is instead at a point such as $q^{2'}$—an allocation that is characterized by declines in total income as well as in y^c and y^a.

To explore these intra-household spillovers, I review results from Brambilla, Porto, and Tarozzi (2008), who study the anti-dumping duties imposed by the United States on imports of catfish fillets from Vietnam in 2003.[132] They use panel data from the new Vietnam Household Living Standard Surveys (VHLSS). The first round of the VHLSS was carried out in 2001–02, before the imposition

[130] See Benjamin (1992) or Singh, Squire, and Strauss (1986) for full models of optimizing agricultural households.

[131] See Atkinson and Stern (1974) for a model where the taxation needed to provide a public good produces inefficiencies that shrink the production frontier.

[132] After the U.S. lifted the embargo on Vietnam in 1994, Vietnamese catfish burst into the U.S. market, which by 2002 became their main export destination and accounted for 50 percent of total production. Faced with increased competition from cheaper Vietnamese catfish, the Association of Catfish Farmers of America (CFA) initiated a successful campaign to halt catfish imports. In 2002, the CFA launched dumping allegations. In January 2003, the U.S. Department of Commerce (DoC) ruled in favor of the dumping claim of the CFA and established tariffs ranging from 37 to 64 percent on imports of frozen catfish (that is, tra and basa) from Vietnam. In July 2003, the U.S. International Trade Commission (USITC) ratified the DoC ruling. As a result, Vietnamese exports of catfish to the U.S. plummeted to the point of being almost completely shut down.

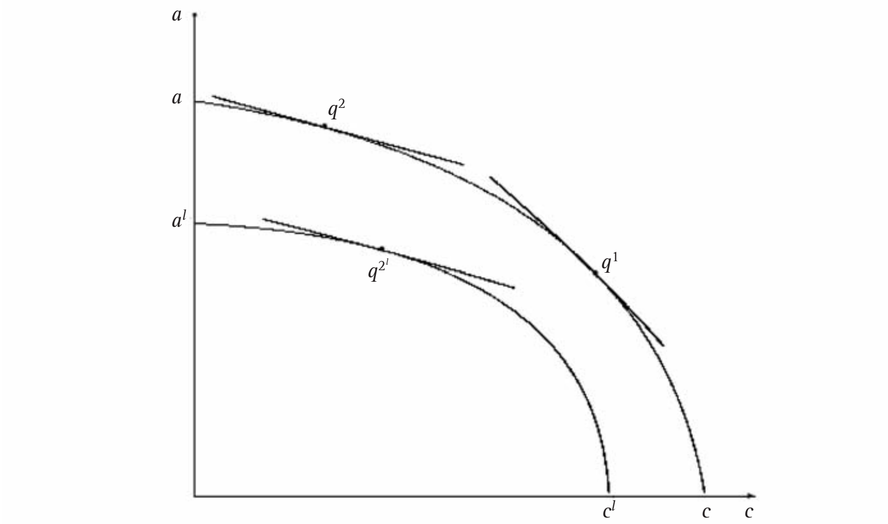

Figure 7.4: *Household production with adjustment costs and spillovers*

Note: Based on Brambilla, Porto, and Tarozzi (2008). q^1 is the initial allocation. After a drop in catfish prices, q^2 would represent the first best allocation. Instead, with adjustment costs and spillovers in both aquaculture and agriculture, the equilibrium is $q^{2'}$.

of U.S. tariffs on catfish in 2003. The second round was carried out in August 2004, after the introduction of these trade barriers.

Table 7.3 reports some key features of the data for households in the Mekong provinces that produce catfish (An Giang, Can Tho, Dong Thap, and Vinh Long) in 2002 and 2004. Panel (A) of the table shows the median level of total annual per capita income (pci) in thousand Vietnamese dong and in US PPP dollars. Income is defined as all sources of household income including earnings from agriculture (both for sale and home consumption), aquaculture, wages, livestock, silviculture, hunting, non-farm activities, and transfers. Despite the U.S. anti-dumping duty on catfish, median per capita income in the Mekong areas increased from 3,537 thousand dong in 2002 to 4,224 thousand dong in 2004. This growth rate was slightly lower than the average national-level growth rate in pci, according to VHLSS data. Panel (B) of the table reports the share of income derived from different economic activities. The main feature of these data is that the share of catfish in household income declined in the Mekong areas after the imposition of the anti-dumping duties, from 11.2 percent in 2002 to 6.8 percent in 2004.

Brambilla, Porto, and Tarozzi (2008) exploit the U.S. anti-dumping duty intervention as a case study to test for the presence of intra-household spillovers (among other topics). Their estimation strategy relies on comparing household outcomes before and after the imposition of the duty across households with different levels of exposure to the shock. Exposure to the shock is measured using

Table 7.3: *Vietnam household living standards survey: per capita income and sources of income panel sample*

	2002	2004
(A) Per capita income		
in Dong	3,537	4,224
in PPP dollars	1,247	1,489
(B) Income shares		
Catfish	11.2	6.8
Other aquaculture	1.0	1.0
Wages	26.7	28.1
Agriculture	42.5	43.2
sales	33.5	33.2
own	9.0	10.1
Livestock	9.5	10.4
Silviculture	0.6	0.6
Farm services	0.7	0.6
Other	7.8	9.3

Note: Based on Brambilla, Porto, and Tarozzi (2008). Calculations based on the panel sample of the Vietnam Household Living Standard Surveys, 2002 and 2004.

the pre-shock shares of catfish income in total income (using data from the 2002 survey round). The authors use a fixed-effects panel data model to regress various outcomes on a quadratic function of the initial shares of catfish income. Impacts are reported for households at three levels of exposure: low, at a level equal to the median share (5.5 percent); medium, at the mean level (11.2 percent); and high, for a level equal to the median share among those farmers above the sample mean (a value close to 20 percent).

The estimated impacts on total household income, per capita income, and net income (that is, total household income net of input purchases) are shown in Table 7.4. All three measures of income were negatively affected by the shock of the anti-dumping duty (the estimates being statistically significant at the 5 percent level or below). A farmer with the median pre-shock share of catfish income in total income suffered a loss of around 6.2 percent of total household income. A farmer with an average pre-shock share suffered an income loss of 11.3 percent, and a high-exposure farmer suffered even more, losing 16.9 percent. The impacts on per capita income were very similar, at 6.4, 11.7, and 17.6 percent, respectively. And the estimated impact on net income was slightly larger: 8.1 percent for low-exposure, 14.7 percent for average-exposure, and 21.7 percent for high-exposure households.

Let me review now the evidence on intra-household spillovers. Brambilla and others (2008) do not test directly for those spillovers but rather explore whether the data reveal patterns of household behavior that are consistent with them (as illustrated in Figure 7.4). They begin by assessing the response of catfish income. Results are shown in column (1) of Table 7.5. The anti-dumping duty had a large impact on catfish income for households at all levels of exposure and especially

Table 7.4: *Average impact of anti-dumping on household income: Mekong provinces*

	Total Income	Per Capita Income	Net Income
Low-exposure	−0.062**	−0.064**	−0.081***
	(0.031)	(0.030)	(0.030)
Mean	−0.113**	−0.117**	−0.147***
	(0.054)	(0.053)	(0.052)
High-exposure	−0.169**	−0.176**	−0.217***
	(0.078)	(0.077)	(0.074)
Observations	561	561	561
R2 (within)	0.162	0.155	0.158

Note: Based on Brambilla, Porto, and Tarozzi (2008). Estimates of a growth equation for total household income (columns 1), per capita household income (columns 2), and net income (columns 3). Results from the quadratic model at three different levels of exposure measured by the pre-shock shares of catfish in income: the median (low exposure), the mean (average exposure), and the median share for farmers with shares above the mean (high exposure).
Robust standard errors within parenthesis: *, **, *** denote significant at the 10%, 5%, and 1% level, respectively.

for highly exposed farmers. For instance, catfish income dropped by 36.7 percent for the median farmer, by 57.7 percent for the average farmer, and by 74 percent for the highly exposed farmer. The imposition of the duty also affected the income earned in non-catfish activities: in column (2) of Table 7.5, we see that the shock caused non-catfish income to decline by 8.7 percent, 14.5 percent, and 18.5 percent for low-, average-, and high-exposure catfish farmers. The estimated impacts on non-catfish income constitute additional evidence consistent with intra-household spillovers.

Table 7.5: *Intra-household spillovers: Mekong provinces*

	Catfish Income (1)	Non-catfish Income (2)	Catfish Investment (3)	Hours Off-farm (4)	Agricultural Investment (5)	Non-agric. Investment (6)
Low-exposure	−0.367***	−0.087**	−0.283***	−0.006	0.105*	−0.277***
	(0.042)	(0.035)	(0.058)	(0.032)	(0.065)	(0.063)
Mean	−0.577***	−0.145**	−0.464***	−0.014	0.219*	−0.456***
	(0.051)	(0.062)	(0.080)	(0.060)	(0.132)	(0.088)
High-exposure	−0.740***	−0.185***	−0.619***	−0.028	0.400*	−0.613***
	(0.047)	(0.090)	(0.086)	(0.093)	(0.224)	(0.096)
Observations	416	560	411	560	399	460
R2 (within)	0.202	0.228	0.105	0.175	0.100	0.104

Notes: Based on Brambilla, Porto, and Tarozzi (2008). Estimates of the impacts of the US anti-dumping duty on catfish income, non-catfish income, and input choices (investment in catfish, hours worked off-farm, investment in agriculture, and investment in non-agriculture activities).
Robust standard errors within parenthesis: *, **, *** denote significant at 10%, 5%, and 1% level, respectively.

Additional support for the existence of spillovers into activities other than fish farming can be derived by inspecting the impact of the anti-dumping duty shock on input choices, both in aquaculture and in non-aquaculture activities (see Figure 7.4). Results are in columns (3)–(6) of Table 7.5.

First, in column (3) of the table, we see that investment in catfish aquaculture (that is, all types of expenditures on catfish activities such as breeding, fish food, materials, repairs and maintenance, and depreciation of fixed assets) declined significantly, by 28.3 percent for low-exposure farmers, 46.4 percent for the average farmer, and as much as 61.9 percent for high-exposure farmers. Thus the shock of the anti-dumping duty seems to have caused households to disinvest heavily in catfish farming—a finding that is consistent with the large drop in catfish income reported above. Second, in column (4), we see that hours worked for wages did not change and, in column (5), that investment in agriculture responded only marginally. Households chose not to disinvest in agriculture and to maintain the hours they worked for wages. Finally, column (6) confirms that total non-agricultural investment declined, suggesting that the shock had overall investment spillovers within the household.

CONCLUSIONS

When prices change, it is always important to know how consumers and producers will be affected, whether there will welfare gains or losses, and whether the poor will be affected more than the rich. Often, the evaluation of the impacts of price changes is done in a somewhat static setting that does not incorporate responses by economic agents. This paper has reviewed a number of instances in which such static evaluations would miss sizeable impacts of price changes. In light of the large increase in food prices observed in the recent past, these biases can be quite severe.

I explored household responses in consumption to show how allowing consumers to move away from more expensive goods can ameliorate some of the losses from higher food prices. I then looked at labor market responses to claim that labor market spillovers can actually account for a large fraction of the impacts of higher food prices, especially in rural areas that specialize in food production. The case study of rural Mexico showed how households who were net consumers before a price shock can become net producers after the shock, thus benefiting from higher prices. Finally, I turned the focus to intra-household spillovers, whereby changes in the price of one commodity can affect household behavior across the whole range of household activities. There is strong evidence supporting the presence of those spillovers in the case of catfish in Vietnam, where lower catfish prices due to the imposition of a U.S. anti-dumping duty caused income and investment to decline, not only in catfish activities but also in other activities such as agriculture and livestock.

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8

Net Buyers and Sellers: Switching in Vietnam

M. ATAMAN AKSOY, JAVIER BEVERINOTTI
AND AYLIN ISIK-DIKMELIK

Most household-level studies in developing countries show that among the poor, more of the households are net food buyers than sellers, and conclude that high food prices would therefore hurt the more numerous poor net-food-buying households (Coady and others 2009; Byerlee, Myers, and Jayne 2006; Christiaensen and Demery 2007; Ivanic and Martin 2008; Warr 2005; Hoekman and Olarreaga 2007).[133] Recent price increases have focused further attention on the negative impacts on the poor, with Ivanic and Martin (2008) and World Bank (2008) arguing that the increases would swell the ranks of the poor by 100 million people.

While different studies of these relationships use different models, they all simulate the effect of food price increases on the consumption and production of households and rely on household survey data on the incomes and consumption patterns of individual households. Most of the studies do not use data on net sales to measure net purchases and sales of food, and their estimates of the effect of food price changes in practice depend on the share of food in household budgets. Simply put, households for whom food constitutes a significant share of consumption will be more affected by food price changes. As the first-stage response, households who are net sellers of food would gain from a price increase and households who are net buyers would lose. Attempts to model some responses to food price increases through changes in labor markets and consumption do not significantly change the results obtained using food shares in household budgets (Ivanic and Martin 2008; World Bank 2008). Their results show large welfare losses among poor net food buyers when food prices increase.

These studies do not take account of the possibility that many rural households may switch between being net buyers and sellers of food, depending on such factors as yields and cropping choices. Consumers can also adjust their consumption patterns by reducing their consumption of products whose prices increase.

133 Some recent studies have emphasized heterogeneity of net sales positions and the welfare impact of trade liberalization on the entire income distribution of poor rural households, rather focusing more narrowly on the poverty index (Ravallion 2006; Ravallion and Lokshin 2004; Coady and others 2009).

Porto in Chapter 7 of this volume shows that, if the substitution effects among the products grown or consumed are very large, households and farmers might change their net food buying and selling status. Switching from net buyer to net seller status and vice versa changes a household from a loser to a gainer from a food price increase and vice versa. Thus households who switch will change the net effect of a food price movement on welfare; analysis that takes account of these movements may reverse the overall conclusions that should be drawn for food price policy.

Finding out whether households actually switch between net-buying and net-selling status is often difficult. Most household surveys provide only single-period data, and the lack of consistent panel data makes it difficult to estimate changes that take place over time. Isik-Dikmelik (2006), using panel data from Vietnam, questioned whether single-period estimates of net buying status provide a realistic picture of these changes, and found that between 1993 and 1998, almost 21 percent of Vietnamese households switched between being net sellers and net buyers.

Vietnam undertook significant agricultural reforms in the 1990s as part of the "doi moi" reforms to move towards a market economy.[134] One such major reform was in rice in 1997, when the rice export quota was liberalized until it was no longer binding and internal trade restrictions on rice trading were lifted. Before the reform the flow of rice from the South (which produces a surplus) to the North was restricted, to encourage self-sufficiency in each region, and the internal trade ban coupled with the binding export quota caused rice prices to be low in the South and high in the North. The reforms of 1997 led to higher real rice prices everywhere but proportionally more in the South (Benjamin and Brandt 2004); on average nationally, rice producer prices rose by almost 50 percent and sales prices by 70 percent, while overall inflation was about 45 percent.[135] Fertilizer markets were also liberalized, which led to a decline in fertilizer prices.

The response in Vietnam to these agricultural reforms was overwhelmingly positive. Between 1993 and 1998—the years for which there are household survey data—the real incomes of rural households rose by almost 60 percent. This is unusually rapid growth for rural communities, corresponding to real annual income growth of almost 10 percent. Moreover, more than half of this rural income growth arose in agriculture (see Isik-Dikmelik 2006 and Chapter 9 in this book).

Here we extend the results of Isik-Dikmelik (2006) and analyze the pattern of net food sales and purchases by the same set of Vietnamese households over the five-year period 1993–98. We find that in addition to large numbers of households switching from net buying to net selling of rice and vice versa, more than half the households changed their net purchase (sale) levels significantly.

[134] The reforms included land titling reforms and the liberalization of fertilizer markets. See Niimi and others (2003) for a detailed description of the "doi moi" reforms. Also see Chapter 9 of this volume for a detailed analysis of Vietnam and the changes in incomes.

[135] Rice has a large share in the consumer price indexes. Non-food prices increased by less than rice prices.

We then estimate the determinants of net buying (and selling) and show that net rice buyers are richer, and are typically non-agricultural wage earners or farm households who produce cash crops.

Focusing on the characteristics of households who switched, we show that the switchers are predominantly farming households, are poorer, and tend to be marginal buyers or sellers—that is, their net sales or purchases represent only a small share of their incomes or production.

Lastly, we find that food price changes at the household level have large and significant effects on net sales, production, and consumption. This suggests that price increases would lead to higher production, and, more important, to lower consumption, thus modifying the first-order effects of price changes on welfare.

BUYERS, SELLERS, AND SWITCHERS

In the literature the definitions used for a net seller (buyer) of a commodity range from a positive (negative) net benefit ratio[136] to the presence (absence) of sales of that commodity. We think that using the presence of sales may not be a good way to identify net sellers, because some households may sell right after harvest, only to buy more of the commodity later in the year, making them net buyers. Further, when using the absence of sales to identify net buyers, it is difficult to distinguish net buyers from subsistence households (who consume as much as they produce).

The definition we use here is similar to the net benefit ratio but without the use of shares. According to our definition, a household is a net seller (buyer) of rice if its net sale of rice is positive (negative), where net sales of rice are defined as: the value of production of rice minus the value of own consumption of rice minus the value of purchased rice. In other words, a household is a net seller (buyer) if it consumes more of the good (whether self-produced or purchased) than it produces.

Table 8.1 shows the number of households in the panel and their net food buying status in the two survey years.

As expected, the majority of households in both years were net food buyers. The number of net buying households rose between 1993 and 1998 even though total rice production increased tremendously. Even in rural areas, net buyers tended to outnumber net sellers. During the five-year period, about 97 of the 4,295 households moved from rural to urban areas.[137] Among urban households, 5 percent were net sellers of rice in 1993, and by 1998, this ratio had increased to 8.6 percent. The opposite happened in rural areas, where the share of net seller households decreased somewhat, from 50.9 to 46.9 percent.

[136] Deaton (1989) introduced the concept of the net benefit ratio, which is the share of income contributed by the net sales of a commodity. It can be approximated by subtracting the share of the commodity in expenditure from the share of the value of production of the commodity in income.

[137] In this exercise, we are using the panel data, so we are looking at the same households rather than the fully representative sample.

Table 8.1: *Numbers of net buyers and sellers, 1993 and 1998*

	1993	1998
Net sellers		
Urban	41	78
Rural	1,778	1,593
Total	1,819	1,671
Net buyers		
Urban	764	824
Rural	1,712	1,800
Total	2,476	2,624
All households		
Urban	805	902
Rural	3,490	3,393
Total	4,295	4,295

The characteristics of net buyers and sellers confirm most of our expectations.[138] Households who were net buyers tended to be the poorer households in rural areas, larger households, households who were farming cash crops intensively, and households who did not own land and worked or earned wages from activities outside agriculture. Households in Vietnam's two rice bowls (Red River Delta and Mekong River Delta, which account for 60 percent of the country's rice production) were less likely to be net buyers and more likely to be net sellers. In 1993, households in living in the Central Highlands were more likely to be net buyers than those in the Northern Uplands (our base region), but by 1998 the reverse was true. Among Vietnamese households with higher incomes, those who lived in rural areas were less likely to be net buyers than those who lived in urban areas. And among urban households, those with agriculture as their main occupation were less likely to be net buyers than households in other industries such as services.

In both years, urban households were more likely to be net buyers (by 27 percent in 1993 and16 percent in 1998), as were households with large shares of cash-crop income in their total income, and households with no land in either year. In 1998, unlike in 1993, male-headed households had a higher probability of being net buyers.

Table 8.2 shows the numbers of households who switched from being net rice buyers to net sellers, and vice versa.

[138] In Tables A8.1 and A8.2 in the appendix to this chapter, probit equations are estimated for the determinants of net sellers in 1993 and 1998. Thus we estimate two equations for finding the probability of being a net buyer (or seller).

Table 8.2: *Switchers, 1993–98*

	Buyer to Seller	% Buyers	Seller to Buyer	% Sellers
Total	378	15.3	526	28.9
Rural	354	20.7	498	28
Urban	24	3.1	28	68.3

All in all, one in five households (21 percent) switched their status during these five years. More households switched from seller to buyer status (29 percent of sellers did so) than did the reverse (15 percent of buyers switched to seller status). In rural areas, almost 25 percent of households switched from one group to the other.

The significant proportion of households who switched prompts the question of the suitability of distinguishing net seller and net buyer groups when making welfare predictions. Using two separate surveys rather than panel data for the same Vietnamese households would have yielded quite a different impression of the results of a food price increase: a gain versus loss for 15 percent of households, and the opposite for 29 percent of them.

To see whether the switchers differed in some way from the households who did not switch, we look first at occupations (Table 8.3). The data suggest that switching took place mainly among the agricultural households: in 1993 in the full sample, 67 percent of households classified themselves as agricultural, while among the switchers almost 80 percent did so. This is not surprising: to become net sellers, agricultural households can adjust their production of rice, but non-agricultural households need to begin agricultural production or just adjust their consumption.

Table 8.3: *Occupational structure, 1993 (percent)*

Occupation	Buyer to Seller	Seller to Buyer	Total Net Buyers	Total Net Sellers	Total
Agriculture	77	79	57	81	67
Rural	73	77	50	79	63
Urban	4	2	7	2	4
Non-agricultural	23	21	43	19	33
Rural	21	20	21	18	20
Urban	2	1	22	1	13
Total	100	100	100	100	100

Did the incomes of the switchers differ from those of the other households? Table 8.4 shows the income status of households at the beginning of the period. The switchers in urban areas were quite few, so their averages might not be very representative. Focusing on the total and the rural numbers, we see that the average incomes of switchers were lower than those of buyers and sellers who did not change their status. Richer households, for some reason, did not seem to change either their net selling or buying status. Net buying households were also richer than net selling households.

Table 8.4: *Real income, 1993 (average, dollars)*

	Seller to Buyer	Net Sellers	Buyer to Seller	Net Buyers
Rural	6,872.4	7,999.6	6,380.8	7,912.6
Urban	10,759.6	7,839.5	6,372.3	16,011.5
Total	6,975.8	7,995.6	6,380.3	10,766.8

Finally, were the switchers marginal sellers or buyers? If switching households buy only a small amount of rice compared to their income (expenditure), or sell only a small amount compared to their production, then small changes in their demand or supply will be enough to shift these households from one category to another. Also, households whose net purchases are a large proportion of their income are more vulnerable to price increases.

Figure 8.1 shows the distribution of net-food-seller households, based on their net sales expressed as a percentage of their total rice production in 1993. Overall, the sellers who switched did tend to be those whose net sales were a relatively small proportion of their production; their average ratio of net sales to production was 35 percent, compared with 46 percent among non-switching households. But it is important to note, too, that many households who sold a *large* share of their output in 1993 had also become net buyers by 1998.

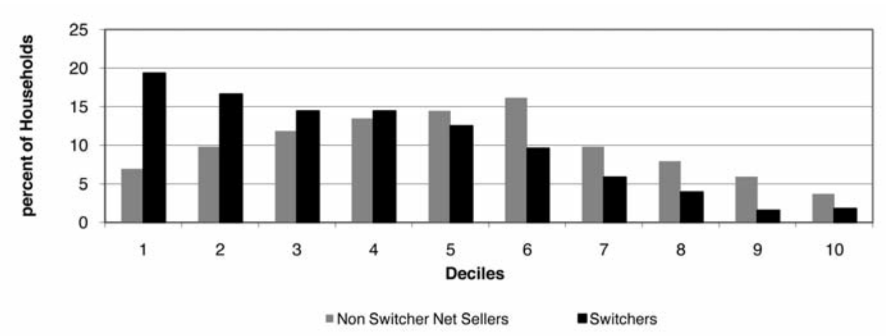

Figure 8.1: *Net sellers, 1993: switchers and non-switchers*

Note: Households in decile 1 are defined as those whose net sales were between 0 and 10 percent of their production, and households in decile 10 are those who sold between 90 and 100 percent of their production. One group, the switchers, is the net sellers in 1993 who switched to become net buyers in 1998; the other, the non-switchers, is the net sellers in 1993 who continued to be net sellers in 1998. Percentages are defined as the number of switching households in that decile divided by the total number of switching households; the same is true for non-switchers. For example, about 18 percent of the switching households in decile 1 had a net-sales-to-total-production ratio of less than 10 percent. On the other hand, only about 7 percent of the non-switching households had such a small ratio.

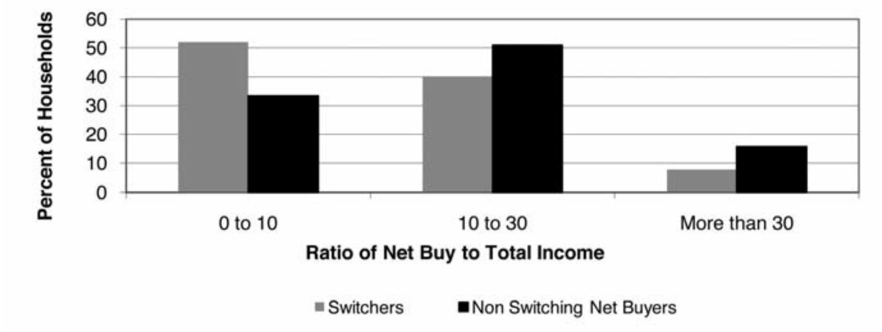

Figure 8.2: *Net buyers, 1993: switchers and non-switchers*

We look next at the households who switched from being net buyers of rice to net sellers. Such households would tend to be smaller producers who increased or moved into rice production. Figure 8.2 shows the distribution of net buyer households who switched or remained net buyers, divided into three categories: marginal net rice buyers, whose net purchases of rice were less than 10 percent of their income in 1993; buyers whose net purchases were between 10 and 30 percent of their income; and buyers whose net purchases were more than 30 percent of their income.

These results are similar to those for net sellers: the switchers tended to be marginal net buyers, whose net rice purchases were less than 10 percent of their expenditures. Some households who did not switch were very vulnerable in 1993, with net rice purchases representing more than 30 percent of their incomes.

Estimations

What household characteristics might have influenced the probability of the switch? To pursue this question we group the households into two sub-samples according to their net selling position in 1993. For each subgroup we create the switch variable, which is a dichotomous variable for those households who switched or did not switch their position. We estimate two Probit models to determine the characteristics of households who switched from net seller in 1993 to net buyer in 1998, or from net buyer in 1993 to net seller in 1998. In each model, the non-switchers constitute the control group. To minimize the problems with endogeneity, we only use variables from the initial (1993) period.

We find that among the 1993 net seller households, those with farms, those in the North Central Coast, those who had lower ratios of net rice sales to total expenditures, and those with higher incomes (expenditures) were less likely to switch from net selling to net buying. (See Tables A8.3 and A8.4.)

The more interesting case is that of the 1993 net buyer households who switched to net selling, by either extending or starting up their own rice production (Table A8.4). Compared with households living in the Northern Uplands, the 1993 net-buyer households were 10 percent less likely to switch if they lived in an urban area; more likely to switch if they lived in South Central Coast (12 percent) or the Mekong Delta (8 percent); and less likely to switch if they lived in the Central Highlands or the Southeast (7 percent and 4 percent respectively). Both marginal buyers and medium net buyers were more likely to switch than were large net buyers (the increases in probability are 16 percent and 6 percent respectively). Being landless decreased the probability of switching (by 13 percent), as did a small increase in the share of cash-crop profit in household income (by 7 percent).

Next we test whether the changes that took place in household production and consumption of rice over the five-year period help to explain the buyer/seller switches that occurred. We would expect changes to have occurred in both production and consumption, because rice prices increased both absolutely and relative to other prices over the five years, and because higher prices would tend to reduce consumption and increase production. Table 8.5 shows the averages and changes in real rice consumption and production for all rural and urban households and for households who switched their status.

Table 8.5: *Average units of real production and consumption, 1993*

	Production			Consumption		
	1993	1998	% Change	1993	1998	% Change
Rural	1,937	2,284	17.9	1,377	1,549	12.5
Urban	211	305	44.6	1,244	1,232	–1.0
Total	1,614	1,913	18.5	1,352	1,490	10.2
Seller to buyer	2,093	1,002	–52.1	1,157	1,614	39.5
Buyer to seller	1,010	2,517	149.2	1,554	1,447	–6.9

The table shows, first, that the average production increase (19 percent) was larger than the average consumption increase (10 percent). The surplus reflects the significant increase in rice production that took place in Vietnam during these five years, as well as the response of consumption to higher rice prices. Given the large rural income increase, we would expect some increase in rural rice consumption, and this in fact occurred. Meanwhile, urban rice consumption fell slightly. As expected, households who switched from seller to buyer status had large declines (of more than 50 percent) in their production, and large increases in their average consumption (40 percent). By contrast, households who switched from net buyer to net seller status had a large increase in their production (150 percent) and a small decline in their consumption (7 percent).

What about the impact of switching on household welfare? As reported above, we find that although large changes took place in the net rice buying status of households, many of the switchers were in the marginal categories, with net sales or purchases that were small compared to their incomes or production. If these households' changes in their net sale amounts were small compared to their incomes, the switch might have made little difference to their living standards, and simulation exercises would yield similar results between 1993 and 1998 despite the large number of switchers.

From Table 8.6, which shows the distribution of households with respect to their net rice sales as a share of their total expenditures, we see that only 45 percent of households stayed in the same net-sale-status categories, while 55 percent moved to other categories. For example, in 1993 there were 20 households whose net purchases (negative net sales) of rice amounted to between 60 and 100 percent of their expenditure, but by 1998, there was only one household in that category. These changes partly reflect the overall increase in net sales, but they also reflect the fact that some households changed their net sale status. In 1993 there were 126 households whose net rice sales were minus 40 to 60 percent of their expenditures (i.e. they were net purchasers, using 40 to 60 percent of their total spending to buy rice).[139] By 1998, only 15 households, or 12 percent, were in that category: of the remainder, 60 households or 48 percent had moved into the –20 to –40 percent category; 33 percent had moved two categories up, to the zero to –20 percent category; and 8 percent had become net sellers. Similar large shifts took place among those who in 1993 had been net sellers.

Table 8.6: *Net sales status, 1993 and 1998*
(households' net rice sales as a share of their total expenditure)

					1993						
	Frequency	(–1 to –0.6)	(–0.6 to –0.4)	(–0.4 to –0.2)	(–0.2 to 0)	(0 to 0.2)	(0.2 to 0.4)	(0.4 to 0.6)	(0.6 to 1)	(more than 1)	Total
	(–1 to –0.6)	0	0	1	0	0	0	0	0	0	1
	(–0.6 to–0.4)	5	15	24	6	5	2	0	1	0	58
	(–0.4 to –0.2)	7	60	267	192	47	13	7	6	2	601
1998	(–0.2 to 0)	5	41	357	1119	315	83	26	11	7	1964
	(0 to 0.2)	2	5	42	226	330	168	69	31	9	882
	(0.2 to 0.4)	0	3	5	47	105	104	39	34	8	345
	(0.4 to 0.6)	1	1	3	17	27	32	29	30	5	145
	(0.6 to 1)	0	1	2	12	29	31	22	21	13	131
	(more than 1)	0	0	4	4	11	13	15	22	22	91
	Total	20	126	705	1623	869	446	207	156	66	4218

Note: For this table, we calculate net sale values over expenditure.

Negative values show net rice purchases, and positive values show net rice sales (there were 66 households whose net sales were greater than their total expenditures in 1993). Each cell shows the number of households in each group for the two years. Intervals are generally within the 20 percentage point range. To illustrate, shifting from one category to another reflects an average change of 20 percentage points of expenditures. For example, a household in the –0.2 to –0.4 category has net purchases of rice between 20 and 40 percent of its expenditure. A 10 percent price increase would have an income effect of between 2 to 4 percent of its expenditure. If this household moves into the next category, with the –0.4 to –0.6 range, the same 10 percent rice price increase would lower its income by 4 to 6 percent—a much greater effect. A larger move would lead to much larger income effects, and change the results of the simulations.

[139] We should note that these households are very vulnerable to a price increase.

Thus Table 8.6 clearly shows that large changes took place in the net rice selling and buying status of households. Such changes in status would not have been revealed by two separate surveys of the same households—which thus would have suggested quite different conclusions about the impact of price increases on welfare. This consideration is especially important for households clustered around a poverty line. Faced with an increase in food prices, such a household surveyed in one period would appear at risk of being driven into poverty, but surveyed in another period would appear set to gain. Thus, one should be very careful in using one-period estimates to simulate the effect of food price changes.

Influence of prices on net seller status

The next issue is the importance of prices as a driver of changes in the net seller status of households. As shown by Porto in Chapter 7 of this volume, a price increase would lead producers and consumers to increase their output and reduce their consumption—other things equal. For the analysis below, we test the effect of prices on the net rice sales of individual households to see whether the households that face larger price changes have larger changes in their net rice sales. For this test, we use producer prices to deflate the value of the rice production and consumption of each household in order to estimate the real value of changes in rice production, consumption, and net sales.[140]

As can be seen from Figure 8.3, most of the rice price changes that households experienced in the five-year period were between 40 and 60 percent, but there is enough variation among them to test whether they affected net buying (or selling) behavior. In Tables A8.5, A8.6, and A8.7, we test the changes in real net selling, real production, and real consumption to see whether the magnitude of price changes had any impact. The dependent variables are the changes in real consumption, production, and net sales of rice between 1993 and 1998. The changes modeled are for the same households between the two years.

We find that for net sellers, the price change is highly significant and its coefficient is very large: households who received higher price increases for rice had larger increases in their real net sale levels. In addition to the price effect, some household

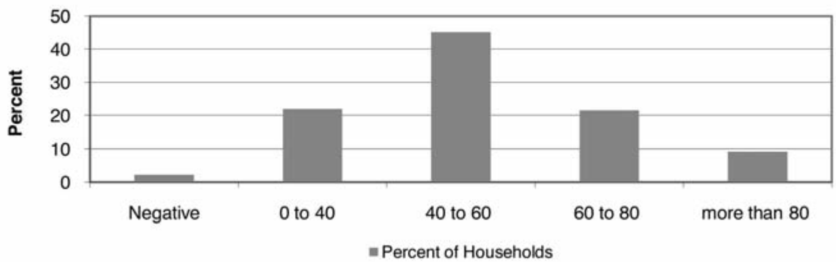

Figure 8.3: *Distribution of price changes, 1993–98*

[140] Price data were not available for all households for both periods. We filled the gaps by using regional average prices and inflation rates. Given this method, there might be some correlation between regional dummies and the price changes that were filled in.

characteristics such as having a male household head had positive effects, while the age of the household head had a negative effect. There were also regional effects.

The next step is to see whether the components of net selling are also correlated with the price changes. (Table A8.6 shows the equations for the regressions of changes in real rice production.) In these estimations, the price change is significant and has the expected sign, but it is also correlated with the regional dummies. Part of the correlation is due to the construction of household price series, and part is due to differential changes in regional rice prices.[141] The results suggest that price changes explain only a very small share of the change in production, and that variables such as weather and other agricultural variables are important determinants. Also, unlike for the other two variables—net sales and consumption—many households had no production in either one or both years. The sales and consumption variables are continuous and this is probably one of the reasons for the small and less significant effect of prices on production levels.

Finally, we analyze the relationships between household-level price changes and changes in real consumption of rice. The consumption estimates are even better than the production and net sales estimates, and the coefficient of the price variable has the expected sign and is significant. Households who experienced bigger price increases had a much smaller increase in their consumption levels.

CONCLUSIONS

The households who switched from being net food buyers to net sellers constituted 15 percent of all net food buyer households and 8.7 percent of all households. Households who switched from being sellers to buyers were 29 percent of the net seller households, and 12 percent of all households. In rural areas, the shifts were larger. For example, 21 percent of the rural net food buyer households in 1993 had become net food sellers by 1998, and 29 percent of the rural net seller households in 1993 had become net food buyers by 1998.

Most of the switchers were farmers, with lower incomes, and were marginal net sellers or buyers. As expected, these households saw much larger changes in their production and consumption of rice compared to non-switchers.

Not all the households who switched from net buyer to seller status were marginal buyers, however; among the households whose net purchases in 1993 were more than 10 percent of their expenditures, 15 percent switched from net buyer to net seller status. The pattern was similar in the case of net sellers.

We also found that food price increases had large and significant effects on households' net sales, production, and consumption over the period. This suggests that a price increase would lead to higher production, and more importantly to lower consumption, thus attenuating its first-order effects on welfare.

[141] As pointed out above, price data were not available for all households. To fill the gaps, we used regional rice prices for 1993 and 1998. If we use all regional dummies, the price variable becomes marginally significant.

Our results show quite large shifts in the net rice selling or buying behavior of households within a five-year period and one in which rice output increased significantly. Given that many net food sellers and buyers can switch between the two categories, point estimates might give misleading results. Thus one needs to interpret the exact numbers used here and in other studies with some caution.

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APPENDIX: ESTIMATION TABLES

To find out the characteristics that contribute to being a net buyer, we run a Probit regression for each year. Formally, we estimate:

$$NB_{h,t} = \phi_t + \gamma_t X_{h,t} + \eta_{h,t} \qquad (1)$$

for t=1993, 1998. The dependent variable (NB) is dichotomous, taking a value of 1 if the household is a net buyer of rice and 0 if the household is a net seller.[142] The independent variables ($X_{n,t}$) are: demographic characteristics of the household head that might be of relevance (gender, age education level); locational characteristics (region, urban-rural); and economic household characteristics (share of cash crop income, share of non agricultural wages) as they relate to assets and income structure, and income (logarithm of total income). We run a separate regression for each year, and report the results in Tables A8.1 and A8.2 respectively.

Table A8.1: *Determinants of net buyers in 1993 (PROBIT)*
Dependent variable: net buyer of rice dummy=1 if household is a net buyer; 0 if a net seller

	All	Rural	Urban
Demographics			
Household size	0.021	0.043	0.00048
	[0.00524]***	[0.00652]***	[0.00110]
Gender of HH Head (1=male)	–0.02036	0.00883	–0.00042
	[0.02476]	[0.02995]	[0.00432]
Age of HH Head	0.0013	0.0017	–0.00007
	[0.00077]*	[0.00088]*	[0.00019]
Highest Diploma Obtained by HH Head (No-diploma dummy is omitted)			
Primary	–0.04141	–0.04923	–0.00865
	[0.02588]	[0.02929]*	[0.00952]
Lower Secondary	–0.01874	–0.01694	–0.01294
	[0.02836]	[0.03228]	[0.01445]
Upper Secondary	–0.01262	–0.02994	
	[0.04638]	[0.05229]	
Technical Worker	0.10226	0.09703	
	[0.03877]***	[0.05421]*	
Vocational High	0.14957	0.15866	
	[0.03791]***	[0.05698]***	
Undergraduate	0.24138	0.26661	
	[0.04901]***	[0.10313]***	

[142] A handful of households who are neither net sellers nor net buyers are automatically excluded from the regression. Hence we can analyze this regression as the determinants of both net buyers and net sellers.

	All	Rural	Urban
Economic characteristics			
Landless dummy (1= no land)	0.47592		
	[0.01369]***		
Land size (log)		−0.13176	
		[0.01752]***	
Real Total Income (log)	−0.05335	−0.04593	0.00238
	[0.01241]***	[0.01478]***	[0.00140]
Share of cash crop income	0.48025	0.59573	0.02272
	[0.12559]***	[0.17158]***	[0.02845]
Share of non-agricultural wages	0.13008	0.14804	0.00527
	[0.04558]***	[0.05732]***	[0.00976]
Industry of HH Head Dummy (Other Industry dummy omitted)			
Agriculture	−0.10707	−0.05506	−0.04036
	[0.02871]***	[0.03755]	[0.02659]***
Manufacturing	0.00975	−0.02185	−0.00344
	[0.04927]	[0.05951]	[0.01105]
Regional Characteristics (Northern Uplands dummy omitted)			
Urban dummy	0.27636		
	[0.02500]***		
Red River Delta	−0.25503	−0.26594	
	[0.02940]***	[0.02817]***	
North Central Coast	−0.13769	−0.14337	−0.99442
	[0.03165]***	[0.03223]***	[0.13518]***
South Central Coast	−0.1295	−0.14311	−0.88332
	[0.03972]***	[0.03866]***	[0.01284]***
Central Highlands	0.2111	0.28874	
	[0.04773]***	[0.07727]***	
South East	−0.0583	−0.01896	
	[0.04480]	[0.05177]	
Mekong Delta	−0.33181	−0.2478	−0.93467
	[0.03208]***	[0.03102]***	[0.07018]***
Observations	3399	2685	253
Pseudo R2	0.2677	0.1579	0.3003

Notes: The regression is presented in the marginal effect format. The coefficients reflect the marginal effect of changes in the respective independent variable. For dummy variables the marginal effect is for the discrete change of dummy variable from 0 to 1.
Robust standard errors are in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table A8.2: *Determinants of net buyers in 1998 (PROBIT)*

Dependent variable: net buyer of rice dummy=1 if household is a net buyer; 0 if a net seller

	All	Rural	Urban
Demographics			
Household size	0.025	0.05	0.00002
	[0.005]***	[0.007]***	[0.00017]
Gender of HH Head (1=male)	0.068	0.053	0.001
	[0.023]***	[0.028]*	[0.00087]
Age of HH Head	0.001	0.001	0.00002
	[0.001]	[0.001]	[0.00003]
Highest Diploma Obtained by HH Head (No-diploma dummy is omitted)			
Lower Secondary	−0.128	−0.153	−0.00169
	[0.039]***	[0.043]***	[0.00389]
Upper Secondary	−0.127	−0.158	−0.00299
	[0.042]***	[0.046]***	[0.00625]
Technical Worker	−0.147	−0.179	0.0005
	[0.044]***	[0.047]***	[0.00109]
Vocational High	−0.064	−0.095	0.0004
	[0.058]	[0.066]	[0.00113]
Undergraduate	−0.093	−0.102	−0.00126
	[0.059]	[0.065]	[0.00534]
Masters	−0.063	−0.082	−0.0001
	[0.054]	[0.062]	[0.00202]
Doctorate	0.001	−0.045	0.00069
	[0.091]	[0.118]	[0.00090]
Economic characteristics			
Landless dummy (1= no land)	0.449		0.0318
	[0.012]***		[0.01884]***
Land size (log)		−0.153	
		[0.015]***	
Real Total Income (log)	−0.053	−0.043	0.00045
	[0.012]***	[0.016]***	[0.00048]
Share of cash crop income	0.58	0.889	0.00044
	[0.080]***	[0.118]***	[0.00244]
Share of non-ag wages	0.115	0.104	0.00027
	[0.049]**	[0.062]*	[0.00093]
Industry of HH Head Dummy (Other industry dummy omitted)			
Agriculture	−0.16	−0.127	−0.00804
	[0.023]***	[0.031]***	[0.00836]***
Manufacturing	−0.038	−0.073	−0.00187
	[0.046]	[0.057]	[0.00327]
Regional Characteristics (Northern Uplands dummy omitted)			

	All	Rural	Urban
Urban dummy	0.163		
	[0.026]***		
Red River Delta	–0.307	–0.391	–0.88112
	[0.029]***	[0.029]***	[0.15152]***
North Central Coast	–0.117	–0.16	–0.99916
	[0.031]***	[0.035]***	[0.00302]***
South Central Coast	–0.265	–0.315	–0.96828
	[0.036]***	[0.036]***	[0.06741]***
Central Highlands	0.143	0.206	
	[0.057]**	[0.080]***	
South East	–0.141	–0.118	
	[0.046]***	[0.050]**	
Mekong Delta	–0.347	–0.354	–0.98386
	[0.031]***	[0.031]***	[0.03721]***
Observations	3532	2887	530
Pseudo R2	0.2503	0.2064	0.521

Notes: The regression is presented in the marginal effect format. The coefficients reflect the marginal effect of changes in the respective independent variable. For dummy variables the marginal effect is for the discrete change of dummy variable from 0 to 1.
Robust standard errors are in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table A8.3: *Switch from seller to buyer (PROBIT)*

Dependent variable: switch from seller to buyer dummy=1 if seller in 93 and buyer in 98; =0 if seller in both 93 and 98

	All Sellers Households in 1993
Demographics	
Household size	–0. 002
	[0.007]
Gender of HH Head (1=male)	–0.007
	[0.031]
Age of HH Head	0.001
	[0.001]
Highest Diploma Obtained by HH Head (No- diploma dummy is omitted)	
Primary	0.029
	[0.033]
Lower Secondary	0.011
	[0.037]
Upper Secondary	0.055
	[0.066]
Technical Worker	0.055
	[0.071]
Vocational High	0.130
	[0.084]*
Undergraduate	0.360
	[0.263]
Economic characteristics	
Landless dummy (1= no land)	–0.144
	[0.129]
Net of sales to expenditures in 1993	–0.454
	[0.064]***
Total expenditures in 1993	–0.000
	[0.000]***
Percentage Change in Prices	–0.458
	[0.055]***
Occupation dummy (1=agricultural)	–0.057
	[0.033]*
Regional Characteristics (Northern Uplands dummy omitted)	
Urban dummy	–0.011
	[0.072]
Red River Delta	0.060
	[0.067]
North Central Coast	–0.156
	[0.053]***
South Central Coast	0.025
	[0.065]
Central Highlands	–0.050
	[0.060]
South East	0.634
	[0.125]***
Mekong Delta	0.201
	[0.072]***
Observations	1549
Pseudo R2	0.1187

Table A8.4: *Switch from buyer to seller (PROBIT)*

Dependent variable: switch from buyer to seller dummy=1 if buyer in 93 and seller in 98; =0 if buyer in both 93 and 98

	All Buyer Households in 1993
Demographics	
Household size	–0.002
	[0.003]
Gender of HH Head (1=male)	0.009
	[0.015]
Age of HH Head	–0.001
	[0.000]*
Highest Diploma Obtained by HH Head	
(No-diploma dummy is omitted)	
Primary	0.009
	[0.016]
Lower Secondary	–0.019
	[0.016]
Upper Secondary	–0.035
	[0.022]
Technical Worker	–0.044
	[0.018]**
Vocational High	–0.01
	[0.025]
Undergraduate	–0.036
	[0.027]
Economic characteristics	
Landless dummy (1= no land)	–0.127
	[0.017]***
Share of cash crop income	–0.069
	[0.037]*
Share of non-ag wages	–0.028
	[0.024]
Intensity of Net-Buy Dummy Large buyer dummy omitted)	
Marginal buyer	0.156
	[0.029]***
Medium Buyer	0.054
	[0.020]***
Regional Characteristics	
(Northern Uplands dummy omitted)	
Urban dummy	–0.094
	[0.017]***
Red River Delta	0.026
	[0.020]
North Central Coast	–0.006
	[0.019]
South Central Coast	0.122
	[0.033]***
Central Highlands	–0.075
	[0.013]***
South East	–0.039
	[0.018]**
Mekong Delta	0.081
	[0.028]***
Observations	2132
Pseudo R2	0.203

Notes: The regression is presented in the marginal effect format. The coefficients reflect the marginal effect of changes in the respective independent variable. For dummy variables the marginal effect is for the discrete change of dummy variable from 0 to 1. Robust standard errors are in brackets.

Table A8.5: *Determinants of change in real net sales*

Dependent variable: change in real net sales between 1998 and 1993

Demographics	All Households
Household size	19.98
	[16.82]
Gender of HH Head (1=male)	99.48
	[48.83]**
Age of HH Head	–3.59
	[2.44]**
Highest Diploma Obtained by HH Head (No-diploma dummy is omitted)	
Primary	–80.64
	[90.99]
Lower Secondary	–158.58
	[78.66]**
Upper Secondary	–99.93
	[100.38]
Technical Worker	–101.67
	[95.94]
Vocational High	–116.22
	[80.67]
Undergraduate	–90.91
	[160.13]
Economic characteristics	
Landless dummy (1= no land)	–384.56
	[105.88]
Real net seller in 1993	–0.205
	[0.06]***
Price variation	1235.75
	[160.83]***
Occupation dummy in 1993 (1= agricultural)	128.89
	[67.41]*
Regional Characteristics (Northern Uplands dummy omitted)	
Urban dummy	–65.4
	[88.39]
Red River Delta	279.96
	[53.45]***
North Central Coast	–120.35
	[58.67]**
South Central Coast	108.36
	[68.84]
Central Highlands	–1097.68
	[147.45]***
South East	98.94
	[188.28]**
Mekong Delta	277.3
	[138.73]**
Observations	3676
R2	0.0761

Note: The regression uses robust standard errors, in brackets.

Table A8.6: *Determinants of change in real production between 1998 and 1993*
Dependent variable: change in real rice production

Demographics	All Households
Household size	35.6
	[18.15]*
Gender of HH Head (1=male)	150.49
	[48.05]**
Age of HH Head	–13.02
	[2.52]***
Highest Diploma Obtained by HH Head (No-diploma dummy is omitted)	
Primary	–110.23
	[89.22]
Lower Secondary	–152.18
	[74.81]**
Upper Secondary	–154.20
	[96.02]
Technical Worker	–186.46
	[87.34]**
Vocational High	–154.14
	[73.95]**
Undergraduate	8.62
	[154.78]
Economic characteristics	
Landless dummy (1= no land)	–312.70
	[115.56]***
Real production in 1993	–0.197
	[0.065]***
Price variation	278.94
	[149.99]*
Occupation dummy (1= agricultural)	145.39
	[68.43]*
Regional Characteristics (Northern Uplands dummy omitted)	
Urban dummy	151.37
	[80.91]*
Red River Delta	108.25
	[55.29]*
North Central Coast	–57.94
	[50.93]
South Central Coast	155.33
	[67.1]**
Central Highlands	–935.13
	[117.58]***
South East	200.32
	[107.84]*
Mekong Delta	363.12
	[142.69]**
Observations	3676
R2	0.0659

Note: The regression use robust standard errors, in brackets.

Table A8.7: *Determinants of changes in real consumption, 1993 to 1998*
Dependent variable: change in real consumption

Demographics	All Households
Household size	128.12
	[9.15]***
Gender of HH Head (1=male)	71.77
	[22.59]***
Age of HH Head	–7.28
	[0.743]***
Highest Diploma Obtained by HH Head (No-diploma dummy is omitted)	
Primary	–19.07
	[26.91]
Lower Secondary	1.36
	[27.83]
Upper Secondary	–75.1
	[41.03]*
Technical Worker	–35.13
	[44.49]
Vocational High	–9.81
	[39.71]
Undergraduate	41.07
	[68.88]
Economic characteristics	
Landless dummy (1= no land)	–56.62
	[34.86]
Total real consumption in 1993	–0.68
	[0.028]***
Price variation	–820.78
	[68.51]***
Occupation dummy (1= agricultural)	55.60
	[24.42]**
Regional Characteristics (Northern Uplands dummy omitted)	
Urban dummy	182.92
	[31.85]***
Red River Delta	–151.45
	[27.19]***
North Central Coast	–1.54
	[32.19]
South Central Coast	58.6
	[36.2]
Central Highlands	316.94
	[85.39]***
South East	67.71
	[40.80]*
Mekong Delta	104.5
	[37.59]***
Observations	3676
R2	0.3697

Note: The regression uses robust standard errors, in brackets.

9

Trade Reforms and Welfare: An Ex-Post Decomposition of Income in Vietnam[143]

AYLIN ISIK-DIKMELIK[144]

Given the importance of rice in Vietnam's trade and agriculture, and also in consumption, the liberalization of rice in Vietnam in the 1990s provides an excellent case to study how, and through what linkages, trade policy reform affects household welfare. The implementation of trade reforms, the most noteworthy of which was the liberalization of rice, resulted in substantial improvement in welfare as evidenced by a drastic decline in poverty. Using analytical and empirical methods, this chapter examines the roles of each channel (direct vs. indirect) in this improvement for different groups of households.

Analysis of the impact of trade liberalization on household welfare generally uses one of two main approaches: either ex-ante studies, in which changes in prices due to a proposed trade liberalization are simulated and the results are used to estimate the change in household welfare (for example Ravallion 1990; Minot and Goletti 2000); or ex-post econometric studies, in which data from before and after the change in prices are used to estimate changes in household welfare (for example Dercon 2006; Nicita 2004; Porto 2003).[145]

Typically, the main impact of trade reforms on household welfare takes effect through changes in prices. The standard literature result is that net sellers of the good will benefit while net buyers will suffer in response to an increase in price.[146,147] However, as Porto (2005) shows, the net buyer approach might be

[143] A longer version of this paper has previously been published as a World Bank Policy Research Paper (Isik-Dikmelik 2006).

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[145] Under both of these approaches, both impact analysis and analysis allowing for behavioral responses have been used in the literature. Reimer (2002) provides a good survey of the literature.

[146] For instance, Mellor (1978) (examining the effect of changing relative food prices on consumers, producers, employment, and agricultural production using data from India), and Barrett and Dorosh (1996) (analyzing a change in the price of rice in Madagascar) observe that higher food prices will benefit net food sellers and hurt net food buyers.

[147] Underlying this result is the fact that in most developing countries, particularly in rural areas, households both produce and consume some of the commodities, especially major food crops.

misleading, as it only takes into account the static response to the price change. In fact, over time, changes in quantity (both from consumers, who substitute cheaper products for the one whose price has risen, and from producers, who raise their production of that product), as well as other indirect links, are likely to play big roles in determining the impact on welfare.

Using panel data for Vietnamese households for 1993 and 1998—before and after the major reform of the rice market— this chapter investigates the importance of the various links from trade reforms to household welfare over time: the first and second-round price effects, the labor market effect, and the multiplier effect. First we document the characteristics of different groups of households and the switches that took place in their status as net buyers or sellers of rice, in addition to calculating the income growth that took place for the different groups over the five-year period. We then examine the sources of the income growth for each group to understand the importance of various links in household welfare, and use multivariate regression analysis to help explain what factors contributed to the change in welfare. It is difficult to attribute all the changes in household welfare to trade reforms; however, by constructing a counterfactual without the reforms, Litchfield and others (2003) find that liberalization was a crucial component of the decline in poverty in Vietnam.

Our results show that the trade reforms benefited all groups of households. The extent of this benefit differed, depending on characteristics such as where households lived (urban-rural, regions) and whether they were net rice buyers or sellers. Poorer households experienced the most gain. Thus growth was pro-poor, as also evidenced by Vietnam's drastic decline in poverty rates during this period.

As would be expected, the importance of the various links from trade reform to household welfare varied among groups of households. The direct effect of the reform, channeled through changes in rice prices and production (hence income from rice), was most important for net rice seller households and households who lived in Vietnam's more prosperous South. The indirect effect—the effect on earnings from outside agriculture, especially non-farm business income and non-agricultural wages—contributed a significant part of the growth for all households. The labor market link was not significant for most rural households, as shown by the small (mostly negative) contributions of agricultural wages to growth. This is consistent with the fact that landless agricultural workers are not common in Vietnam; almost all rural households had rights to some land during both survey years and agricultural wages contributed only small shares of rural income. Rural households who specialized increasingly in food crop production experienced higher than average growth, as did rural households who got more of their income from non-farm business in 1998, compared to 1993. We also find that households who switched from being net sellers to net buyers had more growth than those who switched the other way.

The chapter is organized as follows. The first section reviews some theoretical considerations. Section 2 presents an overview of the Vietnamese economy and describes the characteristics of households, and Section 3 explains the methodology used. Section 4 presents the results, describing the growth that took place in income, the sources of the growth, and the household characteristics that determined growth. Section 5 concludes.

THEORETICAL CONSIDERATIONS

In general, poor households spend more than half their income on food. For the urban poor, who are net buyers of food, the expected effect of an increase in food prices will be negative. For the rural poor, the results are ambiguous: most rural households (including the poor) are producers of food, and hence the net effect will depend on whether a household is ultimately a net buyer (subsistence farmer) or a net seller (market-integrated farmer). Clearly the effect of a food price increase on poverty will be determined by the mix of net food buyers and sellers in rural and urban areas. Barrett and Dorosh (1996) state that the majority of small farmers are net food buyers and hence will be adversely affected by an increase in food prices.

Deaton (1989) examines the effect of a hypothetical change in rice prices on the distribution of real income in Thailand, using non-parametric techniques. He finds that higher rice prices will benefit all rural households, especially the middle-income ones; the extent of the benefit depends on the region. A similar study by Budd (1993) for Cote d'Ivoire shows that impacts will differ across regions and that they will be relatively small, so that the rural poor will not be much affected. Barrett and Dorosh (1996) extend that methodology and examine the effect of a change in rice prices on household welfare in Madagascar. They find that a good portion of the farmers are net rice buyers and, based on first-order effects, will likely suffer from increased rice prices. As they mention, this contradictory result (to the previous two similar studies) may reflect the fact that rice is the major staple in Madagascar, with very large budget shares, and also that Madagascar is much poorer than Thailand.

In earlier studies of Vietnam in the 1990s, Glewwe and others (2000) examine how poverty changed, and how it was affected by Vietnam's economic success; they use a multinomial logit model to estimate the movements in and out of poverty from 1993 to 1998 and the determinants of these movements, in addition to describing the poverty profile. Niimi and others (2003) build on the framework provided there and focus on the trade effects on both urban and rural populations. They also introduce and test a conceptual framework that links trade liberalization and extreme poverty. Benjamin and Brandt (2004) provide a description of the changes that occurred in Vietnam between the two surveys, and analyze the effect of these changes on the distribution of welfare.

To trace the validity of earlier theoretical results, we analyze the effect of trade reforms on the welfare of different groups of households. We use income as the measure of welfare to illustrate the link between the factor income price and employment. Compared to patterns of expenditure, which are likely to be similar among households with similar total spending levels, sources of income are more differentiated and so offer a better idea of how a given household will be affected by trade liberalization. Indeed, Van de Walle and Cratty (2003) note that a household's sources of income noticeably affect its standard of living. In analyzing the link between trade liberalization and prices and tracking the effects on other earnings (e.g. returns to production factors), we follow Winters (2002).

ECONOMY AND HOUSEHOLD CHARACTERISTICS

Vietnam is mostly rural, with four out of five people living in rural areas. The incidence of poverty is higher in rural areas than in urban (at 45 percent, versus 10-15 percent), and 90 percent of the poor live in rural areas.[148] Agriculture is still very prominent. The rural population is concentrated in the main rice-growing areas: the deltas of the Red River and the Mekong.

Geographically Vietnam can be divided into two main regions: the North, which includes the Red River Delta, and the South, which includes the Mekong Delta. The two regions differ dramatically in the structure of production and in welfare levels. Rural households in the South many of whom produce cash crops and rice for the market, are on average richer than those in the North, who on average draw more of their income from agriculture, particularly from subsistence production of rice and from livestock.

During the 1990s Vietnam took big unilateral steps in trade liberalization, becoming one of the most open economies in Southeast Asia. It also experienced a drastic decline in poverty. The reforms for liberalization started in the late 1980s with the "doi moi" reforms, which sought to gradually change the economy into a market economy. Both domestic and external trade policy reforms increased Vietnam's interdependence with the rest of the world.[149]

One of the most important of these reforms was the liberalization of trade in rice—a key commodity for the country. Vietnam is one of the world's largest exporters of rice, accounting for 9–17 percent of world rice exports.[150] Rice is also Vietnam's major staple, providing about 60 percent, on average, of the caloric intake of households (Minot and Goletti 2000). About 80 percent of households cultivate rice, on about 65 percent of the country's cultivated area, using half their rice output for subsistence. Urban households consume less rice per capita than rural ones. About 90 percent of the urban households are net rice buyers, consuming more rice than they produce, while among rural households only about half are net rice buyers. [151]

The liberalization of trade in rice that took place in 1997 had both an international and a domestic component: Vietnam liberalized the export quota on rice until it was no longer binding[152], and also lifted internal restrictions on rice trade.

[148] World Bank (1999).

[149] The land titling reform and liberalization of the fertilizer market are examples. See Niimi and others (2003) for a detailed description of the "doi moi" reforms.

[150] In the last decade, it has been the second largest exporter (by volume) of rice (Minot and Goletti 2000).

[151] A detailed description of net buyer-seller households is provided in the next section.

[152] The export quota on rice was abolished in 2001. However, the liberalization in 1997 was very effective as it practically resulted in the quota being redundant. Vietnam switched from being a net importer of rice in 1992 to being the world's second largest exporter (by volume) of rice in 1998 (Litchfield, McCulloch, and Winters (2003).

As described in Chapter 8 above, before the reform the flow of rice from the South (where more rice is produced and there is a surplus) to the North had been restricted to encourage self sufficiency in each region. The internal trade ban coupled with the binding export quota had caused low prices of rice in the South and high prices in the North. The increase in the export quota and the lifting of internal restrictions led to higher real rice prices everywhere, but proportionally more in the South (Benjamin and Brandt 2004; Niimi and others 2003; Seshan 2005).

The unit prices in Vietnam's household survey data confirm this.[153] On average nationally between 1993 and 1998, prices rose by 45.6 percent (which corresponds to a yearly inflation rate of 7.8 percent), while rice producer prices increased by 49 percent and rice sales prices increased by 67 percent (Table 9.1), pointing to an increase in real rice prices at the household level.

Table 9.1*: Changes in producer rice prices 1993–98, by region (percent)*

Rice Price	Increase in Sales Unit Prices	Increase in Production Unit Prices
Northern Uplands	57	43
Red River Delta	62	35
North Central Coast	72	52
South Central Coast	98	56
Central Highlands	130	86
South East	62	54
Mekong Delta	65	69
Total	67	49

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.
Note: The percentage change in the mean unit price of one kilogram of rice is derived from sales and production values and quantities.

Household characteristics

Table 9.2 shows some basic descriptive statistics of the panel sample for the two survey years, 1993 and 1998. Over the five-year intervening period, average household size decreased; the decline was slightly larger in urban areas. Average farm size increased by approximately 40 percent, from about 5,000 to about 7,000 square meters, and rice production increased by 30 percent. After the reforms of 1988 moved the country away from collectives and considered households as the unit of economic activity, the government started titling land to households. Although only a small percentage of the country's land is usable for cropping, only one in five households own no land, and most of those households are urban. In rural areas only 8 percent of households in 1993, and 7 percent in 1998, were landless.

[153] The analysis in this chapter is based on the panel data from the Vietnam Living Standards Survey (VNLSS) for 1992/1993 and 1997/1998, as described in the appendix to the chapter. For clarity we refer to the first round of the survey as VNLSS 1993, and the second round as VNLSS 1998.

Table 9.2: *Descriptive statistics*

	1993			1998		
	Rural	Urban	National	Rural	Urban	National
Household size	5.0	5.0	5.0	4.8	4.5	4.8
Proportion of male household heads (%)	78	57	74	77	57	73
Education of HH head (years)	5.3	6.8	5.6	6.5	8.3	6.9
Age (HH head)	45.2	47.3	45.6	47.7	50.6	48.4
Percent of people living in North	57.3	41.3	54.3	57.2	43.3	54.3
Percent of people who own no land	8.1	75.5	20.8	7.2	73.2	21.1
Land cultivated (m^2)	5353.0	3045.9	5137.1	7325.4	4674.6	7131.8
Quantity of harvested rice (kg)	2232.0	1660.6	2213.2	2912.7	2360.5	2885.4
Percent of net sellers of rice	51.0	5.1	42.4	46.9	8.6	38.9
Percent who received any technical agricultural advice	58.1	8.5	48.8	64.1	13.5	53.4

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.

Income and expenditure structure

As seen above, an important link through which trade liberalization affects household welfare is prices. A change in prices will affect the expenditure of all households and the income of those households that produce the affected commodities. Hence, the extent of the effect of trade liberalization on welfare will depend on which products are important income sources for the poor and which products are consumed extensively.

Therefore, before documenting the magnitude of the effect and estimating its determinants, we first analyze the sources from which different groups of households get their income, and what households spend their income on.[154] We define total household income to include the household's own consumption of crops that it cultivates (as these are also a source of income that finances part of the consumption); this is a net income measure that takes into account the expenses associated with farming and other enterprises owned.

For rural households, income from crops provided 41 percent of total income in 1993 (40 percent in 1998). Rice provided 24 percent (23 percent in 1998) of total income. More than half of a rural household's income from crops came from production for the family's own consumption; the proportion was higher among the poorer (subsistence-farmer) households. Livestock and wages from agriculture were other major sources of income, providing a total share of 22 percent on average, and more for the poorest households (28 percent in total). Although the share of agricultural income in total household income remained the same over the five-year period, the components changed: on average, the shares of profit from rice and other crops increased while the share of own consumption de-

[154] See Isik-Dikmelik (2006) for detailed tables and figures.

clined. While a decrease in shares may not reflect a decline in the magnitude (as incomes increased between 1993 and 1998) the increase in shares indicates a higher amount.

For urban households, the major sources of income in both years were wages and self-employment. However, agriculture still provided a notable share, especially among the poorer households (Figure 9.1). Further, only about half of this agricultural income was from own consumption, pointing to the existence of urban households who farm to provide goods for sale. In general for urban households over the five-year period, the structure of income changed relatively little even though the income level rose considerably. But among the poorest urban households, the share of business income increased while the share of own consumption declined.

Over the five-year period, as incomes rose, Vietnamese households were able to reduce the share of income they spent on food. Food items still took a large share of expenditures for households in both rural and urban areas in 1998, but this share had decreased over the period, particularly among the poorest decile in urban areas (from 76 to 65 percent) (Table 9.3).

Rice took more than one third of total spending for most households, even in 1998. But among the poorest decile the share of rice declined over the period—particularly among the poorest in urban areas (from 45 percent of total spending in 1993 to 32 percent in 1998) (Table 9.3). Among the rural poor, most of the expenditure on rice reflected own consumption, but among the urban poor, own consumption was small, at only about 5 percent of the total expenditure.

Education and health took a smaller share of spending among poorer households than richer ones. That difference was more pronounced in rural areas; and

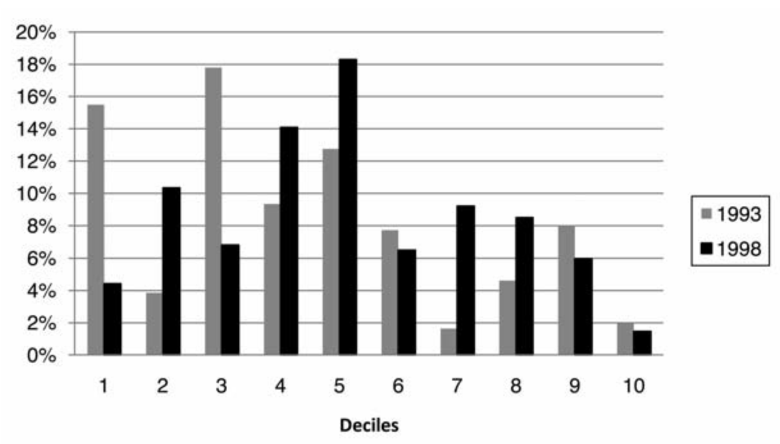

Figure 9.1: *Share of agriculture in total income (excluding own consumption), urban households*

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.

Table 9.3: *Shares of food and rice in household spending, 1993 and 1998 (percent)*

Share of food in household spending	1993	1998
Rural	67	63
Poorest decile	75	72
Urban	60	58
Poorest decile	76	65
Share of rice in household spending		
Rural	33	27
Poorest decile	43	41
Urban	17	14
Poorest decile	45	30

might reflect the fact that the poor are less likely to afford health care and also less likely to send their children to school.

Net seller-net buyer households

In the literature, the impact of a price change on household welfare is seen to depend heavily on a household's net exposure to price changes for the commodity in question. To provide comparability with other studies, we now group the households into net rice seller and buyer categories and outline their characteristics.

Just as in Chapter 8 above, we use a definition of net buyer and seller households that is similar to the net benefit ratio[155] but without the use of shares. According to our definition a household is a net seller (buyer) of rice if its net sale of rice is positive (negative), where net sales of rice are defined as: the value of production of rice minus the value of own consumption of rice minus the value of purchased rice. In other words, a household is a net seller (buyer) if it consumes more (less) of the good—whether self-produced or purchased—than it produces. According to this definition, in 1993 around 95 percent of the urban households and 49 percent of the rural households were net rice buyers (91 percent of the urban households and 53 percent of the rural households were net buyers in 1998).

As Porto (2005, and Chapter 7 above) points out, the dynamic response of households makes the definition of net buyer (seller) endogenous. This response shows itself in our data in the switches that took place between net buyers and sellers between1993 and 1998. Over that period, the number of net buyers of rice rose by 3 percent nationwide, with an increase in rural areas of about 4 percent and a decrease in urban areas of about 1 percent (Table 9.4). Though these changes may seem small they reflect a switch by some 12 percent of the Vietnamese population (and 29 percent of those who were net sellers in 1993). Meanwhile, 9 percent of the population (and 15 percent of the households who were net buyers in 1993) switched from being a net buyer to a net seller.

[155] Deaton (1989) introduced the concept of net benefit ratio, which is the share of income contributed by the net sales of a commodity. It can be approximated by subtracting the share of the commodity in expenditure from the share of the value of production of the commodity in income.

Table 9.4: *Characteristics of net rice seller and buyer households*

	Net Buyer Households						Net Seller Households					
	Rural		Urban		All		Rural		Urban		All	
	1993	1998	1993	1998	1993	1998	1993	1998	1993	1998	1993	1998
Percent of population	49	53	95	91	58	61	51	47	5	9	42	39
Real income (in 98 prices)	7596	12408	15709	23621	10097	15930	7675	12108	8837	10918	7701	12052
Real expenditure (in 98 prices)	7479	10078	12374	15849	8990	11892	7461	9852	9829	10998	7514	9905
Lower-income households (%)	50	56	13	13	39	43	44	50	22	21	43	49
Living in North (%)	54	58	42	43	50	53	61	57	29	47	60	56

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.
Notes: The proportions are calculated using the sample size in the subgroup of households. For instance, 50 percent of the rural net buyer households in 1993 are in the lowest four deciles of the population.
All the categories are year-specific, and thus include the switching between the categories within the two years.
Real income and real expenditure are in 1,000 dongs.

Some of the switchers were probably households who were close to breaking even, producing just enough rice to meet their own subsistence needs. However, a closer look reveals that some of the switchers were initially large net buyers. (A more detailed look at the determinants of net buying, selling, and switching is provided in Chapter 8 above.)

From Table 9.4, we see that on average net buyers were as wealthy as net-seller households, belying the common conjecture that net sellers of rice are richer than net buyers. And, dispelling the claim that net buyers are the urban poor, net-buyer households in urban areas tended to be less poor than net-buyer households in rural areas. And not all low-income households were net buyers.

To determine how vulnerable net buyers are to changes in the rice price, we introduce a measure of the intensity of net buying.[156] This is defined as the ratio of the value of the household's net purchases of rice to its total expenditure, and measures how much more rice the household consumes than it produces.[157] In Vietnam the intensity of net rice buying declined from 1993 to 1998, pointing to a decline in the vulnerability of net buyers (Table 9.5).

If we look at the net buying intensity among the net-buyer households only, we find that on average these households were moderate net buyers, and that their net buying proportion decreased between 1993 and 1998 (Table 9.6). This change may reflect an increase in their total expenditure or in their consumption of own-produced rice, or both. In any event, the most vulnerable group among the net-buyer households dwindled between 1993 and 1998 (Table 9.6), from 16 percent of the net buyers to 9 percent, even though rice prices increased substantially.

[156] We examine the degree of vulnerability only for net buyers of food, since it is they who are typically believed to be the most vulnerable to food price increases.
[157] Net purchase of rice = value of purchased rice + value of own consumption of rice - value of own production.

Table 9.5: *Net buying behavior of households (percent)*

	1993			1998		
	Rural	Urban	National	Rural	Urban	National
Intensity of net buying – All	−9.1	14.4	−4.7	−10.2	9.0	−6.1
Intensity of net buying – Net buyer	18.0	16.2	17.5	15.5	12.6	14.6

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.
Note: Intensity of net buying is defined as the proportion of the value of the household's net purchases of rice to its total expenditure. Large net buyers, for example, allocate more than 30 percent of their total household expenditure to net purchases of rice. The negative percentage values represent the share of net-sold rice in total expenditure, and are present since we include the net buying intensity of all households in our calculation of the mean.

Table 9.6: *Intensity of net buying, net-buyer households only (percent of net buyer households)*

	Rural		Urban		All	
	1993	1998	1993	1998	1993	1998
Marginal (0–10%)	32	38	35	44	33	40
Medium (10%–30%)	50	51	53	52	51	51
Large (>30%)	17	11	12	4	16	9

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.
Note: Intensity of net buying is defined as the proportion of the value of the household's net purchases of rice to its total expenditure. Large net buyers, for example, allocate more than 30 percent of their total household expenditure to net purchases of rice. The table shows the distribution of net buyers across the three intensity categories.

Since most of the rice farmers live in rural areas and hence the net sellers are mostly in the rural areas, too, the following discussion of differences in regional income patterns focuses on rural households.

North-South

As noted earlier, there are distinct regional differences between the Northern and Southern part of Vietnam. Broadly, rural Northern households are generally producers of subsistence crops, while rural Southern households are mostly rice farmers and cash crop producers.

For Southern households, both net buyers and sellers, the share of agricultural income in total income rose dramatically between 1993 and 1998 (Table 9.7). Real income was also rising (as discussed in the next section). For Southern net seller households, the rise in the agricultural share of income reflected an increase in agricultural sales, especially of rice but also of other commodities, while for net buyers the rise reflected an increase in sales, mainly of food crops, and a decline in the share of rice output consumed at home.

Table 9.7: *Sources of income for rural net buyer and seller households, North and South (percent of household income)*

	South				North			
	Net Buyer 1993	Rice 1998	Net Seller 1993	Rice 1998	Net Buyer 1993	Rice 1998	Net Seller 1993	Rice 1998
Income from agriculture	37	40	50	60	55	56	69	65
Sales	20	29	30	42	24	26	32	37
Own consumption	17	11	21	18	32	30	37	28
Business income	21	20	10	11	14	13	9	12
Agricultural wages	19	14	18	7	4	2	2	1
Other wages	11	11	8	8	9	9	6	8
Other income	11	15	14	15	17	20	14	15
Total income [a]	8,415	16,033	9,131	14,631	6,891	9,740	6,734	10,192

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.
[a] Total income is in 1998 prices, measured in 1,000 dongs.

As shown in Table 9.7, specialization is taking place, with net sellers in the South selling more (and cultivating more), and net buyers moving even further away from producing rice to cultivate other crops. For net seller households in the North, the share of sales in total agricultural income rose and the share of their rice production consumed at home declined. Also, their shares of business income and non-agricultural wages increased, perhaps as the result of a move out of rice production and into other sectors.

Table 9.7 also shows that while real incomes increased, the share of agricultural wages in total income declined across the board. Since rice is a labor-intensive commodity, one might expect that as rice prices rise, so will the agricultural wage rate and/or agricultural employment, provided there is surplus labor in agriculture. A closer look reveals that real income from agricultural wages increased only for net buyer households in the South (especially among the lower deciles 1-5). It declined for other households.

Hence, our results illustrate that the expected labor market effect of rice market liberalization (i.e. from higher prices to higher labor income) is small. This is consistent with the fact that more than 90 percent of Vietnam's rural households have rights to land, and that agricultural wages contribute only a small share of income. Part of the reason for the increase in the South may be that with the increase in cultivation of rice and specialization there, agricultural labor demand might have increased, leading net buyers to work on other households' farms.

METHODOLOGY

To analyze the impact of the effect of a change in price on household welfare, it is typical to use an agricultural household model (Singh and others 1986). In this model the households both produce and consume some of the goods. The effects of a trade policy change on household welfare may be traced through prices, the impact on household earnings (through factor markets), and the impact on the public sector (changes in government revenue) (Winters 2002). The effect through prices is twofold: the effect on income (direct, first-order, price effect on income from the commodity), and the (second-round) effect on expenditure through the consumption effect.

The farm household model indicates that the first-order effect of a change in food prices on household welfare will depend on the household's net trading position. Deaton (1989) formalized this with the concept of the net benefit ratio (NB), which is a proxy for the net trading position of the household, to estimate the first-order impacts of price changes on household welfare.[158] The net benefit ratio for a commodity is the difference between the production ratio (PR; value of production as a proportion of income, or expenditure) and consumption ratio (CR; value of consumption as a proportion of income, or expenditure) of that commodity. It is the proportion of net sales to income or expenditure and is approximated by the difference between the income share of the commodity and the expenditure share of the commodity. Formally, the net benefit ratio is expressed as (Deaton 1997):

$$NB = PR - CR = \frac{p_i^p q_i}{X} - \frac{p_i^c y_i}{X} \tag{1}$$

where q_i is the production and y_i is the consumption, X is the total income, and p_i^p and p_i^c are producer and consumer prices respectively.

Thus, the first-order effects, which dominate in the short run, will be positive for net-seller households and negative for net-buyer households. The second-round effects, which reflect the production response, are generally estimated by a Taylor expansion of the first-order effect (Nicita 2004).

To estimate the overall impact, first the response of production (which is ignored in the first-order effects) and the link through the labor (factor) markets should be taken into account.[159] Here the basic intuition behind the Stolper-Samuelson theorem may be applied to the labor markets. The increase in the price of a commodity increases the demand for (and hence the returns to) the factor that is used intensively in its production. Thus an increase in the price of a labor-intensive product will increase the wage rate. Alternatively, if there is surplus labor (underemployment) the effect may be felt more through increased employment than through a higher wage rate. Most developing countries have surplus rural labor, which underscores the importance of the labor market link in estimating the overall impact.

Another channel also needs to be taken into account: as the incomes of households rise, so does the demand for services and other non-farm goods, creating a spillover. This multiplier effect is hard to estimate in a partial equilibrium framework. In our analytical approach, we decompose the contribution of each income source to overall income growth in order to identify the different links discussed.

[158] Well behaved preferences and technology are assumed in this study.
[159] See Porto (2005 and Chapter 6 above) for an application to Mexico.

The decomposition shows that the growth in non-farm sources of income has been substantial in Vietnam, indicating a significant multiplier effect.

Sources of income growth

Using the panel data, we first trace the growth in income for different groups of households, and then calculate growth incidence curves to study how the overall growth is distributed across households within a group. Next we examine the changes that took place in each income source for different groups of households. As the sum of these changes constitutes the growth in real income, we are able to determine the contribution of each source to total income growth. This in turn allows us to examine the importance of each source, albeit indirectly, in response to the trade reforms in Vietnam. One must be cautious in attributing all the changes to trade reforms. Yet it has already been established that the reforms played an important role in the growth (and the decline in poverty) experienced in Vietnam between 1993 and 1998 (Litchfield and others 2003; Seshan 2005).

We group the sources of income into four main categories: agricultural income; non-farm self-employment (business) income; income from wages (agricultural and other); and other income (remittances, pensions etc.). The changes in each source of income and their role in overall growth are calculated for groups of households, taking the initial (1993) categories as the base.

Agricultural income includes livestock income, value of crops produced and consumed at home, and profit from crops. Profit from crops and own consumption of crops can be thought of as capturing the direct price and production effect of a trade policy change. The direct effect of the policy change would be felt through prices and, in the longer term, production would respond, with the volume changes reflected in the income from crops.

Analytically, the link from factor income to household earnings may be captured by agricultural wages, since labor is the only factor that most households supply, especially in rural areas. In urban areas, non-agricultural wages may represent the labor market link. In addition, the multiplier (development) effect may be signified by the contributions of business income and non-agricultural wages. The available data do not allow us to make direct estimates of these links (first and second-round price effects, labor market effect, and the multiplier effect), but with the categorization of income sources as described above we are able to make indirect estimates of each link.

Empirical approach: determinants of income and changes in welfare

Determinants of income and growth

The decomposition of income growth provides insights into the components of total income growth. In this section, we take a more formal approach and analyze the determinants of changes in household welfare. In other words, we investigate empirically who gained the most and what characteristics were associated with the growth in welfare. The empirical method we use is a reduced-form approach in which the relations between various household characteristics and income are examined.

Before analyzing the determinants of growth, we first investigate the microeconomic determinants of household welfare using a fixed-effects model.[160] Formally we estimate:

$$\log y_{h,t} = \mu_h + \varphi X_{h,t} + \omega_{ht} \tag{2}$$

where $y_{h,t}$, the dependent variable, is real household income (logarithm) and the independent variables include indicators such as the household head's demographic characteristics and education; regional dummies; whether or not the household owns any land (for the urban regression); logarithm of land size (for the rural regression); whether or not the household is a net rice seller; and the share of cash crop income as a proxy for cash crop farmers.

Incidence of changes in welfare

A reduced-form approach is adopted to estimate which household groups gained the most and which links are the most important in the effect of trade liberalization on household welfare.[161] In particular, exploiting the panel nature of our data, we use the initial household characteristics as well as the changes in endowments and characteristics as our independent variables. The dependent variable is the change in real household income. Formally, our specification is as follows:

$$\Delta \log y_{h,t} = \alpha + \beta X_{h,1993} + \delta \Delta X_h + \varepsilon_{h,t} \tag{3}$$

where X is the matrix of initial household characteristics (household size, age, education, gender, region, land etc.) and ΔX_h is the change in endowments and status (change in land, change in shares of different income sources, etc.). This specification allows us to examine the relation between endowments and the change in welfare, as well as the returns to certain assets and characteristics. It is similar to a first-differenced estimation, with the obvious inclusion of level variables in our case. Since we are using a difference model, the time-invariant factors are also controlled for.

We estimate this model using ordinary least squares, which ensures that marginal return coefficients (for the differenced variables) control for unobserved fixed effects. The standard errors are corrected for clustering and survey design (Deaton 1997); we take communes as our clusters to account for the possibility that households in the same commune may not be independent. Clearly, the issue of endogeneity, specifically with respect to the difference variables, is a potential problem. The initial characteristics of the households are predetermined, so any question about their simultaneity is avoided. For the difference variables, we

[160] The presence of fixed effects has been confirmed using a Hausman test. Although this test may have been biased due to potential measurement errors, we felt it prudent to adopt the fixed-effects model. The results using a random-effects model are presented in Isik-Dikmelik (2006). Full regression results are omitted here for the sake of brevity.

[161] The specification is similar to that of Dercon (2006).

add each separately and interpret our results cautiously without putting too much weight on the value of coefficients (because of the potential inconsistency of the estimates). However, even inconsistent estimates will give us some insight about the association between income growth and the changes in household characteristics.

RESULTS

Growth in income

The liberalization of the rice market affected the welfare of households substantially. Although Vietnam undertook other reforms to move to a market economy between 1993 and 1998, the rice reform was the one of the most important. Table 9.8 shows the effect of reforms as reflected in the changes in real income for different groups of households; it illustrates that the real income of an average Vietnamese household rose by 59 percent over the five-year period.

Table 9.8: *Changes in real income for different groups of households, 1993–98 (percent)*

Households		% Change in Real Income
All Vietnam		59
	Rural	63
	Urban	49
Seller-buyer category		
	Net buyer	60
	Net seller	56
Net buying intensity		
	Marginal buyer	52
	Medium buyer	64
	Large buyer	80
Regions		
	Northern Uplands	51
	Red River Delta	42
	North Central Coast	94
	South Central Coast	79
	Central Highlands	101
	South East	53
	Mekong Delta	58

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.
Note: Data are for the same households in both 1993 and 1998; the categories presented refer to the status of households in 1993.

A look at the sub-categories shows that rural households' income increased by more than that of their urban counterparts (by 63 percent versus 49 percent). Net buyer households had a slightly bigger income increase than did net seller households (60 percent versus 56 percent)—contrasting with the standard literature result, which only takes into account the direct first-round effects of price increases.

Moreover, contrary to the popular view that net-buyer households will lose in response to an increase in prices, we see that large net buyers (those buyers whose net purchases of rice took more than 30 percent of their total spending) experienced the largest income increase (80 percent). Among the regions, incomes seem to have increased the most in the two regions that were the poorest to begin with: North Central Coast and the Central Highlands (gains of 94 percent and 101 percent respectively).

Nationwide, the overall inequality in income did not change much in the five-year period (Table 9.9). Nonetheless, the difference between what happened in urban and in rural areas is striking: while inequality slightly declined within rural areas, it increased within urban. Looking at the difference in average income between rural and urban areas, we see a narrowing of the gap: in 1993, only 11 percent of the overall inequality was due to the rural-urban difference, and this proportion decreased to 9 percent in 1998. Three of Vietnam's main regions (North Central Coast, South East, and Mekong Delta) experienced slight declines in inequality over the period, while the others experienced increases—some of them very large, as in the Red River Delta and Central Highlands.

Table 9.9: *Measures of income inequality, by region*

	Income			
	Theil T		Gini	
	1993	1998	1993	1998
All	0.46	0.46	0.49	0.48
Rural	0.40	0.38	0.45	0.45
Urban	0.42	0.50	0.49	0.51
Within group	0.41	0.42	–	–
Between group	0.05	0.04	–	–
Regions				
Northern Uplands	0.26	0.27	0.38	0.39
Red River Delta	0.39	0.50	0.45	0.49
North Central Coast	0.38	0.35	0.42	0.42
South Central Coast	0.44	0.46	0.49	0.47
Central Highlands	0.37	0.44	0.45	0.50
South East	0.46	0.42	0.50	0.48
Mekong Delta	0.45	0.41	0.48	0.47
Within group	0.41	0.41	–	–
Between group	0.05	0.04	–	–

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.

The growth-incidence curves in Figure 9.2, which plot the average growth in income by percentiles, visually present the distribution of growth in income for different groups of households. They show that in rural areas the poorest households experienced higher growth than the average[162], reflecting the decline in rural poverty between 1993 and 1998. A broadly similar pattern can be seen in urban areas: the poorest households (lowest decile) experienced much higher income growth than the average, while the richer households experienced lower than average growth.

[162] The average growth displayed is the growth rate in mean.

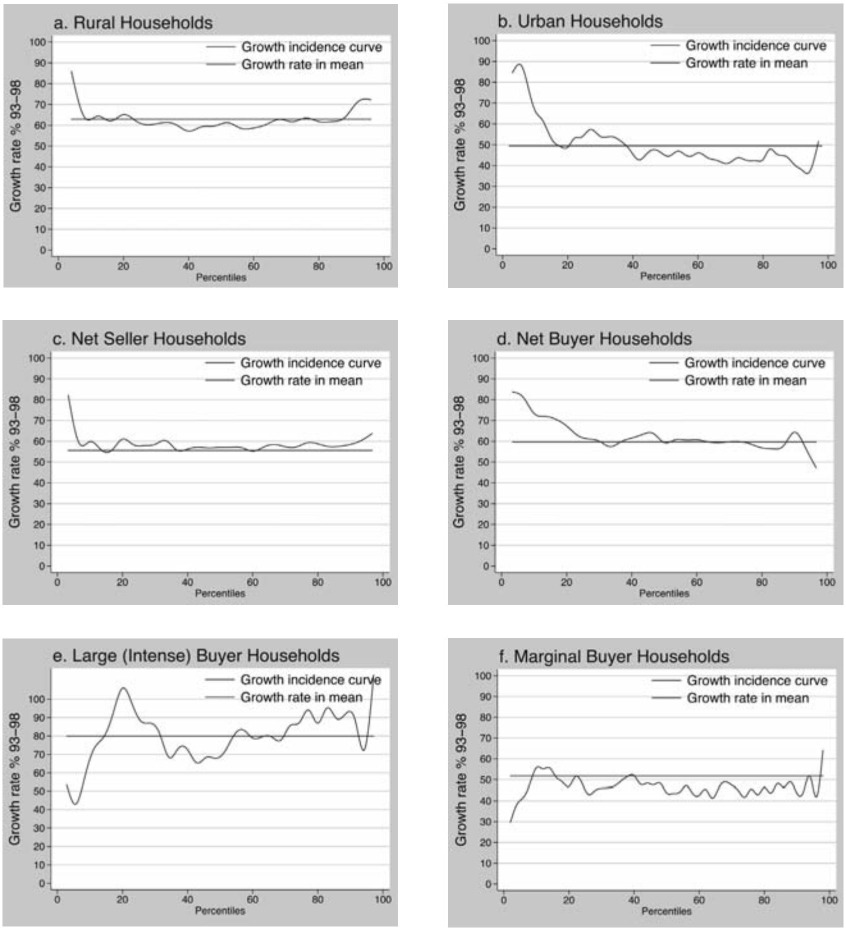

Figure 9.2: *Growth incidence curves*

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.

Income growth has definitely been pro-poor in rural areas. Similarly, poor net-buyer households experienced higher than average income growth, even though the income growth for the richer net buyers was around 55 percent. Among net seller households, the distribution of the growth was relatively even, except that growth rates were higher among the poorest.

Though the growth incidence curves summarize the growth experiences of households they do not illustrate the importance of the links from trade reform to welfare. These are discussed in what follows.

Sources of income growth

Confirming our insights from the growth incidence curves, Table 9.10 indicates that both in rural and urban areas the lower-income households experienced more income growth than middle-income and richer households.[163] Among poorer rural households, half of the growth was due to the increase in agricultural income, a significant part of which was from crop profit. Business income (i.e. non-farm self-employment) and non-agricultural wages contributed healthy amounts to overall growth for these households, underscoring the importance of development effects. For lower-income households in urban areas, the driving forces for growth were business income and non-agricultural wages, along with remittances. (See the appendix to this chapter for a detailed decomposition.)

Rural net buyers and rural households in the South are the only groups for whom agricultural wages made a positive contribution to income growth. As noted earlier, the almost universal access of rural Vietnamese to land, and the fact that laborers in agriculture are mostly net buyers from rural areas, may explain why the effect of an increase in the rice price on agricultural wages and employment is so limited.

For net sellers in rural areas, the biggest contributors to income were profit from crops—more than half of which came from rice—followed by business income and "other" income. Poorer net sellers experienced higher growth than their middle-income and richer counterparts.

Also notable is the role of cash crop income in the rural South. For rural households in this region, like all other groups of rural Vietnamese households we distinguish, profit from crops provided the largest component of the income growth that took place. But in the rural South, on average, cash crops and food crops other than rice each contributed almost as much as rice, with cash crops playing a larger role than rice for the poorer households. This indicates the introduction of cash crops (such as coffee) in rural areas and specialization.

The ex-post decomposition allows us to observe the various channels that were discussed previously. However, we refrain from attributing all the observed changes to the change in trade policy. Below we undertake more formal empirical analysis to explore the effects of certain household characteristics on income growth.

Determinants of income and changes in welfare

Exploiting the panel nature of the data, we estimate the determinants of income using the fixed-effects model described above. The main findings match our expectations.[164] Households with a larger share of cash crop income had higher household income, other things equal. Net seller households had more income

[163] The deciles in these analyses are constructed using per capita adjusted income, and 1993 characteristics (deciles, subgroups) are used to trace the growth for the same households. The lowest 40 percent in a given group corresponds to all the households who were in the group and also in the lowest four deciles of the overall income distribution.

[164] For detailed regression results on the determinants of income, see Isik-Dikmelik (2006).

Table 9.10: *Decomposition of the income growth of 1993–98 (percent of household income growth)*

Household Category	Agricultural Income	Non-Farm Self Employment	Non-Agr. Wage Income	Other Income	Total Growth	% of the Sub-Sample in the Population
RURAL						
Lowest 40%	50	10	5	10	75	38
Middle 40%	26	10	6	15	57	33
Top 20%	23	12	11	12	59	10
Total	35	10	6	12	63	81
URBAN						
Lowest 40%	7	28	14	24	73	3
Middle 40%	8	22	18	14	62	7
Top 20%	1	15	12	14	43	9
Total	3	18	13	15	49	19
RURAL-NET BUYER						
Lowest 40%	46	9	10	12	77	20
Middle 40%	29	11	8	19	66	15
Top 20%	24	16	15	14	69	5
Total	36	11	10	14	71	40
RURAL NET SELLER						
Lowest 40%	54	10	–1	9	72	18
Middle 40%	23	9	5	13	50	18
Top 20%	20	9	9	9	46	5
Total	33	10	3	11	56	41
RURAL SOUTH						
Lowest 40%	65	12	6	12	95	13
Middle 40%	37	12	10	18	77	15
Top 20%	28	15	14	13	70	7
Total	44	13	8	15	79	35
RURAL NORTH						
Lowest 40%	40	8	6	9	63	25
Middle 40%	15	7	4	12	39	18
Top 20%	12	7	5	6	31	3
Total	25	8	5	10	48	47

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.
Note: The contribution of each income source is presented such that their sum equals the total income growth experienced by those households.

than net buyer households in urban areas, but not in rural. Across all groups of households, the returns to education were significant (the more education the household head had, the higher was household income), and the age of the household head, which is used as a proxy for experience, also had a positive and significant effect on income. Households in manufacturing and other non-agricultural sectors had higher incomes, on average, than households in agriculture, underscoring the relative poverty of farmers. Further, male-headed households had 14 percent more household income, on average, than female-headed. The regional effects are picked up under the fixed effects and hence are not significant as independent variables in the estimation.

In investigating the determinants of changes in welfare, the estimation of equation (3) for urban and rural households yields results that are mostly intuitive and reinforce our earlier findings.[165] However, as mentioned earlier, due to potential simultaneity with respect to change variables, we focus on the associations without arguing a causal relationship.

We find that neither the age nor the gender of the household head affected the growth of income in urban areas, though age positively affected the growth in rural. The initial educational level of the household—although interestingly only at the lower secondary and undergraduate levels—positively affected income growth. From the rural regression, regional variables show that households who lived in the Central Coasts (both North and South), Southeast, and the Mekong Delta experienced higher growth in income than households in the Northern Uplands—a finding that is consistent with our earlier growth figures.

Having a larger land area to farm seems not to significantly affect the growth in household income, though the returns to land are mildly significant for rural households. Holding everything else constant, we find that households who were initially food crop producers had higher income growth.

For rural households, specializing increasingly in food crop production over the five years did not affect their total income growth. But placing growing reliance on non-farm business income and non-agricultural wages had positive and significant effects on their income growth. This is not surprising, given the results of the decomposition, and it emphasizes the significance of the multiplier effect. Further, households who switched from being net buyers of rice to net sellers gained more than households who switched from being sellers to buyers.

The results for urban areas are similar to the rural estimates but with a few important differences. The regional effects are not significant for urban households, except in the Red River Delta region. Being initially a food crop producer in an urban area had no significant effect on the growth of household income. Changes in the structure of household income, namely changes in the shares of income from food crops, cash crops, or business, do not suggest a clear interpretation, potentially because of correlation among these variables.

CONCLUSION

Our results show that growth in Vietnam in 1993–98 was broad-based and pro-poor. Within every category of households analyzed, the households who were poorer experienced higher income growth. In addition, net-rice-buyer households gained more than net-seller households, indicating that the first-order effects prevalent in the literature are not good representations of the ultimate effect. Further, a significant amount of switching between the net seller and net buyer groups of households indicates that using net seller-buyer categories may not accurately depict the effect of a food price change on households.

[165] The changes in income-related variables are added separately to determine the association of each with the growth that took place. Various models (which correspond to each of the change variables being added) have been estimated, and their full results are reported in Isik-Dikmelik (2006).

Decomposition of the growth that took place in income in response to the reforms of rice trade indicates that the two most important links for rural households were agricultural income (showing the direct effect of the rice price changes) and non-farm employment (business income and wages). The direct effect was most important for net-seller households and for households living in the South. The development effect—the spillover effect of changes in income resulting from increased demand for local goods and services—proved to be a significant part of the growth. Business income and non-agricultural wages, along with remittances, were the driving forces for the growth experienced by urban households, underscoring the contribution of the development effect. The labor market link was not significant except for rural net buyers and for households in the rural South.

The results of the empirical analysis both confirm our earlier findings and point to other factors. For instance, income was significantly larger for those households with greater shares of cash-crop income in total income. Further income gains were larger for rural households with greater shares of non-farm business income and non-agricultural wages. These results indicate strong associations though they do not prove a causal relationship, given the potential simultaneity of the change variables.

Overall, the results indicate that Vietnam's trade reforms benefited everybody but especially the poor. The evidence on the magnitude of the spillover effects, often ignored in simulations, underscores the need for a broader model to successfully simulate the impact of trade liberalization.

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APPENDIX

Data

The analysis in this chapter is based on the panel data from the Vietnam Living Standards Survey (VNLSS) for 1992/1993 and 1997/1998. The VNLSS is a national household-level survey providing detailed information on household activities (agriculture, non-farm enterprise, etc.), in addition to general characteristics (health, education etc.). It also includes a community survey that provides information about rice prices and locational characteristics.

The first round of VNLSS was conducted from September 1992 to October 1993. It includes 4,800 households with a self-weighted sample design, and two strata: urban and rural. In the second round of VNLSS, all the initial households were sought out, along with some 1,200 additional households, for interview, for a total of 6,000 households.

Of the 4,800 households who were interviewed in the first round, 4,305 (around 90 percent) could be interviewed in the second round, and it is this panel of households that we use in our analysis. Since the original 4,800 households were representative of the country, and the panel includes around 90 percent of these households, we consider the panel as representative and do not deal with the weighting issues. Van de Walle and Cratty (2003) also contend that panel households are representative of the nation. For clarity we refer to the first round of the survey as VNLSS 1993, and the second round as VNLSS 1998.

Table A9.1: *Detailed Decomposition of Growth in Total Income, 1993–98 (percent)*

	Profit from rice	Profit from food crops	Profit from cash crops	Other Agriculture	Net Livestock Income	Non-Farm self employment	Agricultural wages	Non-Agricultural Wages	Remittances	Other Income	Total Growth	% of the sub-sample in the population
RURAL												
Lowest 40%	6%	5%	6%	19%	13%	10%	−2%	7%	3%	7%	75%	38%
Middle 40%	7%	4%	3%	5%	7%	10%	0%	6%	5%	11%	57%	33%
Top 20%	7%	9%	4%	−1%	4%	12%	1%	10%	7%	4%	59%	10%
Total	7%	5%	5%	9%	9%	10%	−1%	7%	4%	8%	63%	81%
URBAN												
Lowest 40%	3%	1%	−1%	3%	0%	28%	−3%	17%	14%	10%	73%	3%
Middle 40%	2%	1%	1%	1%	3%	22%	−1%	19%	4%	10%	62%	7%
Top 20%	1%	0%	0%	2%	−1%	15%	−1%	13%	7%	8%	43%	9%
Total	1%	0%	0%	1%	0%	18%	−2%	15%	7%	8%	49%	19%
RURAL–NET BUYER												
Lowest 40%	3%	6%	8%	18%	11%	9%	2%	8%	4%	7%	77%	20%
Middle 40%	3%	3%	6%	7%	8%	11%	0%	8%	6%	13%	66%	15%
Top 20%	2%	8%	6%	0%	7%	16%	1%	13%	11%	3%	69%	5%
Total	3%	5%	7%	11%	10%	11%	1%	8%	5%	9%	71%	40%
RURAL–NET SELLER												
Lowest 40%	10%	5%	5%	19%	16%	10%	−6%	6%	3%	6%	72%	18%
Middle 40%	9%	5%	1%	2%	6%	9%	0%	5%	4%	9%	50%	18%
Top 20%	11%	9%	3%	−3%	0%	9%	1%	8%	4%	5%	46%	5%
Total	9%	5%	3%	7%	9%	10%	−3%	5%	3%	7%	56%	41%
URBAN–NET BUYER												
Lowest 40%	1%	1%	−1%	4%	0%	29%	−4%	18%	15%	12%	76%	2%
Middle 40%	1%	1%	1%	1%	2%	22%	−2%	20%	4%	10%	61%	6%
Top 20%	0%	0%	0%	1%	−1%	14%	−1%	13%	7%	8%	41%	9%
Total	1%	1%	0%	1%	0%	17%	−2%	15%	7%	9%	48%	18%

	Profit from rice	Profit from food crops	Profit from cash crops	Other Agriculture	Net Livestock Income	Non-Farm self employment	Agricultural wages	Non-Agricultural Wages	Remittances	Other Income	Total Growth	% of the sub-sample in the population
URBAN-NET SELLER												
Lowest 40%	10%	−1%	2%	−15%	1%	24%	2%	11%	9%	−12%	31%	0.2%
Middle 40%	22%	1%	8%	−6%	20%	34%	4%	13%	−4%	9%	102%	0.5%
Top 20%	4%	−1%	3%	−8%	−8%	2%	−1%	−1%	3%	−1%	−8%	0.3%
Total	12%	−1%	4%	−11%	4%	20%	1%	8%	2%	0%	38%	1.0%
RURAL-SOUTH												
Lowest 40%	11%	9%	14%	20%	11%	12%	−1%	7%	2%	10%	95%	13%
Middle 40%	14%	10%	6%	2%	5%	12%	2%	8%	5%	14%	77%	15%
Top 20%	11%	11%	7%	−4%	3%	15%	2%	12%	9%	4%	70%	7%
Total	12%	10%	9%	6%	7%	13%	0%	8%	5%	10%	79%	35%
RURAL-NORTH												
Lowest 40%	4%	4%	3%	16%	13%	8%	−1%	7%	4%	5%	63%	25%
Middle 40%	3%	0%	2%	4%	7%	7%	0%	4%	4%	8%	39%	18%
Top 20%	2%	3%	1%	4%	3%	7%	0%	6%	3%	3%	31%	3%
Total	3%	2%	2%	9%	9%	8%	−1%	5%	4%	6%	48%	47%
RURAL-MARGINAL NET BUYER												
Lowest 40%	5%	4%	6%	18%	18%	13%	1%	4%	6%	7%	82%	5%
Middle 40%	4%	4%	4%	−4%	9%	6%	−1%	4%	4%	6%	36%	5%
Top 20%	3%	5%	14%	3%	11%	20%	2%	13%	14%	4%	90%	2%
Total	4%	4%	7%	6%	13%	12%	0%	6%	6%	6%	65%	13%
RURAL-MEDIUM NET BUYER												
Lowest 40%	3%	5%	10%	14%	13%	8%	4%	5%	2%	7%	71%	9%
Middle 40%	3%	−1%	8%	15%	9%	19%	2%	12%	7%	19%	93%	8%
Top 20%	1%	10%	0%	−2%	3%	11%	0%	12%	9%	2%	47%	3%
Total	3%	3%	8%	12%	10%	13%	2%	8%	5%	11%	74%	20%
RURAL-LARGE NET BUYER												
Lowest 40%	2%	8%	8%	24%	1%	7%	1%	17%	6%	8%	84%	6%
Middle 40%	1%	16%	8%	13%	2%	−11%	−1%	2%	6%	10%	47%	1%
Top 20%	–	–	–	–	–	–	–	–	–	–	–	0%
Total	2%	10%	8%	21%	1%	3%	0%	14%	6%	9%	74%	7%

	Profit from rice	Profit from food crops	Profit from cash crops	Other Agriculture	Net Livestock Income	Non-Farm self employment	Agricultural wages	Non-Agricultural Wages	Remittances	Other Income	Total Growth	% of the sub-sample in the population
URBAN-MARGINAL NET BUYER												
Lowest 40%	53%	6%	0%	−26%	42%	257%	25%	−7%	−1%	12%	360%	0%
Middle 40%	7%	3%	1%	2%	19%	42%	0%	33%	7%	8%	122%	1%
Top 20%	1%	0%	0%	2%	0%	14%	0%	11%	5%	5%	37%	5%
Total	1%	0%	0%	1%	2%	16%	0%	11%	5%	5%	42%	6%
URBAN-MEDIUM NET BUYER												
Lowest 40%	1%	1%	−1%	0%	1%	9%	−10%	16%	14%	3%	33%	1%
Middle 40%	1%	1%	1%	2%	0%	16%	−2%	19%	3%	9%	50%	5%
Top 20%	0%	0%	0%	1%	−3%	17%	−2%	18%	9%	13%	52%	3%
Total	0%	0%	0%	1%	−1%	16%	−3%	19%	7%	10%	50%	9%
URBAN-LARGE NET BUYER												
Lowest 40%	0%	3%	0%	12%	0%	40%	0%	18%	15%	23%	110%	1%
Middle 40%	0%	3%	0%	0%	−3%	44%	1%	9%	10%	15%	79%	1%
Top 20%	0%	6%	0%	12%	−21%	0%	0%	−21%	63%	104%	143%	0%
Total	0%	3%	0%	8%	−2%	41%	0%	15%	14%	21%	100%	2%

Source: Author's calculations using VNLSS 1993 and VNLSS 1998.

10

Trade Reforms, Farm Productivity, and Poverty in Bangladesh

IRINA KLYTCHNIKOVA AND NDIAMÉ DIOP[166]

Trade liberalization measures undertaken in the 1980s and 1990s opened new markets for small-scale irrigation equipment in Bangladesh and led to substantial growth in rice productivity. In rural areas, non-farm activities grew in importance as sources of livelihood and income (World Bank 2004). Between 1991 and 2000, Bangladesh's real GDP increased by 60 percent. But despite this impressive growth performance, poverty in Bangladesh declined by only 9 percent in the 1990s, leaving poverty levels stubbornly high: in 2000, about half of the Bangladeshi population, or about 63 million people, lived below the official poverty line.

Many studies have tried to shed light on the somewhat timid response of poverty in Bangladesh to the good growth performance over the 1990s. Mujeri (2002), using a computable general equilibrium (CGE) model, found that while Bangladesh's greater integration into the world economy had been generally "pro-poor," the gains to the poor were relatively small because of structural bottlenecks and other constraints. World Bank (2002a) showed that the benefits of economic growth during the 1990s had not been distributed evenly across regions. In the same vein, World Bank (2004) showed that the aggregate numbers hid important distributional effects across income levels and employment types. Hossein (2004) found that the 1990s saw increased mobility of labor from farm to non-farm jobs and an improvement in agricultural wages. He found that the rise in agricultural wages had had a tremendous impact on the poorest households, who were disproportionately concentrated in this segment of the labor market.

To help explain the poverty dynamics in Bangladesh in the 1990s, in this chapter we investigate the links between productivity-enhancing trade liberalization measures and household welfare. Our premise is that despite the structural transformation of the Bangladeshi economy and the declining role of agriculture, strengthening agriculture is still the most direct vehicle to reduce poverty. More

[166] The findings, interpretations, and conclusions of this paper are those of the authors and should not be attributed to the World Bank, its executive directors, or the countries they represent. The authors are grateful to Ataman Aksoy, Aylin Isik-Dikmelik, Ramon Lopez, and an anonymous referee for helpful comments and discussion. The remaining errors are our own.

half of Bangladesh's working population still depends on agriculture for livelihood and income and the sector's contribution to overall growth is still large. In particular, any policy change that affects the rice economy is bound to have important poverty impacts: rice accounts for more than half of real agricultural GDP and about 15 percent of the total monthly expenditures of Bangladeshi households. Taking the case of the trade liberalization policies and deregulation in agriculture, which peaked in the early 1990s, we investigate the links between agricultural productivity improvements, declining rice prices, and the trends in poverty and inequality in rural areas.

The reforms in agriculture included liberalization of the input markets for fertilizer and irrigation equipment. In a gradual process, the government removed restrictions on imports of small diesel engines in 1987 and eliminated the duty on such imports in 1989. Deregulation and privatization of public tubewell installations, and the removal of restrictions on imports of minor irrigation engines and pumps, led to a rapid spread of farmer-owned and -operated small-scale irrigation.

The policy changes led to a large-scale shift towards higher yielding rice varieties, and a seasonal shift in favor of the irrigated winter (*boro*) rice crop, boosting rice productivity and agricultural growth. Rice production increased faster than population, allowing Bangladesh to achieve self-sufficiency in rice (Dorosh 2004; Ahmed and Sattar 2003; World Bank 2002b). Throughout the 1980s and 1990s, the rising volume of rice production was accompanied by a decline in rice prices, and in the five years between 1995 and 2000, real producer and consumer prices of rice fell by 22 and 27 percent respectively. Some categories of Bangladesh's rural households experienced significant income growth between 1995 and 2000.

The starting point for our analysis is the improvement in rice productivity, which the literature has shown to be mainly the result of the liberalization of the input markets (Dorosh 2004; Ahmed and Sattar 2003; World Bank 2002b; Gisselquist and Harun-ar-Rashid 1998). Using a combination of ex-post and ex-ante approaches, we map the gains and losses experienced by different types of rural households as a result of the trade reforms, and examine the pathways through which these changes seem to have affected income levels. We do not directly test the link between trade reforms and poverty, but we assess the distribution of the income gains among rural households that resulted from productivity improvements, and show which channels seem to have affected different household groups, particularly the poor. We do not simulate the effect of trade reforms in a general equilibrium model, because the survey data for the two periods give us a natural experiment and we know what happened to rice prices and productivity.

We find that the net effects of increased rice productivity and lower rice prices in Bangladesh were extremely pro-poor. As in Vietnam after the rice reforms that were described in the previous chapter, in Bangladesh the poorest households emerge as having been particularly positively affected by agricultural trade liberalization in the 1990s, regardless of which particular category of households is analyzed. In Bangladesh this is mainly because poor households were predominantly net rice buyers, whether in urban or rural markets. The main losers were large net sellers of rice, who were among the better-off rural households.

The chapter is organized as follows. The first section offers some theoretical insights on how net buyers, net sellers, and agricultural wage earners are likely to be affected by trade reforms and particularly by improved technology in agriculture. The second section describes our analytical approach and the survey data used, and Section 3 describes the price and productivity changes that took place in rice markets and the characteristics of different groups of households. The fourth section presents the results of an ex-ante simulation of the partial impact of the reforms, and the fifth section is an ex-post examination of the growth in income that took place for different categories of households and of the channels through which this growth seemed to occur. The last section highlights our main conclusions.

THE WELFARE EFFECTS OF IMPROVED TECHNOLOGY: THEORETICAL INSIGHTS

Other things equal, productivity gains improve producer welfare because of their positive effect on profits. However, productivity gains may also translate into lower output prices—for example when domestic markets are segmented—and in turn have a negative effect on producer welfare.

To explain how household welfare is affected by reforms that raise agricultural productivity and lower rice prices, we distinguish between net sellers and net buyers of rice. Households may purchase or sell rice at different times of year, but over the course of the year they can be defined as net rice suppliers or net rice consumers. We also define an additional category of rural households: agricultural wage earners. Conceptually, the welfare effects of productivity improvements will differ for these three categories of households.

Considering the channels through which trade measures affect poverty outcomes enables an assessment of the likely overall poverty impact of a specific trade liberalization measure. The links between trade liberalization and poverty are complex. Trade liberalization measures can affect multiple actors, markets, and institutions in the economy, and neither these effects nor the poverty level itself are static or easily measured. As pointed out by Winters (2002), some of these effects may be positive and others negative, especially in the short term, making the net effect on poverty difficult to assess.

The first of the links between trade liberalization and welfare can be established through the direct effect of trade-related measures on crop prices and productivity, and we refer to this channel as the direct first-round effect. The direct first-round effect of a single price change on household welfare is proportional to the household's net supply position in that good, valued at current prices and as a share of the household's total expenditure. Declining price levels benefit net buyers and hurt net sellers. This relationship was formally described by Deaton (1989) in his pioneering study of the welfare effects of an increase in rice prices in Thailand, and was subsequently used in many empirical studies of the welfare effects of price changes on farm households (e.g., Benjamin and Deaton 1993; Barrett and Dorosh 1995; Seshan 2005).

A productivity improvement has no direct effect on net buyers, but it affects the profit levels of net sellers. For net sellers, technical change causes income to increase as long as the elasticity of output with respect to technical change is greater than the elasticity of price with respect to technical change (see, for example, Minten and Barrett 2007). Intuitively, if output increases faster than the price falls in response to technical change, net sellers will enjoy higher income and welfare even if some of the gains accrue to net buyers. If market prices fall, the *only* way for net sellers to gain is to have productivity increase faster than the rate of decline in prices; the net effect of improved technology on net sellers depends on the relative magnitude of the productivity effect and the price effect.

The second link between productivity-enhancing trade liberalization measures and welfare can be established through the second-round direct effects resulting from price- and productivity-induced changes in the rural labor market. Technical change is likely to increase the marginal physical productivity of labor, but this marginal output is often valued at a lower price. Thus, in response to technical change, if the marginal physical product of labor increases faster than prices fall, employment and wages will rise, benefiting agricultural wage earners. Employment and wages adjust in the same direction as the marginal revenue product of labor, so the key question for understanding the direction of the welfare effect on agricultural wage earners is whether technical change raises or lowers the marginal revenue product of labor (Minten and Barrett 2007).

A change in productivity and prices has a further effect on agricultural households. In developing countries with imperfect labor markets, households often work on their own farms, either in market or subsistence agriculture, rather than working for a wage within or outside agriculture. Changes in agricultural prices and productivity, induced by trade liberalization, can affect the implicit trade-off between family-farm work and wage employment and induce people to switch between these two employment types. Because of the labor market response, a household's net sales position could change after a trade reform. This observation shows that static analysis of the first-round effects without accounting for the labor market response yields an inaccurate assessment of the actual welfare change (De Janvry, Sadoulet, and Cordillo de Anda 1995; Porto 2005 and Chapter 7 above). To sum up, trade-related measures may affect the probability of employment in wage jobs as well as the wage rate, both of which can have important ramifications for a household's poverty status (De Janvry, Sadoulet, and Cordillo de Anda 1995; Edmonds and Pavcnik 2004; Minten and Barrett 2007; Nicita 2006; Seshan 2005).

The third link is the effect of trade liberalization on non-agricultural markets and employment opportunities in rural areas through spending spillovers. This phenomenon has been referred to as the consumption growth multiplier of trade liberalization measures (Delgado and others 1998; Winters 2002). In early studies of the poverty impact of agricultural growth, multiplier effects were understood as agricultural backward and forward production linkages, i.e. increased demand for production inputs and demand for processing services. At first these linkages were thought to be small, and investment in non-agricultural “growth poles” was considered to be more important than investment in agriculture for stimulating overall growth. But the experience of the Green Revolution in India changed this understanding and led to the recognition that agriculture itself could be a motor for overall growth, due to its effect on rural incomes and on consumer demand for goods and services outside agriculture (Delgado and others 1998).

To assess the magnitude of spending spillover effects, tradable goods must be distinguished from non-tradable (Siamwalla 1982). Non-tradable goods include farm and non-farm items that are not traded, such as services and perishable foods. Unlike increased consumption of tradable goods, growth in spending on non-tradable items stimulates local services and industries, resulting in sizable spillover effects. Spending multipliers can be estimated in a general equilibrium model. Alternatively, they can be calculated in a partial equilibrium framework if we know whether the expenditure items are associated with the purchase of tradable or non-tradable goods and services. Several studies (e.g., Delgado and others 1998; Winters 2002) have indicated that consumption multipliers could account for a notable change in rural incomes.

The extent to which the direct or indirect effects of productivity changes predominate depends on the nature of poverty, the nature of technological changes, and the economic and institutional context in the regions where technological improvements take place. To assess the likely magnitude of these two types of effects on the poor—whether or not technological improvements are caused by trade liberalization measures—De Janvry and Sadoulet (2002) propose an analytical framework and describe the conditions in which the direct or indirect effects are likely to dominate. They define direct effects as the rising welfare from higher production for home consumption and as the higher profits for poor farmers who adopt technological innovation. Indirect effects in this framework occur through the price of food for consumers, employment and wages in agriculture, and employment, wages, and incomes in other sectors of economic activity, through different types of linkages which we have defined as the multiplier effects.

Using this conceptualization of direct and indirect effects, De Janvry and Sadoulet (2002) define an archetype computable general equilibrium model for representative African, Asian, and Latin American countries and compare the likely magnitude of the direct and indirect effects of technological innovation in agricultural production. In a typical African country with a traditional agrarian economy, the direct effects are likely to be more significant than the indirect effects. In Asia, the indirect agricultural employment effects are likely to be large, because countries in this region tend to have large numbers of landless rural households. In Latin America, the dominant effect on poverty is likely to be through linkage effects through the rest of the economy. In practice, whether direct or indirect effects have a stronger impact on poverty is an empirical question. As De Janvry and Sadoulet (2002) conclude, where poor rural households have diverse sources of income, including wage labor in or outside agriculture, labor market and multiplier effects could dominate the price and productivity effects.

DATA SOURCES

Though in this chapter we use a slightly different classification of the various effects of productivity improvement on the welfare of the poor, the channels we consider are the same as in De Janvry and Sadoulet (2002). A close look at the changes in the income structure of Bangladeshi households sheds some light on the likely contributions made by various components of the overall welfare effect of rice productivity improvements.

Since the welfare impacts of increased productivity vary according to local conditions—from climate and local labor markets to access to credit, inputs, and the quality of local institutions—we look at the poverty and agricultural productivity dynamics in individual regions of Bangladesh. To capture some of the regional diversity in Bangladesh, six broad agro-ecological regions were modeled, following the classification in World Bank (2000b), taking account of the need for consistency with broad agro-ecological zones, hydrological regions, division boundaries, and the need to limit the number of regions to get a statistically representative sample from the Household Income and Expenditure Survey (HIES 2000) for the region. While we recognize the importance of all three channels through which trade affects household welfare (i.e., direct first-round effects, direct second-round effects, and multiplier effects), we only provide partial estimates of the first-round direct effects and investigate secondary evidence about the significance of multiplier effects. Data constraints do not allow us to estimate the multiplier effects, or even the direct second-round effects, of trade liberalization operating through the labor market.

In our ex-ante simulations we assess the extent to which first-round direct effects have contributed to poverty reduction across a range of household categories. In the ex-post analysis we describe the income growth trends of the same groups of households and provide some possible explanations for these trends.

The data underlying this chapter come from the 1995–96 and 2000 Household Income Expenditure Surveys (HIES) of Bangladesh. We use the 1995–96 survey in the ex-ante simulations and both surveys in the ex-post analysis. The same communities, or *thana* as they are called in Bangladesh, are included in both rounds of this repeated cross-section survey, enabling us to combine the two data sets in a single community-level panel data set. Although it would be preferable to have an individual-level panel data set, having the *thana*-level panel allows us to control for unobserved heterogeneity by community when we examine the trends in rice producer and consumer prices, production volume, and yields.

Although the sampling frame did not change, significant modifications in the questionnaire design between the two surveys make it difficult to compare households in some dimensions that are crucially important in our analysis. In particular, the calculated change in yields is highly sensitive to changes in the size of cultivated area and should be interpreted with caution. Thus, average yields calculated from the *thana*-level panel are sensitive to the presence of outliers.[167] As

[167] This effect persists even after cleaning the data by dropping observations that are more than five standard deviations from the mean of the data.

described in the appendix to this chapter, we resolved some of these issues and developed a consistent definition of farmer households in both surveys. But due to the remaining unresolved survey comparability issues, such as the lack of a consistent definition of agricultural wage earners, we could not conduct a detailed analysis of the welfare effect of price and productivity changes on this category of households.

THE RICE ECONOMY AND HOUSEHOLD CHARACTERISTICS IN BANGLADESH

Rice is a major source of income in rural Bangladesh. Revenues from rice production alone provide 13 percent of total income for the average rural household. Rice accounts for 75 percent of the country's crop production value, 63 percent of its crop sales, and 63 to 84 percent of its cultivated area (World Bank 2002b).

Rice is also the single most important consumption item of both urban and rural households. Rice purchase outlays average 12 percent of total monthly expenditures for urban households and 15 percent for rural households, and differ significantly by household welfare level.

Changes in the rice economy

Bangladesh produces three crops of rice per year: *aman* is typically planted during the summer before the onset of monsoon rains and harvested in the winter, *aus* is planted in the spring and harvested in the summer, and a high-yielding irrigated rice variety, *boro*, is planted in the winter and harvested in the spring or early summer (Del Ninno and Dorosh 2003).

As reflected in the 1995–96 and 2000 HIES, the most notable change in the agricultural sector in Bangladesh in the 1990s was a significant increase in the production of *boro* rice, made possible by the wider availability of small-scale imported irrigation equipment following trade liberalization. The shift was particularly pronounced in the South Ganges Flood Plain and East Hills regions, in which *boro* increased its share of the total annual rice harvest by 18 and 15 percentage points, respectively, between 1995 and 2000. The share of *boro* also rose—by about 10 percentage points—in the North Central, Meghna Flood Plain, and Northwest regions. The smallest change took place in the Coastal region (Figure 10.1).

As Table 10.1 clearly shows, *boro* rice yields nearly three as much per acre as *aus*, and twice as much as *aman*. Due to differences in environmental conditions, yield differentials differ widely by region. Summary statistics from the *thana*-level panel show that a significant increase in rice productivity took place between 1995–96 and 2000, with total annual production per acre rising by 42 percent at the median (Table A10.1).[168]

[168] While this increase seems realistic, given the changes in crop intensity of *boro* production and the yield differential between *boro* and the other rice varieties, the mean increase of nearly 80 percent (not shown) seems much less so. The mean is heavily influenced by the outliers in a community-level panel, and these have much greater weight in the panel data set with slightly more than 200 communities than they do in a household panel of more than 5,000 observations in each year.

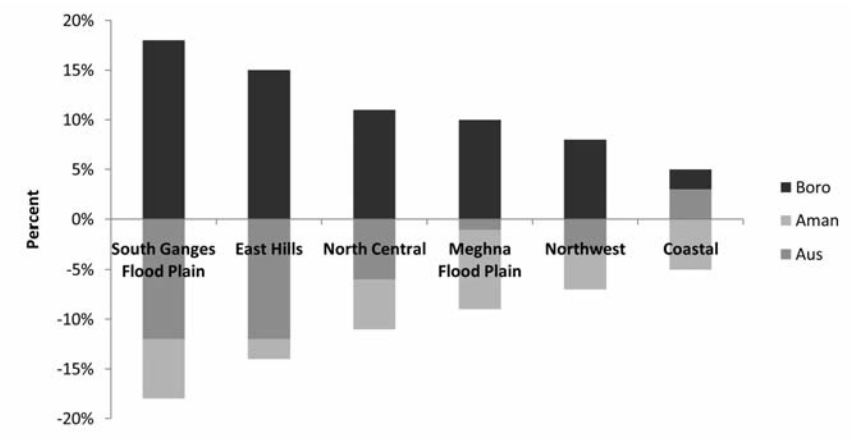

Figure 10.1: *Change in rice production structure, 1995–2000*

Source: 1995–96 and 2000 HIES.
Note: Change in percentage points was calculated by subtracting the shares of rice by variety in total rice production in 2000 from 1995–96. Calculated from summary statistics in the two household-level data sets.

Table 10.1: *Yields of aus, aman, and boro rice in Bangladesh*

	Yields (kg/acre)			Yield Ratios	
	Aus	Aman	Boro	Boro/Aus	Boro/Aman
Northwest	0.47	0.73	1.37	2.91	1.88
South Ganges Flood Plain	0.45	0.53	1.51	3.36	2.85
Coastal	0.43	0.50	1.29	3.00	2.58
North Central	0.40	0.63	1.24	3.10	1.97
Meghna Flood Plain	0.52	0.73	1.09	2.10	1.49
Eastern Hills	0.55	0.71	0.84	1.53	1.18
All Bangladesh	0.46	0.64	1.25	2.72	1.95

Source: Calculated from Bangladesh Bureau of Statistics annual data, which are reported in World Bank (2002b).

The productivity improvement had dramatic consequences for rice harvests. According to the Bangladesh Bureau of Statistics, Bangladesh's aggregate production of rice rose by 30 percent in the period from 1995–96 to 1999–2000 and by 42 percent between 1995–96 and 2000–01, validating the observed increase from survey data (Dorosh 2004).[169] The production increase was largely the result of the policy reforms that encouraged a shift to high-yielding rice varieties and to irrigated *boro* rice, rather than of weather differences between the two survey years (Dorosh 2004; Del Ninno and Dorosh 2003; World Bank 2002b).

[169] Average production volume was approximately 15 million tons in 1980–90; 18.8 million tons in 1990–2000; and more than 24.9 million tons in 2000–03.

Real producer and consumer rice prices declined by an average of 22 to 27 percent in the five-year period, although in some regions the price change exceeded one third (Table 10.2). It is not clear to what extent the observed declines in rice prices were a result of higher productivity, although rice production volume and rice prices are highly correlated in Bangladesh.

Table 10.2: *Change in producer and consumer rice prices, 1995–96 to 2000*

	Price of Paddy (% change)	Consumer Price of Rice (% change)
Northwest	–22	–18 (–20)
Ganges Floodplain	–23	–20 (–22)
Coastal	–28	–23 (–28)
North Central	–15	–19 (–21)
Meghna Floodplain	–31	–30 (–36)
East Hills	Na	–34 (–42)
All Bangladesh	–23	–22 (–27)

Source: Calculated from the community-level panel using 1995–96 and 2000 HIES.
Note: The East Hills region is excluded because it is a minor area of rice cultivation and is not statistically representative. Numbers in brackets are averages from the household-level data set.

The rather significant interregional differences in the price changes (Table 10.2) are caused by differences in demand and supply conditions and in the degree of integration into national and international markets for rice. The discrepancy between the producer and consumer price indexes, along with a strong correlation between domestic rice prices and production volume, suggests that rice can be regarded as a non-tradable commodity in Bangladesh. Hence, we assume that the decline in rice prices is largely a result of growth in production, rather than of changes in international rice prices.

Household characteristics

For the rural poor in Bangladesh, rice takes a large share of household spending. For rural households in the bottom decile of per capita expenditure, rice purchases constitute around 35 percent of total expenditures, compared with only 7 percent for households in the top decile (Table 10.3). In addition to purchases, own consumption of self-produced rice accounts for between 6 and 11 percent of total expenditures for rural households at different welfare levels.

When all rural households in Bangladesh are categorized as either net buyers or sellers of rice, 34 percent can be classified as net sellers. As expected, poverty incidence is higher among the net buyers than among the net sellers, with a 16 percentage point difference in poverty rates (Table A10.2). And as income levels rise, there is a pronounced decline in the share of net buyers and an increase in the share of net sellers (Table 10.3). Rice production provides a substantially larger share of total income for middle-income households than it does for households in either the bottom three deciles or the top decile of total per capita expenditures.

Table 10.3: *Dependence on rice in rural Bangladesh, 2000*

	Deciles of Total Per Capita Expenditures									
	1	2	3	4	5	6	7	8	9	10
Percent of all households										
Net buyers of rice	87	80	78	76	68	71	66	59	60	65
Net sellers of rice	10	17	18	21	28	24	29	35	34	30
Agricultural wage earners	41	34	23	21	14	13	8	3	3	1
Landless households	71	62	58	54	44	46	42	34	30	40
Percent of total income or expenditures										
Income from rice production	9	12	12	13	16	14	16	17	16	12
Expenditures on rice:										
– purchased	35	28	25	23	20	17	16	12	9	7
– self-produced	6	8	10	9	10	10	10	11	10	7

Source: 2000 HIES (only rural households).
Notes: Landless households are defined as those with less than 0.1 acres of land under cultivation (functionally landless). "Agricultural wage earners" are defined as households with at least one member whose primary occupation is agricultural work for a wage. Net sellers of rice are households whose annual rice sales gross income exceeds expenditures on rice purchases.

Half of the rural households in Bangladesh are functionally landless, and on average 20 percent are agricultural wage earners. As expected, the shares of landless households and agricultural wage earners among rural households decline as income rises.

The national averages in Table 10.3 hide substantial variation by region. As shown in Table 10.4, the share of rice production revenues in total income is largest among households in the Northwest, North Central, and South Ganges Floodplain regions.[170]

Table 10.4: *Spatial profile of rural poverty and dependence on agriculture, 2000*

	North-west	South Ganges Floodplain	North Central	Meghna Floodplain	East Hills	Coastal Area
Headcount rates, UPL, 2000 (%)	63	61	49	49	47	37
Headcount rates, LPL, 2000 (%)	49	49	37	26	21	25
(percent of total household gross income)						
Agricultural wage income	22	18	15	10	11	14
Farm income	27	28	22	14	13	18
Crop production revenues	24	22	18	11	11	13
Rice production revenues	17	13	14	9	9	10
Non-agricultural income	30	34	38	37	40	36

Source: HIES 2000, rural households.
Notes: UPL denotes the upper poverty line, and LPL denotes the lower poverty line as defined by the Bangladesh Bureau of Statistics and reported in World Bank (2002a).
Poverty headcount rates are individually weighted, and income structure statistics are weighted using the household weight. Agricultural income includes agricultural wages and production revenues. Non-agricultural income includes non-farm wage income and non-agricultural enterprise income.

[170] The three regions with the largest shares of rice in total production value are the Meghna Floodplain, Northwest, and North Central regions, according to HIES 2000. The South Ganges region has a somewhat smaller share of rice in total production value (around 30 percent compared to between 43 and 51 percent in the other three regions).

EX-ANTE SIMULATION OF THE WELFARE EFFECTS OF RICE PRICE DECLINE

Given the importance of rice in the income and consumption structure of Bangladeshi households, particularly in the main regions of rice cultivation, a productivity improvement and a price change in rice can significantly affect the welfare of rice-producing and rice-consuming households alike. Indeed, the rapid expansion of irrigation and *boro* rice cultivation in the 1990s led to significant growth in rural per capita domestic product, particularly in the Northwest, South Ganges, and North Central regions (World Bank 2002b).

Before turning to the ex-post analysis in the following section, we examine how a real price decline affects different groups of households, according to their degree of participation in the rice market. For this illustrative analysis we use data from Bangladesh's 1995 HIES.

To evaluate the overall welfare impact of price changes on households, we use Deaton's (1989) methodology. The overall welfare effect of a rice price decline, assuming that the consumption and production prices decline by the same percentage, is directly proportional to the net benefit ratio (NBR). This ratio is the difference between the net consumption ratio (CR) and the net production ratio (PR), and the short-run distributional effect of rice price changes is directly proportional to the share of rice in income and consumption (Deaton 1989, 1997):

$$\frac{\Delta w}{x_0} \cong \frac{\Delta p_r^p}{p_{0r}^p} PR_r - \frac{\Delta p_r^c}{p_{or}^p} CR_r, \tag{1}$$

where Δw is the first-order approximation of the net welfare effect of a rice price change on a household and the superscripts p and c are used to distinguish between the prices used to value rice production and consumption, respectively. PR and CR denote the production and consumption ratios, x_0 and is the total household budget.

The longer-term direct effect on welfare—which accounts for the household production adjustment in response to the price change—can be calculated using a Taylor series approximation: [171]

$$\frac{\Delta w^2}{x_0} \cong \frac{\Delta p_r^p}{p_{0r}^p} PR_r + \frac{1}{2}\left(\frac{\Delta p_r^p}{p_{0r}^p}\right)^2 PR_r \varepsilon_{rr}^s - \frac{\Delta p_r^c}{p_{or}^p} CR_r - \frac{1}{2}\left(\frac{\Delta p_r^p}{p_{0r}^p}\right)^2 CR_r \varepsilon_{rr}^H, \tag{2}$$

where Δw^2 is the second-order approximation of the net welfare effect of a rice price change on a household, and ε^s and ε^H are the elasticity of supply and demand, respectively. By adding the second and fourth terms on the right hand side of equation (2), we partially capture the direct second-round effects of the rice price decline, which include the price-induced responses on the supply and demand sides.

The simulations show that the impact of a rice price decline varies across different household categories (Table 10.5). Since most households even in urban

[171] See Minot and Goletti (2000) for a derivation; these authors used this method to study the impact of a rice price increase on welfare in Vietnam.

areas are net consumers of rice, they benefit from a decline in its price. The benefits of a price decline are especially high for net buyers of rice, non-farmers, and the rural poor in the bottom 30 percent of total per capita household expenditures. Meanwhile, net sellers of rice and farmer households, especially large farmers, lose from the price decline.

Table 10.5: *Welfare impact of a 27 percent decline in rice prices, 1995–96 HIES*

	Net Benefit Ratio (NBR=CR-PR)	Simulated Short-Run Welfare Impact (% of total expenditure)	Simulated Long-run Welfare Impact (% of total expenditure)	Actual Income Growth from 1995 to 2000 (% of total expenditure)
Urban	13.2	3.6	4.1	–5.7
Rural	–1.8	–0.5	1.3	4.0
All households	0.7	0.2	1.8	
Rural only				
Bottom 30%	16.0	4.3	5.8	9.1
Middle 40%	–6.9	–1.9	0.1	0.8
Top 30%	–18.8	–5.1	–3.2	3.8
Net sellers	–60.2	–16.3	–12.7	–7.7
Net buyers	21.0	5.7	6.9	8.7
Non-farmers	19.1	5.1	6.2	2.2
All farmers	–25.2	–6.8	–4.2	10.5
Small farmers	–5.0	–1.3	0.6	
Medium farmers	–40.9	–11.1	–7.9	
Large farmers	–68.8	–18.6	–14.3	

Source: 1995 HIES.
Note: Consumption and production include the value of own consumption and production. Long-run scenario assumes elasticity of demand equal to –0.5 and elasticity of supply equal to 1.5.

An approximation of the long-term welfare effect—which accounts for adjustments in household behavior—shows larger gains and smaller losses. When the rice price declines by 27 percent, as it did between 1995–96 and 2000, the estimated impact on total expenditure ranges from a loss of 14 percent for large farmers to a gain of nearly 7 percent for net buyers. The losses are especially high for medium and large farmers.

In actuality, income growth among rural households was stronger than predicted by the simulations, even over the long run. The last column of Table 10.5 shows that rural income increased by 4 percent over the five-year period, compared to the predicted 1.3 percent. Actual income growth was particularly strong for households in the bottom 30 percent of total per capita expenditures, at more than 9 percent over the five-year period. Interestingly, the income of farmers of all sizes increased by 10.5 percent, instead of declining by 4.2 percent, as suggested by our simulations. Urban households are the only category who experienced a worse actual growth performance than predicted by the simulation: a 5.7 percent decline instead of the simulated 4.1 percent growth.[172]

The discrepancy between the results of the ex-ante simulation and actual income growth could be due to several factors. The assumed demand and supply elasticities might not be the real ones. More importantly, the simulation omits the labor market and multiplier effects of a change in rice prices and productivity. Therefore, the simulated welfare impact overestimates the losses for net sellers, particularly if they experienced significant gains from improved productivity. It is an empirical question whether or not the gains outweighed the losses. The positive multiplier effects resulting from growth of the non-farm rural sector, and particularly the service sector for the newly available irrigation equipment, would further magnify the welfare gains, and mitigate the losses, of both net buyers and net sellers. Hence, the direction of the true welfare impact could differ from the simulated one if the omitted effects are sufficiently large.

EX-POST ANALYSIS: DYNAMIC WELFARE IMPACTS OF PRODUCTIVITY AND PRICE CHANGES

A comprehensive evaluation of the impact of changes in rice prices and productivity on household welfare would include three components: the direct first-round effects of the price and productivity changes on net buyers and net sellers in rural and urban areas, the direct second-round effects brought about by labor market repercussions, and the multiplier effects of agricultural growth on rural and urban communities. Data constraints do not allow us to estimate the magnitude of these effects in a structural model. Instead, we pursue an in-depth examination of income growth from different sources and for different categories of households depending on their net position on the rice market and their welfare levels. To examine these trends we rely on the insights provided by growth-incidence curves, which represent the changes in consumption expenditures of particular groups of population in the period between the two household surveys (Ravallion 2004; Ravallion and Chen 2003).

The growth incidence curves, shown in Figure 10.2, reveal that all Bangladeshi rural households experienced a modest increase in total consumption, with the poor experiencing particularly strong income growth. Even among urban households and among rural net sellers, who had average declines in their real income of about 6 and 8 percent, respectively, the poor fared far better than the average. In rural areas, households in the bottom 20th to 30th percentile of per capita household expenditures saw very strong income growth, whether they were net sellers, net buyers of rice, farmers, or non-farmers.[173]

[172] The poor performance of actual income growth in the urban areas may be a result of migration from rural to urban areas. According to census results, the urban population in Bangladesh grew nearly four times as fast as the rural population in the 1990s (World Bank 2002a). However, since the focus of this chapter is on the rural population, we do not examine this tendency in urban income growth any further.

[173] Growth incidence curves for farmers and non-farmers are not shown here, but they too indicate that expenditure growth was positive and strong for the poor.

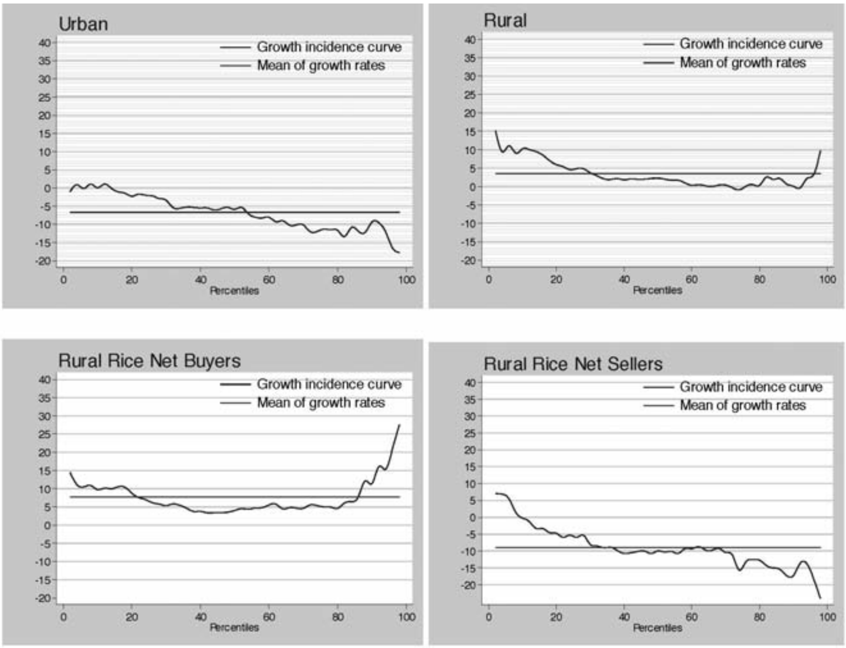

Figure 10.2: *Growth in consumption expenditures in Bangladesh, 1995–96 to 2000*

Source: Calculated from household-level data from the 1995–96 and 2000 HIES.
Note: The horizontal axis shows per capita expenditure groups from poorest to richest, in 2 percent increments. The bottom 30th percentile is the poorest of the population in a specified category of households according to our definition. The vertical axis shows growth in expenditures between 1995–96 and 2000, in percent. The straight line shows the mean of the growth rates for all expenditure groups within a geographic area. Results are weighted by the individual weight.

This finding is reinforced by the results of a decomposition of growth in total expenditure. Using the income shares from the 2000 income structure and applying them to the expenditure growth figures in each of the six categories of households that we analyze here, we examine the sources of growth.[174] This approach can be thought of as a reduced-form measure of the direct first- and second-round effects of a price and productivity change and of the multiplier effects. Table 10.6 clearly shows that the poorest 30 percent of households experienced strong income growth over the five-year period, ranging from 3 percent for net sellers to 14 percent for rural non-farmers. Most of this growth among rural households stemmed from agricultural and non-agricultural wages and from other sources of non-agricultural income.

[174] This approach implicitly assumes that income growth has been homothetic, i.e. that total growth can be decomposed simply in proportion to the share of each income source in the total income. This is a restrictive assumption, not likely to be satisfied in practice. However, it was the only feasible approach given the data constraints. A better approach would have been to examine the actual changes in income from each category, but we were not confident in the reliability of those results, due to the survey comparability issues described in the appendix to this chapter.

The agricultural growth multiplier effect might be captured by changes in two income categories: non-agricultural wages and other income sources. Even though we do not attempt to calculate consumption growth multipliers, it is clear that the spillover effects of agricultural growth on other sectors of the rural economy in Bangladesh accounted for a large share of income growth between 1995 and 2000. Trade liberalization and the resulting growth in agricultural productivity raised the demand for services, machinery repairs, small tractors, and agricultural pumps in rural areas, and brought about growth in non-farm employment opportunities (Winters 2002; World Bank 2004). The evidence presented here appears to corroborate this story.

Table 10.6: *Decomposition of growth in total expenditures, 1995–96 to 2000 (percent)*

	Agricultural Wages	Non-Agricultural Wages	Remittances	Other Sources (Gross)	Agricultural Production	Of Which Rice	Total Growth, Percent
Urban							
Poorest 30%	0.5	3.2	0.1	2.2	0.2	0.1	6.3
Middle 40%	0.0	0.7	0.1	0.5	0.1	0.0	1.3
Richest 30%	0.0	−0.9	−0.1	−1.1	−0.1	0.0	−2.2
Total	−0.1	−2.6	−0.3	−2.5	−0.2	−0.1	−5.7
Rural							
Poorest 30%	2.6	1.9	0.3	2.7	1.7	1.0	9.1
Middle 40%	0.1	0.2	0.0	0.3	0.2	0.1	0.8
Richest 30%	0.1	0.7	0.6	1.5	0.9	0.6	3.8
Total	0.7	0.8	0.3	1.3	0.9	0.5	4.0
Rural net buyers							
Poorest 30%	3.3	2.6	0.3	3.1	0.7	0.3	10.1
Middle 40%	0.3	0.4	0.1	0.5	0.1	0.0	1.4
Richest 30%	0.6	2.7	2.0	4.6	0.8	0.3	10.6
Total	1.8	2.3	0.7	3.1	0.7	0.3	8.7
Rural net sellers							
Poorest 30%	0.5	0.2	0.1	0.7	1.6	1.1	3.2
Middle 40%	−0.4	−0.5	−0.2	−1.3	−2.7	−1.8	−5.1
Richest 30%	−0.1	−0.6	−0.5	−1.5	−2.5	−1.7	−5.2
Total	−0.6	−0.7	−0.4	−2.0	−3.9	−2.7	−7.7
Non-farmers (rural)							
Poorest 30%	4.8	3.6	0.5	4.4	1.0	0.5	14.3
Middle 40%	0.7	1.0	0.2	1.3	0.3	0.1	3.6
Richest 30%	−0.2	−0.8	−0.6	−1.4	−0.1	−0.1	−3.2
Total	0.5	0.6	0.2	0.8	0.2	0.1	2.2
All farmers (rural)							
Poorest 30%	1.4	0.9	0.3	2.0	3.2	2.0	7.8
Middle 40%	0.3	0.5	0.2	1.1	1.6	1.0	3.7
Richest 30%	0.2	1.2	1.0	2.8	3.2	2.0	8.4
Total	0.9	1.3	0.8	3.2	4.3	2.7	10.5

Source: Calculated from 1995–96 and 2000 HIES.
Note: The change in total expenditures in the two surveys was decomposed into growth by source of income, using change in total expenditures and applying to it the income structure in 2000.

The income growth of the poorest net sellers in excess of 3 percent is still somewhat puzzling, because the direct impact of lower rice prices on this household category is negative. This may be because among net sellers who are poor, net rice sales supply only a small share of income. Among the households in the poorest decile of total per capita expenditures, more than 40 percent are in the least intense net seller category, with the value of their net rice sales being between zero and 10 percent of their total expenditures (Figure 10.3). Marginal sellers are much more common in this decile than in all the other, less poor, deciles. It may also be that the total income of the poor rural net sellers grew as the result of direct second-round (labor market) and multiplier effects.

Although growth incidence curves indicate the trends in income growth at different welfare levels, they provide no basis for establishing causality in relation to changes in productivity and rice prices.

To establish this causality, we examine how much the change in total consumption affects changes in rice productivity, producer and consumer prices of rice, and a set of variables that describe the household's income structure and demographic characteristics and the presence of irrigation and other infrastructure. We examine the correlation between these factors and the change in total household consumption in the framework of a simple ordinary least squares regression. For this we use a community-level panel data set with approximately 230 *thana* in rural areas that were covered by both the 1995–96 and 2000 HIES.

To explore the differential effect of changes in prices and yields on different household categories within the framework of the community-level panel data,

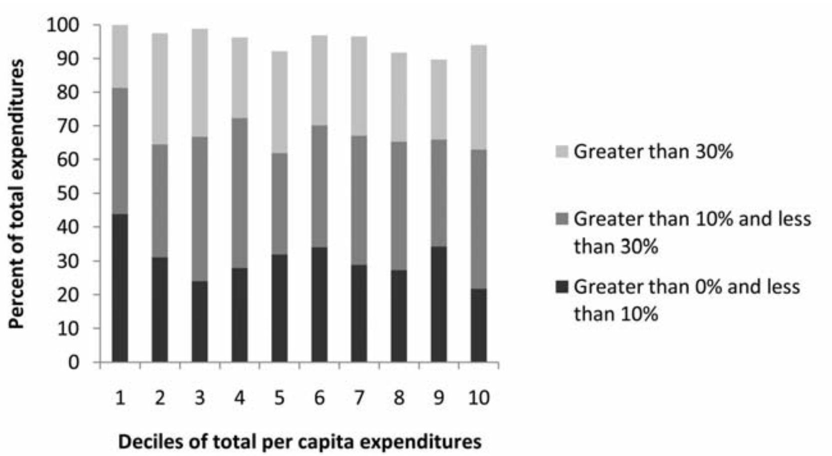

Figure 10.3: *Intensity of net sellers of rice, by income level (rural households)*

Source: 2000 HIES (rural households).
Note: Intensity is expressed as the value of rice sales net of purchases as a percentage of total expenditures. Totals do not always add to 100 percent because some households did not report any sales or purchases of rice and could not be categorized according to the intensity of the rice sales or purchases.

we create three data sets by averaging the characteristics of the poor and the non-poor and then pooling them into a single data set with approximately 460 observations. We proceed in the same way for farmers versus non-farmers and for net sellers versus net buyers. We include a set of demographic control variables in the regression, as well as variables that reflect the production structure, dummy variables to control for unobserved heterogeneity by location, and the economic variables of interest, such as percentage change in yields and prices and interactive variables of these changes with different household categories.

The regression results, shown in Table A10.3, reinforce the earlier finding that the poor experienced significantly higher income growth than the non-poor (Model 1). The share of rice grown under irrigation, which reflects the production structure and the role of irrigation in the production process, had a positive and significant effect on income growth for farmers compared to non-farmers (Model 2) and for net sellers compared to net buyers (Model 3). Interestingly, having more women as a share of household size is associated with higher rates of income growth in Models 2 and 3. The share of children in total household size had a positive effect on income in the net sellers/net buyers group but a negative effect on income in the poor/non-poor group. Further, larger shares of remittances, agricultural wages, and "other" income from non-agricultural sources were associated with higher income growth. This finding suggests that the multiplier effects and indirect labor market effects of the improvement in rice productivity might have played significant roles in income growth.

Turning to the variables of most interest, we find that, as expected, the change in the price of paddy (i.e., the producer price) had a significant impact only on farmer households and net sellers. The smaller the decline in the price of paddy, the higher was the income growth for these groups of households.[175] Somewhat surprisingly, we do not find that productivity improvements, as measured by the change in rice yields, had a positive impact on income growth in Models 2 and 3 where we would expect them to matter, but they did have a significant positive effect on income in Model 1.

High measurement error in the yield variable and the sensitivity of yield changes to outliers, even after the data have been cleaned, may explain the lack of significance of the yield variable in most of our model specifications. Even conceptually, however, a change in yields need not result in income growth. A farming household's profits are influenced by factors such as fertilizer cost and application rate, wages paid to hired agricultural workers, unit labor requirements, access to capital and land, and the price of output. While productivity improvements tend to raise output, they may not necessarily lead to higher profits and income growth. For example, Lopez (2000) has shown that INDAP, an important rural development and poverty reduction program in Chile that is designed to provide technical assistance or credit to farmers with high produc-

[175] A positive coefficient means that an increase in the price change by one unit (so this negative number becomes smaller in absolute value) leads to an increase in total income. In other words, a smaller price decline results in a smaller reduction (or an increase) in total consumption (income).

tion potential, does not seem to have led to income growth.[176] Although technical assistance and credit raised the production volume of crops that were supported by INDAP, these positive production effects were dissipated in higher costs and less off-farm income. Part of the cause was a reduction in off-farm work by families who participated in INDAP. These findings underscore the need for an in-depth analysis of the relationship between increased productivity, profitability, and income growth of rural households.

Though the results of our analysis of correlation between productivity, price changes, and income growth in Bangladesh are not conclusive, they suggest—much like the earlier results in this chapter—that both the second-round direct effects in the labor market and the indirect multiplier effects have been very significant in Bangladesh. Revisiting the archetype models suggested by De Janvry and Sadoulet (2002), we may conclude that Bangladesh combines some features of these authors' Asian and Latin American archetype countries. As noted above, they postulated that in Asia indirect agricultural employment effects are likely to be large, owing to a large pool of landless wage workers in rural areas, and in that Latin America the dominant effect of productivity improvements is felt through multiplier effects. Both seem to be true in Bangladesh.

CONCLUSIONS

Because rice contributes more than half of real agricultural GDP and is Bangladesh's major staple food, any policy change that affects the rice economy is bound to have important poverty impacts. The liberalization of trade in irrigation equipment and fertilizer markets that took place in the 1980s and early 1990s led to a significant increase in rice productivity and a sharp decline in producer and consumer rice prices.

In this chapter we examined the effects of these changes on net consumers, net sellers of rice, non-farmers, and farmers, using a combination of ex-post and ex-ante approaches and data from Bangladesh's 1996 and 2000 household surveys.

We find that rural households who were net consumers of rice experienced an increase in income over the five-year period, and that among this group the income growth tended to be pro-poor. Net sellers of rice experienced a decline in their income level. The results from Model 1, which contrasts poor with non-poor households, show that the income of poor households increased (Table A10.3). That increase may reflect an expansion of job opportunities in the rural non-farm sector and a rise in higher agricultural wages, which members of poor households are more likely to be affected by.

[176] As De Janvry and Sadoulet (2002) have shown, one should not conclude from these findings that access to land is unimportant for poverty reduction or that programs that focus on improving access to land are not effective. The relationship between access to land and welfare improvements is heterogeneous, calling for a sophisticated modeling approach that accounts for structural relationships and different levels of access to infrastructure, education levels, and other endowments and skills. Once these factors are adequately controlled for, these authors find a positive relationship between access to land and income growth in Mexico.

Our findings suggest that for some categories of households the income changes can be attributed to the changes that took place in rice productivity and rice prices. Since net buyers in rural areas tend to be poorer than net sellers, the productivity improvements induced by trade liberalization, and the associated direct and indirect secondary effects, benefited the poor. Although we could not test empirically what happened to the welfare level of agricultural wage earners, secondary evidence suggests that they gained from trade liberalization. The increase in the income of non-farmers in rural areas supports this claim.

Despite important data constraints that affect the comparability of the 1995/96 and 2000 surveys, our results shed some light on why the reduction in overall poverty was somewhat small despite the substantial economic growth that Bangladesh achieved during the 1990s. The greatest beneficiaries of the trade reforms analyzed were the rural landless farmers. These were Bangladesh's poorest category of households in the early 1990s, and thus the major impact of the trade reform may have been to lift a large number of extremely poor up to the "poor" category. This issue deserves further investigation. The household survey that Bangladesh is finalizing at the time of writing could provide useful insights here.

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APPENDIX

Part 1: Statistical Tables

Table A10.1: *Change in yields of rice, 1995–2000 (total annual production in kg/acre)*

	Average Production in 1995	Average Production in 2000	Average Change in Production	Median Percent Change (%)
Northwest	1,710	2,581	872	41
South Ganges Floodplain	1,124	2,294	1,169	69
Coastal	1,084	2,626	1,542	131
North Central	1,486	2,631	1,144	45
Meghna Floodplain	1,841	2,349	509	26
All regions	1,517	2,504	987	42

Source: Thana-level panel combining 1995–96 and 2000 HIES.
Note: Statistics reported in this table are sensitive to the presence of outliers even after dropping observations that are more than five standard deviations away from the mean of the data, and should be interpreted with caution.

Table A10.2: *Poverty incidence by household type in Bangladesh, 2000*

		Poverty Incidence, LPL (%) 2000	Poverty Incidence, UPL (%) 2000	Number of People	Percent of Total (for rural, % of all rural)
All Bangladesh		34	50	126,110,055	100
Urban		19	37	25,294,325	20
Rural		37	53	100,815,729	80
Rural:					
o/w	Landless	50	69	19,261,845	19
	Non-farmers	48	64	50,626,357	50
	Farmers	27	43	50,189,373	50
	Net buyers of rice	43	59	70,443,507	70
	Net sellers of rice	25	39	25,710,623	26

Source: 1995–96 and 2000 HIES.
Notes: UPL denotes the upper poverty line, and LPL denotes the lower poverty line as defined by the Bangladesh Bureau of Statistics and reported in World Bank (2002a).
Weighted data using individual weights. Landless are defined as households with less than 0.1 acres of land in cultivation (functionally landless). Net sellers of rice are households whose annual rice sales gross income exceeds expenditures on rice purchases.

Table A10.3: *Determinants of the change in total household expenditures (OLS regression results)* [1]

	Model 1 [2] Poor vs. Non-poor	Model 2 Farmers vs. Non-farmers	Model 3 Net Sellers vs. Net Buyers
Group dummy variables:			
Poor (bottom 30%)	578.582		
	(2.73)**		
Farmer		1,874.98	
		(4.26)**	
Net seller			660.496
			(1.44)
Economic variables:			
Change in yield	0.15	0.083	0.048
	(2.82)**	(1.12)	(0.66)
Change in price of paddy	23.769	0.741	55.08
	(0.50)	(0.02)	(0.89)
Share of rice in irrigation	0.162	0.466	0.361
	(1.39)	(3.12)**	(2.73)**
Share with access to electricity	69.288	189.739	301.416
	(0.54)	(1.02)	(1.27)
Interactive:			
Change in yield*poor	−0.104		
	(1.74)		
Change in price*poor	36.733		
	(0.69)		
Change in yield*farmer		−0.004	
		(0.04)	
Change in price*farmer		347.397	
		(4.31)**	
Change in yield*net seller			0.050
			(1.04)
Change in price*net seller			475.63
			(5.13)**
Demographic and income structure:			
Household size	76.803	88.965	−551.088
	(0.86)	(0.67)	(4.18)**
Percent of females	14.253	37.775	52.433
	(1.76)	(2.64)**	(3.38)**
Percent of children	−28.543	2.443	27.277
	(3.78)**	(0.22)	(2.13)*
Income structure (shares of total income in 1995):			
Remittances	8.576	38.499	13.452
	(0.69)	(2.16)*	(0.79)
Agricultural wages	9.891	45.35	
	(0.86)	(3.10)**	
Non-agricultural wages	3.123	20.594	11.077
	(0.30)	(1.42)	(0.92)
Non-rice ag. products	−6.249	−9.33	−10.716
	(0.52)	(0.55)	(0.73)
Other sources (non-agricultural)	5.679	30.124	2.383
	(0.56)	(2.11)*	(0.23)

	Model 1 [2] Poor vs. Non-poor	Model 2 Farmers vs. Non-farmers	Model 3 Net Sellers vs. Net Buyers
Location specific characteristics (Northwest is the omitted regional dummy):			
South Ganges region	181.856	402.181	619.071
	(0.92)	(1.38)	(1.74)
Coastal region	585.48	1,512.89	1751.327
	(2.50)*	(4.38)**	(4.21)**
North Central region	116.656	108.135	267.801
	(0.68)	(0.43)	(0.86)
Meghna Flood Plain	688.411	1,242.57	2004.753
	(3.18)**	(3.92)**	(5.26)**
East Hills region	39.65	551.676	1,357.78
	(0.11)	(1.06)	(2.31)*
Constant	−1,003.46	−6,185.50	1533.28
	(0.85)	(3.62)**	(1.80)
Observations	461	465	453
R-squared	0.13	0.20	0.33

Notes:

1 Dependent variable is change in total household expenditures, 2000 Tk/month (thana averages). Absolute value of t statistics in parentheses; * significant at 5%; ** significant at 1%.

2 Calculated from a thana-level panel data set that was created from the 1995–96 and 2000 HIES by first creating a data set with the average characteristics of the poor at the thana level, then those of the non-poor, and then pooling the two data sets and running a regression in Model 1. A similar procedure was used to create the data sets used in Models 2 and 3. Approximately 230 rural thana were used to create the data set. (There is a total of 295 thana in the survey, of which 250 are completely or partly rural, and the rest urban and so excluded from this analysis. In approximately 20 thana, dependent variables were missing, so they are also excluded from the analysis.)

Part 2: Handling Comparability Issues in the Survey Data

The survey design is significantly different in the 2000 HIES from the 1995–96 HIES, particularly as regards land and crop production. In the 1995–96 survey most rural households report having some cultivated land and producing crops, while the share of such households in the 2000 survey is much smaller, as shown in Table A10.4.

Table A10.4: *Percent of rural households with positive amount of cultivated land, production, and agricultural wages*

	Positive Cultivated Land		Positive Production		Positive Ag. Wages	
	1995	2000	1995	2000	1995	2000
All rural	65	49	72 (89)	69	35	33
Non-farmer	40	6	57 (82)	43	37	40
Net seller	95	85	92	100	24	25
Net buyer	48	29	62	52	41	38
Small farmer	100	100	93 (100)	100	43	33
Medium farmer	100	100	96 (100)	99	22	11
Large farmer	100	100	94 (100)	100	14	9

Note: Weighted data. Calculated from 1995–96 and 2000 HIES.

Rather than relying solely on the cultivated area to classify households as farmers, we combined this criterion with the question about occupational status. Still, we needed to address the issue of comparability of the reported cultivated land in two surveys. Given the way this question was posed in 1995, the respondents to that survey reported all land that was owned and/or cultivated, while only half of all rural households reported having cultivated land. The reasons for this discrepancy in the way the question about land was answered are not clear. Possibly, the 1995 survey respondents reported cultivated land that was not their own, but belonged to the owner for whom they worked for wages. Alternatively, land ownership may be under-reported in the 2000 survey. The fact that the average land size of 1.25 acres in 1995 is significantly higher than the average land size of 1.12 acres in 2000 supports this hypothesis. Using "net land with temporary crops" in the 1995 survey and "total net cultivable agricultural land" increases the comparability of land sizes in the two surveys.

The figures in Table A10.4 for 1995, and all other statistics related to land size, are based on the definition of total land as "net land with temporary crops" in 1995. This definition results in comparable average sizes of cultivated land for small, medium, and large farmers, and for non-farmers.

Production figures were initially not comparable either. Before making any adjustments to the data, 89 percent of all rural households reported positive production in 1995, and only 69 percent did so in 2000 (Table A10.4). This discrepancy is due to the fact that some households who should have been reporting income as agricultural wages in 1995 reported them as own production revenues. Using the reported employment status, we identified a group of these households, and counted their production revenues as agricultural wages instead of agricultural revenues. After this correction, the shares of all rural households with positive production are comparable at 72 and 69 percent. The old shares before this correction are shown in brackets in the table. Even though some further refinement is possible, it is not necessary, because we do not use total production or agricultural wage figures in the analysis. The purpose of this adjustment was to illustrate that the data sets are comparable, although the land figures should be interpreted with caution.

To analyze changes in yields and other conditions for the farmer households between 1995–96 and 2000, we need to define farmer households consistently in the two surveys. We did this by combining information about the occupational status and the sector of employment of household members with information about the size of cultivated land. We tried alternative definitions, and this one was found to result in the greatest comparability between the farmer households in the two surveys.

In the 1995–96 survey, we define a household as a farmer household if at least one household member reports having an occupation other than either (i) agricultural worker with no land working for wages or on contract basis, or (ii) nonworking land owner (question Q.7). In the 2000 survey, respondents are defined as farmer households when at least one member reports being a farmer (question 1 in section 5) who is self-employed in agriculture (question 6 in section 5). In addition, households with more than one third of their total household income resulting from agricultural production are classified as farmer households.

11

The Impact of Coffee Price Changes on Rural Households in Uganda[177]

MAURIZIO BUSSOLO, OLIVIER GODART, JANN LAY, AND RAINER THIELE[178]

In Uganda, as in much of Sub-Saharan Africa, poverty is predominantly a rural phenomenon. Since agriculture accounts for a large share of income for most rural households, policies and external shocks that affect agriculture can be expected to have a significant impact on poverty. This is particularly true for the Ugandan economy, whose coffee sector in the 1990s faced both large international price fluctuations—coffee world prices rose dramatically in the first half of the 1990s and then, by 2001, fell back to levels below those of the early 1990s—and an extensive domestic deregulation. The existing empirical evidence suggests that both the domestic liberalization and a temporary coffee price boom have been main factors behind Uganda's remarkable growth performance and its related reduction in poverty (Appleton 2001).

How exactly these factors worked out is less known. Dijkstra and van Donge (2001) as well as Deininger and Okidi (2003) contend that a significant supply response, particularly in the coffee sector, as well as diversification into new crops has resulted from liberalization. Yet, Belshaw and others (1999) conclude that coffee and cotton production have failed to recover over the 1990s mainly because of institutional resistance to reform. In the same vein, it is not clear how producers have responded to temporary coffee price shocks. Evidence for Sub-Saharan Africa accumulated by Dehn (2000) points to a possible asymmetry: price booms are less likely to have a lasting effect on output than price slumps because the windfall profits associated with booms tend to be consumed rather than invested, whereas slumps may force farmers to disinvest. Collier, Gunning and others (1998), however, find marked increases in farmers' savings in response to the 1976/77 coffee price boom in three Sub-Saharan African countries. Regarding indirect effects of temporary coffee price shocks, most studies stress the im-

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portance of Dutch disease effects, which result from spending the windfalls on domestic non-tradables (e.g. Dorosh and others, 2003). They also account for multiplier effects via forward and backward linkages, but typically neglect that these effects may be confined to specific regions due to limited spatial integration.

This paper provides new evidence on the sign and strength of some of these linkages between poverty reduction (or growth) and changes in export crop prices for Uganda. Based on three household surveys for the years 1992/93, 1995/96 and 1999/00, we track five different household groups, applying descriptive analysis, cross tabulations corroborated by confidence intervals, a growth decomposition by income sources, and a multivariate regression analysis. Since we rely on an ex-post assessment of changes in household welfare based on the surveys, we cannot isolate the impact of changes of coffee world prices from that due to the domestic coffee market liberalization; we can only capture their combined effect. In addition, since we do not use panel data, changes shown for particular household groups may reflect both inter-group movements and changes for initial group members.[179]

The remainder of the paper is structured as follows. Section 2 deals with the transmission of international price changes to Ugandan coffee farmers. We then move on to examine the changes in the performance of different households (Section 3) and the possible factors behind them (Section 4). The final section puts the findings of the paper into a broader policy context.

COFFEE PRICE CHANGES AND THEIR TRANSMISSION TO LOCAL MARKETS

Towards the end of the 1980s, the government of Uganda started to embark on a series of reforms commonly regarded as necessary for sustained economic growth (Okidi and others, 2006). Among these reforms, policy changes in the coffee sector figured prominently. The domestic market for coffee was liberalized profoundly in the early 1990s. This liberalization entailed the complete withdrawal of the state from marketing, the abolition of minimum prices, and the removal of the export tax.[180]

In addition to the radical domestic market liberalization, Ugandan farmers were confronted with pronounced fluctuations in coffee prices. World prices went up dramatically in the first half of the 1990s, more than doubling between 1992/93 and 1994/95. The coffee price boom began its reversal in 1996/97. Coffee prices reached a trough in 2001, when they fell below the levels of the early 1990s. At

[179] There is a panel of 1,200 households for the years 1992/93 and 1999/00—a sub-sample of the sample used in our analysis. Yet, we prefer to work with the cross-sections, as (a) the panel does not cover the boom year 1995/96, and (b) the panel would yield sub-groups too small to be of interest to our analysis.

[180] Prior to market liberalization, the coffee sector had been taxed both explicitly and implicitly. Explicitly, the government levied an export tax at a rate ranging between 40 and 100 percent. An additional implicit tax burden resulted from fixing producer prices at 20 percent of the export price (Fafchamps and others, 2003).

the same time, due to the liberalization, one would expect a closer synchronization between domestic and international coffee prices.

Krivonos (2004) confirms this expectation by showing that coffee market liberalization induced a closer relationship between producer prices and world market prices, not only in Uganda, but also in other major coffee-producing countries. For the Ugandan case, 96 percent of the adjustment is realized after six months as compared to 30 percent in the pre-reform period. Fafchamps and others (2003)—by examining the transmission of international coffee prices through the domestic value chain, with coffee growers, traders and exporters as the main market participants—find that fluctuations in international prices are not fully reflected in the prices received by coffee farmers. In a companion paper (Fafchamps and Hill, 2005), this is mainly attributed to the fact that producers are more likely to sell at the farm gate rather than at the nearest market when prices go up, thereby lowering the price they actually receive.

What evidence of pass-through do we get from our household survey data during the 1990s? As shown in Figure 11.1, the three surveys used in our analysis cover one period preceding the coffee boom (1992/93), one period right after the boom (1995/96), when world market prices for Robusta coffee had already dropped quite dramatically, and a later period (1999/00) that follows a further significant decline in world market prices. Thus, two low-price periods and a relatively high-price period can be compared.

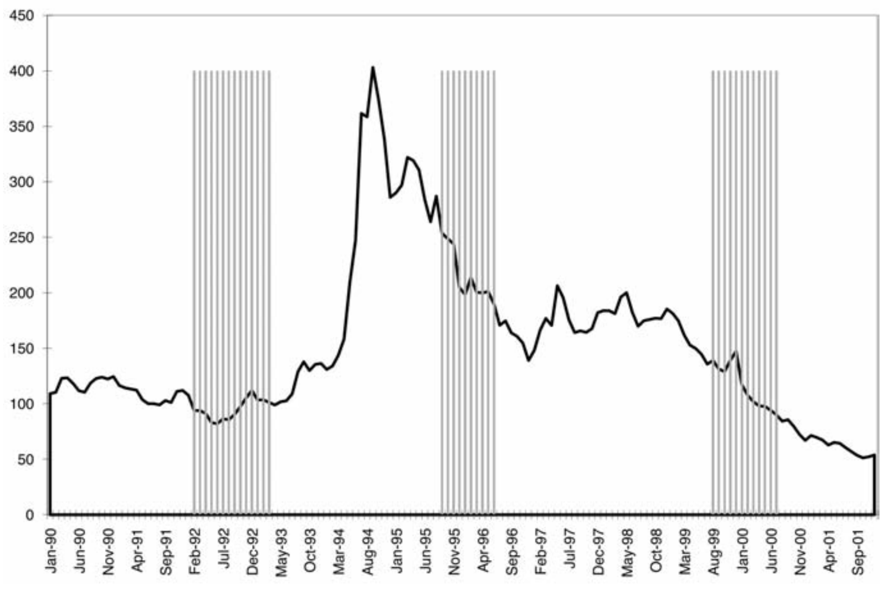

Figure 11.1: *ICO Robusta international price in US cents per kg and survey coverage, 1990–2001*

Source: International coffee organization (www.ico.org), September 2005.

Figure 11.2 shows, for each survey period, how world market price fluctuations relate to the prices received by coffee producers. It turns out that mean prices paid to growers (converted to current US cents and averaged over each survey period) increased more than fourfold between the first and second survey and almost halved between 1995/96 and 1999/00. In 1992 Ugandan shillings, these prices fluctuated around 200 USh per kg in 1992/93, then rose to around 500 USh in 1995/96, and fell again to around 330 USh in 1999/00. This implies that prices received by coffee growers in 1999/00 were 65 percent higher than in 1992/93 when world market prices were at roughly the same level.[181]

The data hence show clear evidence that the share of the world price received by Ugandan coffee farmers has increased significantly in the course of the 1990s. When prices are measured in current US cents (as in Figure 11.2), our data suggest that this share increased from approximately 15 to about 25 percent between 1992/93 and 1995/96, probably reflecting the transition away from "guaranteed" prices and the successful adjustment to liberalization. It appears that the share has stabilized, as it remains constant in the period of falling world prices, confirming Krivonos' (2004) finding of symmetries in the way positive and negative international price changes are transmitted to the domestic market after liberalization.

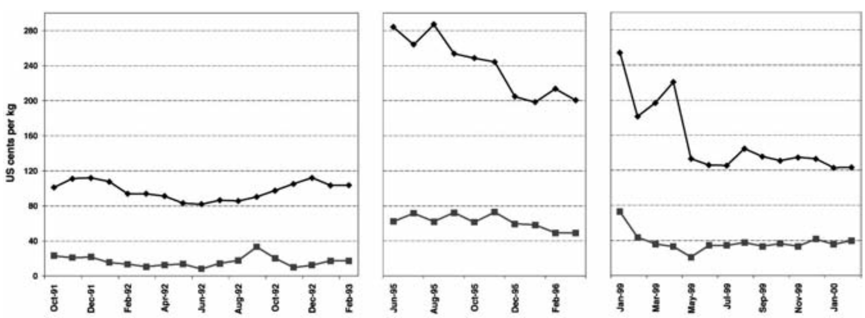

Figure 11.2: *Robusta prices on international reference markets and producer selling prices during the three surveys*

Sources: International Coffee Organization (www.ico.org), September 2005, IHS 1992/93, UNHS 95/96, UNHS 99/00
Note: The upper line is the international price in US cents per kg for Robusta coffee provided by International Coffee Organization (ICO). The lower line is the median price of bulk Kiboko per kilogram converted to US cents. Kiboko is the green coffee bean specific to Uganda and the bulk price of Kiboko a good proxy for the prices farmers receive. Monthly average exchange rates from the International Financial Statistics are used to convert the prices into US cents. We compute the Kiboko prices from the crop and community sections of the household surveys.

[181] These findings are largely consistent with those in Fafchamps and others (2003). The prices used by Fafchamps and others (2003) are monthly producer prices recorded by the Ugandan Coffee Development Authority and thus may be more accurate than those employed here, which are computed from household surveys. However, Fafchamps and others (2003) only consider a single-year period.

COFFEE PRICES, GROWTH, AND POVERTY: HOW DIFFERENT HOUSEHOLD GROUPS FARED

At the aggregate level, Uganda's performance over the period under consideration has been remarkable: yearly growth rates of per capita consumption (estimated from the household surveys) were 4.4 percent between 1992 and 1995, and 8.7 percent between 1995 and 1999. These growth rates were accompanied by a substantial poverty reduction during the 1990s, which accelerated in the second half of the decade. The poverty headcount decreased from 56 to 49 percent during the first period, and from 49 to 34 percent in the second period.

To assess how these aggregate gains were distributed across households and whether their pattern was correlated with coffee price fluctuations, we disaggregate households into five separate groups according to their degree of dependency on coffee farming. The five groups are: coffee farmers, other rural as well as other urban households in coffee regions and non-coffee regions. Coffee farmers are defined as those who report some coffee production, and coffee regions are those districts with actual per capita production of coffee of more than 20 bags (of 60 kg each) or production potential of more than 100,000 bags.[182] To improve comparability across these five groups and among different time periods, we reduced the nation-wide surveys to a more homogenous sub-sample by dropping some districts that were not covered in all the surveys and some specific non-coffee districts, in particular from the North.[183] The latter region has been shown to suffer from adverse agricultural conditions and to be largely de-linked from the rest of the economy.

Based on this sub-sample and for each of the five household groups, Table 11.1 shows their respective sizes in terms of shares of total population and per capita consumption values. The population share of coffee farmers increased considerably in the first period, starting from just 22 percent in 1992 and reaching 38 percent by 1995. Note that the rise may be even higher given that farmers who own coffee trees but do not yet produce as the trees still grow are not counted as coffee farmers (see Section 4). Not much change is recorded in the second period: by 1999 coffee farmers represent 39 percent of the population in our sample. [184] The significant increase in the size of this group is the result of many farmers deciding to start growing coffee, which will be discussed in more detail below.

[182] Coffee districts by this definition are (according to 1992 district definition): Kalangala, Kapchorwa, Kiboga, Luwero, Masaka, Mpigi, Mubende, Mukono, Rakai, Mbale, Kamuli, Iganga, Bushenyi, and Jinja.

[183] The sub-sample includes observations from the following districts: Kalangala, Kiboga, Luwero, Masaka, Mpigi, Mubende, Mukono, Rakai, Iganga, Jinja, Kamuli, Tororo, Bushenyi, Kabarole, Kibaale, and Mbarara. The sub-sample sizes are 4,994 households in 1992/93, 2,241 in 1995/96, and 5,637 in 1999/00. It should be noted that of all the coffee farmers in the sub-sample 89 percent reside in those districts that are defined as coffee districts (in a sample pooled over the three surveys).

[184] It should be noted that the sub-sample is not representative for the regions covered, as only the full national sample is constructed to be representative and district samples are so only to a limited degree. In addition, we have received comments from several observers of Ugandan agriculture that this increase may be exaggerated. An analysis of the primary sampling units however does not hint at any major differences in the sampling procedure between the three surveys, and in particular between the first and the two more recent surveys.

With regard to welfare levels, initially there was no significant difference in mean per capita consumption levels between coffee farmers, other rural households in coffee regions, and rural households in non-coffee regions. With a large and significant rural-urban income gap, Uganda fits well into the pattern prevailing in much of Sub-Saharan Africa.

Table 11.1: *Per capita consumption levels, by household type, 1992–99*

Household Type	1992		1995		1999	
	Mean Per Capita Cons	Pop. Share (%)	Mean Per Capita Cons	Pop. Share (%)	Mean Per Capita Cons	Pop. Share (%)
Coffee farmers	4908 *4592 5224*	22.3	6101 *5713 6489*	37.8	7330 *6939 7721*	39.0
Rural in coffee regions	5233 *4879 5586*	46.1	6444 *5751 7137*	33.9	7859 *7152 8565*	30.6
Rural in non-coffee regions	4913 *4540 5286*	23.0	4746 *4171 5322*	21.9	7017 *6631 7403*	21.4
Urban in coffee regions	8408 *6399 10417*	6.5	10163 *8211 12115*	5.2	15583 *13300 17866*	7.0
Urban in non-coffee regions	7590 *6744 8437*	2.1	11131 *9323 12938*	1.3	16122 *12953 19291*	2.0
Total	5344 *5057 5631*	100.0	6198 *5821 6575*	100.0	8175 *7709 8641*	100.0

Source: Authors' calculations.
Note: In all our calculations, we use the official consumption aggregate provided by the Uganda Bureau of Statistics (UBOS) based on the work by Simon Appleton. Values are in constant 1989 shillings. For details, see the technical appendix in Appleton (2001). We also use official poverty lines as documented in Appleton (2003). 95 % confidence intervals in italics (standard errors corrected for survey design).

Not surprisingly, coffee farmers experienced the highest welfare gains during the coffee price boom, but they were closely followed by the other household groups residing in coffee regions (Table 11.2), leaving the difference between the two groups in terms of mean per capita consumption insignificant. Overall, growth in per capita consumption was markedly higher in coffee regions than in non-coffee regions, where rural households even experienced negative growth rates. In the first half of the 1990s, the most significant difference in consumption growth occurred between the rural households of the two regions, which points to substantial but regionally concentrated multiplier effects of the price boom. As a consequence, rural households in coffee regions were significantly better off in 1995 than their counterparts in non-coffee regions.

In the second period, coffee farmers continued to perform well despite falling coffee prices, and other rural households in coffee regions grew at similar rates. However, non-coffee regions outperformed coffee regions, which brought rural consumption levels closer together again, rendering the regional differences insignificant. The very high growth rates in urban coffee regions as well as in both rural and urban non-coffee regions point to a strong autonomous growth process unrelated to the coffee sector.

Table 11.2: *Per capita consumption growth, by household type, 1992–99*

Household type	Growth in Mean Per Capita Consumption (%)	
	1992–95	1995–99
Coffee farmers	7.53	6.31
Rural in coffee regions	7.19	6.84
Rural in non-coffee regions	–1.15	13.92
Urban in coffee regions	6.52	15.31
Urban in non-coffee regions	13.61	13.14
Total	5.07	9.66

Source: Authors' calculations.

The basic thrust of this descriptive analysis is corroborated by a multivariate regression analysis that pools the observations from the three surveys. Into a regression that explains per adult equivalent consumption expenditures we include dummies for being a coffee farmer and residing in coffee regions, which we interact with time dummies for each year, plus time dummies for 1995/96 and 1999/00. Additional right-hand-side variables comprise a standard set of controls, including education and land endowments, an urban dummy, variables related to non-farm income, as well as various regional controls that are meant to capture different growth dynamics between regions. Some of these controls are also interacted with time dummies. The equation is estimated using ordinary least squares.

The results, which are reported in Part A of the appendix to this chapter, correspond to expectations. Controlling for other income determinants, we find that in 1992/93, neither coffee farmers nor people residing in coffee regions were better off than their counterparts in non-coffee regions. Yet, both the 1995/96 coffee region and the 1995/96 coffee farmer dummy turn out to be significantly related to higher expenditure levels. These effects are quantitatively important: households in coffee regions consumed approximately 9 percent more, and coffee farmers an additional 13 percent. (Note that the vast majority of coffee farmers resides in coffee regions.) The time dummy for 1995/96 is not significant, which underlines the importance of the price boom and regional multiplier effects in explaining overall growth. For coffee farmers, the expenditure differential reversed between 1995/96 and 1999/00, with 4 percent less consumption in 1999/00, whereas it remained positive for households residing in coffee regions. Overall expenditure levels increased by more than 30 percent, as indicated by the coefficient of the 1999/00 time dummy, which again indicates the above-mentioned autonomous growth process.

Consumption growth also led to poverty reduction (Table 11.3). Between 1992 and 1995, poverty among coffee farmers and other rural households in coffee regions was reduced considerably while rural poverty in non-coffee regions increased slightly. During the first half of the 1990s, if not causation, one certainly observes a strong correlation between poverty reduction and booming coffee prices. Between 1995 and 1999, poverty reduction slowed down but continued for coffee farmers and other rural households in coffee regions despite falling coffee prices. Enjoying remarkable growth rate in its consumption levels, the group of rural households in non-coffee regions experienced a concomitant drop of more than 50 percent in its poverty headcount. Urban poverty decreased at a relatively stable pace throughout the entire period.[185]

Table 11.3: *Poverty reduction, by household type, 1992–99*

Household Type	Poverty (Headcount Index)		
	1992	1995	1999
Coffee farmers	56.4	42.3	27.0
	51.0 61.7	*36.4 48.2*	*24.5 29.6*
Rural in coffee regions	52.6	37.1	28.7
	48.4 56.8	*31.1 43.0*	*25.5 31.8*
Rural in non-coffee regions	52.0	54.9	26.5
	46.0 58.1	*47.6 62.2*	*22.6 30.4*
Urban in coffee regions	34.1	20.5	8.7
	20.1 48.1	*12.7 28.4*	*4.7 12.7*
Urban in non-coffee regions	31.1	17.9	10.2
	24.4 37.9	*7.4 28.5*	*3.7 16.7*
Total	51.7	41.8	25.8
	48.6 54.7	*38.1 45.6*	*24.0 27.6*

Source: Authors' calculations.
Note: 95% confidence intervals in italics (standard errors corrected for survey design).

COFFEE PRICES, GROWTH, AND POVERTY: CAN TRANSMISSION CHANNELS BE IDENTIFIED?

Up to this point, we analyzed how different households fared in an environment characterized by strong coffee price changes. In the following, we look at possible transmission channels behind these observations. This may be difficult to achieve given the limitations imposed by using cross-section rather than panel data. However, by further investigating a number of issues focusing on how price shocks may "cause" changes in poverty ratios, we were able to shed some light on certain relevant structural links.

Specifically, we considered four sets of issues: (1) What are the characteristics of the farmers who moved into coffee farming during the 1990s, and can the growth process of this period be qualified as pro-poor, at least for the coffee farmers' group? (2) How have coffee farmers reacted to the price hike and, in particular, were they able to expand supply? In addition, was this positive supply response sufficient to enable coffee farmers to cushion the negative price effect of the second period? (3) Is it possible to clearly identify a coffee price effect by decomposing income growth into different income components for different household groups? More specifically, do changes in the composition of income sources in the second period of falling prices indicate a diversification towards alternative crops or non-farm employment and thus signal a "coping" strategy?

[185] To complement the household-group-specific averages, Bussolo and others (2006) present growth incidence curves for coffee farmers and other rural households in coffee regions. The curves suggest that both groups experienced pro-poor growth over the period 1992–95, and roughly neutral growth thereafter.

(4) Did coffee farmers rely on the alternative coping strategy of selling assets when prices fell?

The coffee farmers' group: who enters and who exits?

Had it been mainly poorer farmers (as proxied by the important poverty correlates land and education) moving into the coffee sector, then the pro-poor pattern of consumption growth found among coffee farmers could be attributed, at least partly, to the price boom.[186] To verify this hypothesis, we performed a logit analysis for each survey, in which the probability of being a coffee farmer is related to household characteristics such as asset endowments. The regression results are presented in the working paper version (Bussolo and others, 2006, Appendix B). Figure 11.3 and Figure 11.4 show the predicted probabilities of these models conditional on land and education endowments. The vertical shifts of the predicted probability line simply reflect a larger number of coffee farmers and hence the interpretation of the graphs has to focus on the slope of the lines. If the slope remains unchanged, this implies that coffee farmers' characteristics as proxied by the explanatory variables are not altered relative to those of non-coffee farmers. Concerning land size, the increasing slope over time means that non-coffee farmers with relatively high land endowments move into coffee farming (Figure 11.3). This effect is particularly pronounced between 1995 and 1999, i.e. the few farmers who started to grow coffee despite falling prices tended to be large landowners. The increasing gradient of land on the probability of producing cof-

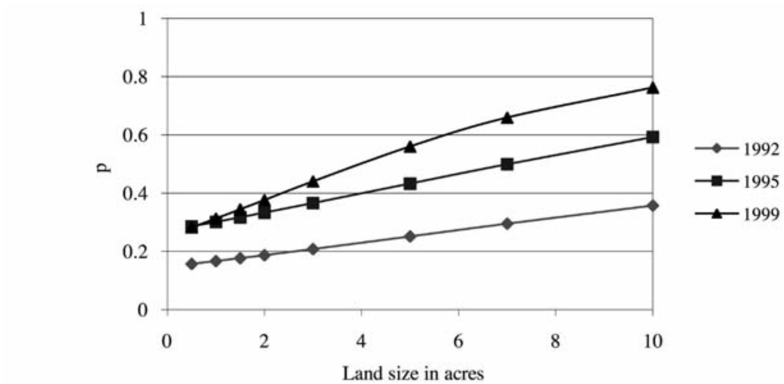

Figure 11.3: *Land size and coffee farming, 1992–99*

Source: Authors' calculations based on logit regressions reported in Bussolo and others (2006).
Note: Predicted probabilities of being a coffee farmer conditional on land size (evaluated at the mean of all other right-hand-side variables).

[186] This argument rests on the following counterfactual reasoning: if poorer farmers entered the coffee sector in a world without a coffee price boom, the income distribution would have worsened. If the income distribution improves despite entry of poorer farmers in the real world, this can only be due to the boom.

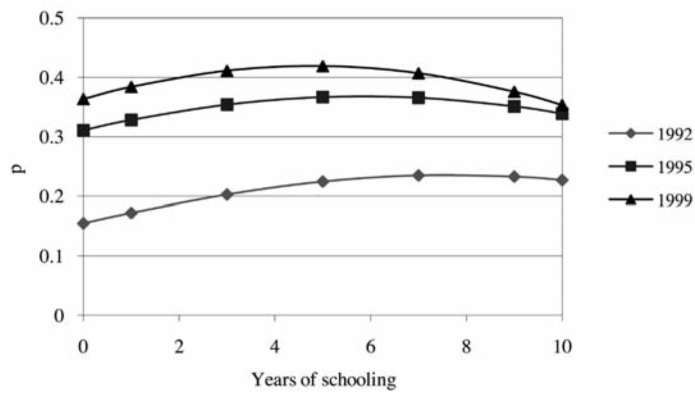

Figure 11.4: *Education and coffee farming, 1992–99*

Source: Authors' calculations based on logit regressions reported in Bussolo and others (2006).
Note: Predicted probabilities of being a coffee farmer conditional on educational level (evaluated at the mean of all other right-hand-side variables).

fee could also be explained by the fact that large households were less likely to drop out of coffee production, and might suggest that falling coffee prices did impact smaller farmers more than larger farmers.

For education, the reverse pattern obtains, with relatively poorly educated households exhibiting a higher probability of moving into coffee farming (Figure 11.4). Again, the impact appears to be stronger in the second period. Taken together, it is therefore difficult to say whether entry has been biased towards poorer or richer farmers. This finding may allow for the conclusion that at least some of the pro-poor growth pattern observed between 1992/93 and 1995/96 for coffee farmers is due to the boom, i.e. poorer coffee farmers have benefited (relatively) more from the boom than the rich. Yet, as land tends to be a more important determinant of income and hence poverty in the rural context, it is likely that the better-off farmers have been in a better position to grasp the opportunities of the liberalized coffee market through entry.

Supply responses of the coffee sector

Besides raising the number of coffee farmers, the coffee price boom and the concomitant coffee price liberalization could have provided an incentive to increase coffee production. A supply response to changes in prices can come about via changing yields for a given set of inputs and/or via changes in input use. We are not able to draw any conclusions concerning possible yield improvements based on the information given in the surveys.[187] Among the inputs used, the area planted with coffee is obviously a key determinant of production. Unfortunately,

[187] The data on agricultural production are too deficient to calculate yield changes that are comparable over time. But even if we could do so, the variations between the surveys could not necessarily be interpreted as a supply response because coffee yields tend to vary widely with weather conditions. This qualification also holds for the following assessment of changes in coffee production.

this variable is not available for 1992 so we start by looking at the overall land area under cultivation to obtain some indirect evidence.

It turns out that coffee farmers started with substantially higher land endowments than other farm households in 1992 (Table 11.4). The data confirm the commonly held view in Uganda that farm size has further declined during the 1990s due to population pressure, but the change is significant only for non-coffee farmers, whose land area declined significantly from 2.9 to 2.4 acres between 1992 and 1999. Land size may have gone up slightly during the second half of the 1990s, but the change is not significant.

Table 11.4: *Land under cultivation, by farm type, 1992–99*

Farmtype	Land under cultivation in acres		
	1992	1995	1999
Coffee farmer	3.6	3.7	3.3
	3.3 4.0	*2.9 4.4*	*3.1 3.5*
Non-coffee farmer	2.9	2.2	2.4
	2.7 3.0	*1.9 2.4*	*2.1 2.6*
All	3.0	2.7	2.8
	2.9 3.2	*2.4 3.1*	*2.6 2.9*

Source: Authors' calculations.
Note: 95 % confidence intervals in italics (standard errors corrected for survey design).

The mean land size of coffee farmers also decreased between 1992 and 1999. In the early 1990s, however, their land size increased slightly if not significantly. This could be partly due to larger farmers moving into coffee, in line with the above findings. As shown in Table 11.5, the share of coffee farmers in overall farm households with landholdings of more than 10 acres increased steeply between 1992 and 1995. But the finding is of course also consistent with a rise in the area planted with coffee. The latter cannot be substantiated here because coffee is intercropped in Uganda and the way land use by crop is recorded in the surveys does not allow an accurate measure of the area of land planted with coffee to be derived.

Unfortunately, there is very little information on other agricultural inputs in the 1995/96 survey. Actually, only hired farm labor turns out to be an agricultural input that is comparable across the three surveys, but the data appear to be severely contaminated by changes in survey design between 1992/93 and 1995/96. Yet, there is some evidence that in the second half of the 1990s more permanently hired labor was used in agriculture, and more so by coffee farmers.

Regarding the evolution of coffee production, 1992 and 1995 should not be compared because of large differences in the survey design, while 1995 and 1999 are more readily comparable. The data show a large and significant expansion of coffee production across all farm sizes (Table 11.6), which may at least partly explain why coffee households could raise their living standards in a phase of falling prices. In combination with the rising share of coffee farmers, this dramatic production increase also provides an indication that farmers have indeed responded to the coffee price boom, with the delay in production reflecting the

Table 11.5: *Distribution of coffee farmers, by land size groups, 1992–99*

Landholdings in Acres	Distribution of Farms by Land Size (%)			Share of Coffee Farmers in Each Land Size Group (%)		
	1992	1995	1999	1992	1995	1999
Less than 1	25.5	29.5	22.7	18.5	24.6	27.6
1–2	28.7	32.0	31.4	24.9	39.1	42.7
2–3	19.1	17.1	19.6	23.8	49.2	49.6
3–5	16.9	12.4	15.6	27.6	43.5	50.7
5–10	7.8	5.9	8.1	39.0	56.9	64.7
More than 10	2.0	3.2	2.8	40.8	70.2	72.9
Total	100.0	100.0	100.0	24.9	39.1	44.5

Source: Authors' calculations.

time that has to pass between planting and harvesting. This reasoning is supported by the fact that the share of those who have coffee plants but do not harvest coffee declines from 16 percent in 1995 to 9 percent in 1999 (for 1992, we do not have this type of information).

Table 11.6: *Changes in coffee production, by coffee farm size, 1992–99*

Production Size Group	Mean Coffee Production (kg per year)		
	1992	1995	1999
1	69 *65 72*	42 *38 45*	65 *62 69*
2	166 *161 171*	135 *129 141*	186 *182 189*
3	317 *309 326*	263 *254 73*	348 *341 355*
4	636 *606 667*	492 *475 509*	693 *676 709*
5	1443 *1248 1639*	1746 *1303 2189*	2362 *2014 2709*
Total	364 *315 413*	377 *292 461*	479 *432 527*

Source: Authors' calculations.
Note: Coffee production is in kg (approximately per year). 95 % confidence intervals in italics (standard errors corrected for survey design). Production size groups are defined according to coffee production quantity. Production size group 1 includes all coffee farms that produce less than 0.5 times median coffee production in the respective year. Production size group 2 (3, 4, 5) produces between 0.5 and 1 (1and 2, 2 and 4, more than 4) times median production in the respective year. This procedure helps to account for changes in survey design as well as external shocks (above all weather shocks) that affect overall production levels.

Decomposing income growth by source: is a coffee price effect clearly discernable?

For coffee farmers, Table 11.7 again illustrates the strong impact of the coffee price fluctuations on household welfare. Income growth between 1992 and 1995 was almost entirely due to increased income from coffee.[188] Yet, there was also a notable increase of income from non-agricultural activities, possibly indicating that the income earned from coffee was immediately invested in setting-up non-agricultural enterprises.

For other rural households in coffee regions, the income earned from non-agricultural activities increased markedly between 1992 and 1995, in particular for richer households. Income growth for poorer households, however, stems primarily from increased crop income. This suggests that repercussions of the coffee boom worked through both stimulating non-agricultural activities and non-coffee crop agriculture. While multiplier effects in non-agriculture seem to have favored richer households, the poor benefited from agricultural (possibly food-demand) linkages. The overall growth pattern due to these multiplier effects is biased in favor of the poor, a result that is corroborated by the growth incidence curves presented in Bussolo and others (2006).

After 1995, rural growth in coffee regions was driven by agricultural incomes, but the trend towards higher incomes from non-agricultural activities was not reversed with falling coffee prices. For coffee farmers, income earned from other crops than coffee compensated for the losses incurred from falling coffee prices.

To put the above findings into perspective, income growth decompositions are also reported for non-coffee regions (see Part B of the appendix to this chapter). The sluggish growth performance of rural households in these regions in the early 1990s highlights the importance of the coffee price boom for rural areas in coffee regions. In contrast, urban growth performance was very similar in coffee and non-coffee regions in both periods except for the increase in remittances and transfers in coffee regions during the price boom. The decomposition shows that income growth of rural households in non-coffee regions in the second period was mainly driven by agricultural growth, although income from non-agricultural activities also became somewhat more important. The general strong performance of agriculture, and not specific circumstances in coffee regions, seem to have helped coffee farmers to compensate the losses from falling coffee prices.

Such an interpretation is substantiated by a closer look at the agricultural sector. Table 11.8 shows the market integration of non-coffee farmers in both coffee and non-coffee regions as well as the number of crops planted by different farm types including coffee farmers. We interpret the number of planted crops as

[188] As income data are notoriously deficient in the surveys, many observations for income from different sources had to be imputed using a simple methodology described in Bussolo and others (2006; Appendix C). In addition, absolute incomes are difficult to compare across time due to survey design changes so that we base our analysis on income shares, assuming that biases arising from survey design changes affect different products uniformly. To keep the decomposition consistent with the preceding analyses we decompose per capita expenditure growth applying the derived income shares to this welfare measure.

Table 11.7: *Growth decomposition, by income sources, for coffee farming households and households in coffee regions*

Expenditure Decile	Growth in Income from						Per Capita
	Coffee	Other Crops	Other Agricul-ture	Non-Agricul-tural	Remitt., Transfers, Other	Total Growth	Expenditure Level, Initial Year
Coffee farmer, 1992–95							
bottom 30%	35.1	6.6	–5.4	11.0	–2.6	44.6	16173
middle 40%	30.7	1.8	–5.3	7.6	–0.9	33.8	26027
top 30%	23.1	–6.3	–1.9	23.8	5.2	43.9	40745
Total	27.8	–1.2	–3.7	16.2	1.7	40.9	27648
Coffee farmer, 1995–99							
bottom 30%	–22.0	30.3	1.1	–1.7	2.6	10.4	23394
middle 40%	–18.8	32.5	1.3	–0.2	1.3	16.1	34837
top 30%	–7.2	30.0	3.1	–7.0	–2.7	16.2	58630
Total	–13.6	30.8	2.2	–3.9	–0.5	15.0	38953
Rural households in coffee regions, 1992–95							
bottom 30%		23.8	–8.1	9.0	1.7	26.4	13493
middle 40%		15.5	–3.3	13.9	4.3	30.4	21854
top 30%		–8.1	–3.7	25.0	0.9	14.1	34417
Total		5.4	–4.4	18.4	2.1	21.6	23254
Rural households in coffee regions, 1995–99							
bottom 30%		20.9	1.0	4.7	0.6	27.1	17059
middle 40%		13.3	0.9	5.6	–2.1	17.8	28497
top 30%		28.2	3.3	4.5	1.3	37.2	39269
Total		21.7	2.0	4.9	0.0	28.7	28275
Urban households in coffee regions, 1992–95							
bottom 30%		24.6	–1.6	15.3	1.4	39.7	17507
middle 40%		9.6	3.4	35.8	14.0	62.8	29096
top 30%		0.8	–3.2	7.3	16.3	21.2	60084
Total		7.1	–1.1	16.4	13.2	35.6	35562
Urban households in coffee regions, 1995–99							
bottom 30%		–3.6	1.4	29.4	2.6	29.8	24449
middle 40%		–3.0	–0.9	14.8	–2.9	8.1	47365
top 30%		1.8	1.6	69.7	–1.3	71.7	72813
Total		–0.7	0.7	44.9	–1.2	43.8	48209

Source: Authors' calculations.

a proxy for more productive and more diversified farming systems. The figures for both market integration and diversification illustrate the strong growth dynamics between 1995 and 1999. Maybe somewhat surprisingly at first sight, market participation of non-coffee farmers in coffee regions as well as the number of crops planted dropped significantly during the boom phase. Given the purchasing power generated by the rise in coffee prices one might have expected the reverse, but two factors help explain this phenomenon: first, it is likely that the more market-integrated farmers moved into the coffee sector, which also explains the drop in the number of crops planted by coffee farmers; second, the increased specialization into non-agricultural activities was possibly associated with a retreat from agricultural markets.

Table 11.8: *Participation in agricultural markets and number of crops planted, by farm type, 1992–99*

Farmtype	Share of Farmers Participating in Product Markets (%)			Number of Crops		
	1992	1995	1999	1992	1995	1999
Coffee farmers				6.0	5.3	6.8
				5.8 6.3	*4.9 5.8*	*6.7 6.9*
Non-coffee farmers in coffee regions	54	39	63	4.5	3.1	4.2
	50 57	*32 46*	*58 67*	*4.3 4.7*	*2.7 3.5*	*4.0 4.4*
Non-coffee farmers in non-coffee regions	63	68	79	4.8	5.6	5.7
	58 68	*59 77*	*75 83*	*4.5 5.1*	*5.1 6.2*	*5.4 5.9*

Source: Authors' calculations.
Note: Market participation is defined as the share of farmers with positive sales; 95% confidence intervals in italics (standard errors corrected for survey design).

Consumption smoothing via asset sales

There is also some evidence that coffee farmers responded to falling coffee prices by selling assets as a means of smoothing consumption. The share of farmers owning cattle, arguably the asset that can most readily be sold, increased over the period 1995–99 for coffee and non-coffee farmers alike, but the mean value of cattle in constant prices went down for coffee farmers, while it went up quite dramatically for non-coffee farmers (Table 11.9). Looking at which coffee farmers might have sold cattle does not produce very clear-cut results, but two tentative conclusions can be drawn: first, poorer coffee farmers did not experience losses in cattle value (which can also be inferred from the median value of cattle even rising for coffee farmers), i.e. there is no indication of desperation-led selling of cattle; and second, the value of cattle appears to have fallen significantly for the most specialized coffee farmers.

Table 11.9: *Changes in cattle endowments, by farm type, 1995–99*

Household Type	Share of Farmers With Cattle (%)		Value of Cattle (In 1989 Prices)	
	1995	1999	1995	1999
Non-coffee farmers	16	21	196328	297653
	12 19	*12 23*	*146024 246632*	*249418 345887*
Coffee farmers	21	28	258471	221835
	17 25	*17 31*	*101795 415148*	*180119 263551*

Source: Authors' calculations.
Note: 95% confidence intervals in italics (standard errors corrected for survey design).

This evidence is supported by qualitative questions in the 1999/00 survey, in which households were asked to assess the availability of different types of assets at the date of interview compared to 1992. It turns out that farmers who grew coffee on more than 60 percent of their cultivated land reported declining livestock assets. Under the plausible assumption that the evaluations of farmers mainly refer to recent changes in asset availability, this fits well with the quantitative evidence.

CONCLUDING REMARKS

This paper has shown for Uganda that a coffee market liberalization followed by a price boom was associated with substantial reductions in poverty which could even be sustained when prices went down again. This is not to deny that other factors such as the return to peace and stability have played their part in raising welfare levels. Yet coffee farmers, and especially the poorer among them, seem to have benefited from the price hike, and many non-coffee farmers switched to coffee production, indicating that part of the price increase was perceived as permanent. Other rural households in coffee regions fared almost as well as coffee farmers during the first half of the 1990s. By contrast, rural households' consumption in non-coffee regions stagnated, which suggests that the indirect effects of the coffee boom were confined to coffee-producing regions. Finally, falling coffee prices in the second half of the 1990s do not seem to have erased the previous income gains of rural households in coffee regions. In this latter period, coffee farmers raised production, probably as a delayed response to better incentives. Additionally, they adjusted to lower prices by investing in alternative crops and possibly also by selling assets. Yet, the key explanatory factor appears to be the strong general performance of the agricultural sector in the late 1990s, which also reduced possible negative multiplier effects on non-coffee farmers.

Overall, the case of coffee in Uganda thus lends support to the view that agricultural trade liberalization is beneficial for the poor. The extensive trade and poverty literature suggests, however, that simple general conclusions about the relationship between trade liberalization and the well-being of the poor cannot be drawn.[189] Among other things, the impact of trade liberalization depends on the policy environment in which it is carried out. The agricultural policy framework and government strategy has certainly played a role in triggering agricultural growth. It may thus well be, for example, that the income diversification observed for Ugandan coffee farmers would not have been possible without the thorough structural reforms in which the coffee market liberalization was embedded. In the same vein, windfalls from temporary commodity price booms may only be saved at least partly if there are reliable investment opportunities in other sectors of the economy.

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[189] For a comprehensive survey of this literature, see Winters and others (2004).

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APPENDIX

Part A: Determinants of per adult equivalent expenditure (OLS regression; pooled data)

Independent Variables \ Dependent Variable	Log per Adult Equivalent Expenditure
Coffee farmer in 1992	–0.033
	(–1.1)
Coffee region in 1992	0.041
	(–0.79)
Coffee farmer in 1995	0.086
	(2.70)**
Coffee region in 1995	0.129
	(2.02)*
Coffee farmer in 1999	–0.038
	(2.13)*
Coffee region in 1999	0.064
	(2.66)**
Time dummy 1995	0.025
	(–0.26)
Time dummy 1999	0.31
	(4.47)**
Regional controls significant at least at 10 percent level	East (interacted with time dummy for 1995, 1999), District with major urban agglomeration (interacted with time dummy for 1992, 1999), District close to Kampala (interacted with time dummy for 1992, 1995, 1999)
Regional controls not significant at 10 percent level	East (interacted with time dummy for 1992), West (interacted with time dummy for 1992, 1995, 1999), District with major urban agglomeration (interacted with time dummy for 1995)
Household controls significant at least at 10 percent level	years of schooling (interacted with time dummy for 1999, years of schooling squared (interacted with time dummies for 1992, 1995, 1999), experience (squared), female, urban (interacted with time dummies), land (interacted with time dummy for 1999), land squared (interacted with time dummy for 1995, 1999), nonfarm household, share of non farm income (both interacted with time dummies), no agricultural sales-dummy
Household controls not significant at 10 percent level	years of schooling (interacted with time dummies for 1992, 1995), land (interacted with time dummies for 1992, 1995), land squared (interacted with time dummy for 1992), distance to nearest product market
Pseudo-R^2	0.3109
Observations	12863

Source: Authors' calculations.
Notes: Robust z statistics in parentheses, * significant at 5%; ** significant at 1%; OLS regression on pooled cross section data.

Part B: Growth decomposition by income sources for households in non-coffee regions

Expenditure Decile	Growth in Income from						Per Capita Expenditure Level, Initial Year
	Coffee	Other Crops	Other Agricul-ture	Non-Agricul-tural	Remitt., Transfers, Other	Total Growth	
Rural households in non-coffee regions, 1992–95							
bottom 30%		11.9	−2.1	−2.2	−5.0	2.6	13547
middle 40%		8.7	−0.7	−2.9	−6.3	−1.2	23744
top 30%		−7.3	−2.6	12.7	2.5	5.2	33973
Total		1.7	−1.9	4.6	−1.9	2.6	23755
Rural households in non-coffee regions, 1995–99							
bottom 30%		40.0	3.9	13.7	6.6	64.2	13897
middle 40%		34.1	−0.6	10.3	4.2	48.0	23467
top 30%		52.2	6.0	9.7	0.3	68.2	35746
Total		44.1	3.5	10.6	2.8	61.0	24370
Urban households in non-coffee regions, 1992–95							
bottom 30%		16.7	−2.4	4.9	−2.3	16.8	20430
middle 40%		−5.5	−0.6	49.6	1.5	45.1	30992
top 30%		1.5	0.5	20.1	3.2	25.3	56774
Total		2.4	−0.4	25.7	1.7	29.4	36065
Urban households in non-coffee regions, 1995–99							
bottom 30%		7.7	−1.0	30.9	−1.2	36.3	23870
middle 40%		15.4	0.1	10.3	2.1	28.0	44960
top 30%		2.0	2.0	67.7	−5.0	66.6	71144
Total		7.3	0.9	43.0	−2.1	49.1	46658

Source: Authors' calculations.

12

Food Price Increases and the Wage Channel: Sugar in Brazil[190]

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Sugar is one of the most distorted sectors in the world. In many industrialized countries sugar producers benefit from a variety of import restrictions, production and export subsidies. The result has been supression of world market prices. As noted in Hoekman and Howse (2008), in the early 1970s, for example, the European Community was a net importer of sugar, buying some 2.5 million tons on the world market. As a result of high intervention prices for sugar – averaging more than double the world price since the mid 1980s, and rising to a multiple of four in 2000 – production expanded so much that the EC became a net exporter. In the late 1990s/early 2000s EC net exports of sugar were in the range of 4 to 5 million tones, making it the 2nd largest exporter in the world (after Brazil). Some estimates suggest that world prices could increase by as much as 40 percent following the elimination of all trade distorting policies in this sector (Mitchell, 2005). This would benefit many developing countries that have a comparative advantage in the production of sugar. Around 60 to 70 percent of world production takes place in tropical countries from sugar cane and 30 to 40 percent in more temperate climates from sugar beet.

Brazil is the largest producer and exporter of sugar in the world and is generally held to be one of the largest beneficiaries of global liberalization.[192] But who is

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[192] Such liberalization is on the table in the Doha Development Agenda. Although these negotiations have been deadlocked, other forces have been pushing towards reform. Thus, in 2005 Brazil won a WTO dispute that found that the EC had exceeded its permitted level of export subsidies, partly as a result of which the EU reduced its sugar subsidies and cut its reference price by around 40 percent. See Hoekman and Howse (2008) for an analysis of the legal and economic dimensions of the WTO dispute, including implications for ACP producers that will suffer an erosion of preferential market access.

likely to be the largest winner *within* Brazil? Some argue that given the structure of the sugar sector, little of the economic gains will accrue to small farmers and agricultural workers. Instead, most of the gains from global liberalization would go to large (multinational) firms that are established in Brazil and their relatively skilled (and often foreign) workers.[193] Others argue that an increase in sugar prices could benefit the poorest segments of the population because the sugar sector accounts for a substantial share of employment among the poor in Brazil. A third of sugar workers in the North and Northeast are illiterate, and almost 60 percent of sugar workers in Brazil have not completed primary school. Moreover, the sugar sector's overall contribution to GDP and employment is around 1 percent and reaches 3 to 4 percent in Pernambuco. General equilibrium effects may increase wages and employment in other sectors as well, depending on inter-industry linkages and factor mobility across sectors and industries.

This chapter focuses on the relationship between sugar prices, wages and employment. We first estimate the extent of price transmission from world markets to 11 Brazilian states, and then simultaneously estimate the impact that changes in local sugar prices have on regional wages and employment for workers with different characteristics, as suggested by Winters et al. (2004). We find that wage effects tend to benefit relatively more workers in the top income quintile, while the employment effect benefits relatively more workers belonging to the bottom income quintile, who are moving out of unemployment. When these two effects are put together, households experience similar gains in percentage terms throughout the entire income distribution.[194] We estimate that a 10 percent increase in world sugar prices[195] will increase aggregate labor income by some $2 billion (or 0.4 percent of GDP). Thus, Brazilian workers are likely to benefit substantially from liberalization of the sugar sector in OECD countries. Our estimates also suggest that around 280,000 Brazilians will be brought out of poverty following a 10 percent increase in world sugar prices.

The rest of the chapter is organized as follows. After providing background information on the functioning of the sugar sector in Brazil and the characteristics of its labor force, we discuss the empirical methodology used to

[193] Since Brazil opened its sugar sector to foreign investment in the late 1980s some 30 international firms entered the Brazilian market, representing about 10 percent of total sugar production (Moraes, 2004). This includes several large groups such as FDA (a joint-venture formed by Brazilian group Cosan, with participation of 47.5 percent, and by French groups Tereos/Union DAS, also with 47.5 percent, and Sucres & Denrées/Sucden, holding 5 percent); Coinbra/Louis Dreyfus (takeover of two sugar mills Luciania Mill and Cresciumal), Béghin-Say (takeover of Guarani sugar mill) and Glencore Group from Switzlerand.

[194] This result has important implications for the theoretical and empirical literature on trade and wages. Indeed, the empirical puzzle that often trade liberalization leads to more wage inequality in developing countries may only be part of the story. Our results suggest that it can simply be explained by the fact that in developing countries where unemployment is often high (or more generally where there are difference in the supply elasticities of skilled and unskilled labor), the focus should not be on wage inequality, but rather on labor income inequality.

[195] A 10 percent increase in the world price of sugar is at the lower end of the range of estimates provided in the literature (see Mitchell, 2005). To obtain percentage changes in income for other estimates of changes in world price, see footnote 4.3.

estimate the transmission of changes in the world price of sugar into local sugar prices and the impact of local prices on wages and employment. We then present the empirical results and offer concluding remarks. A data appendix discusses data sources and variable construction.

THE SUGAR SECTOR IN BRAZIL

Brazil produces around 28 percent of all sugar cane in the world and exports around 25 percent of the world's total processed raw sugar (FAOSTAT).[196] A key feature of the sugar cane industry is the close relationship between harvesting and processing – raw cane must be transported to mills rapidly, as the quality of sugar deteriorates quickly once it has been cut. As a result, mills tend to be located in the midst of the sugar cane area. There are two main sugar cane producing regions: the Center-Southeast and North-Northeast. There are approximately 300 plants processing sugar cane (sugar mills), almost 75 percent of which are in the Center-South. Because of poorer soil quality, the costs of growing sugar cane are higher in the North. Processing costs are also higher in the North than in the Center-South. The state of São Paulo in the Center-South is by far the biggest producer. It accounts for 75–80 percent of sugar cane production and 60–65 percent of sugar production (Table 12.1). However, the North-Northeast accounts for 70–75 percent of exports (Bollings and Suarez, 2002). Almost 45 percent of all production is consumed domestically. Domestic food manufacturers account for approximately 35–45 percent of total consumption, direct consumption for the rest.

Prior to reforms in the 1990s the Brazilian sugar and alcohol industry was highly regulated. Sugar mills and distilleries received credit guarantees and subsidized interest rates. Domestic marketing of sugar and alcohol was state-controlled, with the Institute of Sugar and Alcohol (IAA) acting as a state trading enterprise, setting and allocating production quotas for sugar mills and distilleries. Above-quota production was allowed to be exported subject to licensing requirements and export taxation. The government set the domestic prices paid to sugar cane growers, giving higher prices to the growers in the higher-cost Northern production areas.

In 1990 the sugar market was reformed. The IAA was abolished, and sugar and ethanol policies were separated. Controls over the domestic price of sugar were removed. The export tax on sugar was lowered and eventually eliminated. Production taxes were made uniform across regions. In 1998 the state monopoly controlling ethanol distribution was abolished. The result of dergulation was that sugar and alcohol prices became market determined, with domestic sugar prices following world market prices. Concentration in the sector increased though mergers and acquisitions and FDI inflows (Moraes, 2004). The integration of Brazil's sugar market with the world market following these reforms is illustrated

[196] A bit more than half of Brazilian sugar cane is used for the production of ethanol (fuel alcohol). Brazil's interest in ethanol production dates back to the first oil crisis. The ethanol content of gasoline is regulated by decree at around 20 to 24 percent.

Table 12.1: *Sugar production in Brazil by state – 1990–04 (million tons)*

STATE/HARVEST	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03	03/04
PARA	0	0	0	0	0	0	0	0	0.01	0.02	0.01	0	0	0
CEARA	0.04	0.03	0.02	0.02	0.01	0.03	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
PERNAMBUCO	1.19	1.16	1.31	0.96	1.31	1.36	1.22	1.23	1.05	0.86	1.1	1.1	1.23	0.98
ALAGOAS	1.23	1.24	1.44	1.06	1.57	1.54	1.51	1.77	1.31	1.22	2.06	1.68	1.99	1.52
OTHER NORTH-EAST	0.40	0.34	0.36	0.23	0.32	0.41	0.43	0.51	0.4	0.38	0.43	0.46	0.56	0.47
NORTH-NORTHEAST	**2.86**	**2.77**	**3.13**	**2.27**	**3.21**	**3.34**	**3.18**	**3.53**	**2.78**	**2.49**	**3.61**	**3.25**	**3.79**	**2.98**
MINAS GERAIS	0.41	0.44	0.37	0.41	0.45	0.44	0.49	0.49	0.63	0.8	0.62	0.75	1.09	1.35
RIO DE JANEIRO	0.28	0.42	0.32	0.35	0.39	0.4	0.42	0.35	0.37	0.36	0.31	0.22	0.31	0.33
SAO PAULO	3.47	4.57	5	5.6	6.68	7.24	7.93	8.7	11.79	13.09	9.68	12.35	14.35	15.17
PARANA	0.22	0.24	0.23	0.31	0.43	0.56	0.78	0.94	1.24	1.43	0.99	1.35	1.47	1.87
GOIAS	0.04	0.05	0.11	0.15	0.2	0.23	0.31	0.29	0.34	0.37	0.4	0.51	0.58	0.67
OTHER CENTRAL-SOUTH	0.09	0.11	0.16	0.25	0.34	0.45	0.54	0.58	0.79	0.85	0.64	0.79	0.98	1.03
CENTRAL-SOUTH	**4.51**	**5.83**	**6.19**	**7.07**	**8.49**	**9.32**	**10.47**	**11.35**	**15.16**	**16.9**	**12.64**	**15.97**	**18.78**	**20.42**
BRAZIL	**7.37**	**8.6**	**9.32**	**9.33**	**11.7**	**12.65**	**13.66**	**14.88**	**17.94**	**19.39**	**16.25**	**19.22**	**22.57**	**23.4**

Source: Moraes (2004)

in Figure 12.1 by the high correlation between changes in Brazilian producer and consumer prices and world prices for raw (contract no. 11 in New York's stock market) and refined sugar (contract no. 15 in London's stock market).

There are four distinct groups involved in sugar production: sugar mills, independent sugar cane producers, agricultural wage workers and industrial workers. Each is represented by one or more organizations. The earnings of each group, including minimum wages of workers and the price of sugar cane paid to producers, depend on the outcome of annual negotiations between the various entities. The minimum wages negotiated in 2003/2004 were 51 US cents per hour for hired agricultural workers and 56 US cents for mill workers, corresponding to $113 and $122 per month, respectively (Moraes, 2004).

Around 75 percent of sugar cane is grown by the mills, which hire seasonal workers at hourly wages, while the rest belongs to independent producers (Moraes, 2004). In 2002, approximately 765,000 people were employed in sugar and alcohol production. Of these, 48 percent were employed in sugar cane production, and 12 percent were employed in the alcohol producing sector. Moraes (2004) estimates that 95 percent of employment is formal. Table 12.2 shows the distribution of workers by region, age groups and education levels for both sugar cane growing and production of sugar. Forty percent more workers were employed in the Central-South region than in the North. The ratio of employment to production (combining Tables 12.1 and 12.2) suggests that the Central-South region is 2.5 times more productive than the North region. This reflects land quality differentials, a higher degree of mechanization in the Central-South region, and skill differences across regions. In the Central-South region only 4 percent of workers are illiterate, whereas in the North the proportion is roughly one-third.

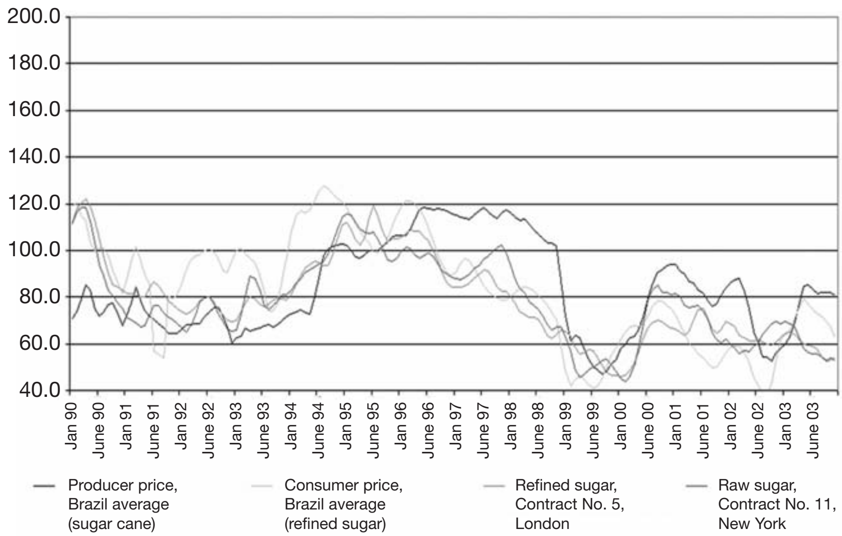

Figure 12.1: *Evolution of sugar prices indices (1995=100)*

Table 12.2: *Employment in the sugar sector, 2002 (number of workers)* [197]

	Brazil		North		Central/South	
	Cane	Sugar	Cane	Sugar	Cane	Sugar
Age group						
10 to 17 years	1571	1035	297	629	1274	406
18 to 29 years	160488	175613	36613	94075	123875	81538
30 to 49 years	169916	185080	39903	90424	130013	94656
50 and above	35645	35245	9516	18050	26129	17195
Total	**367620**	**396973**	**86329**	**203178**	**281291**	**193795**
Education						
Illiterate	46567	70722	33722	63489	12845	7233
8th grade completed	297810	273239	50190	128320	247620	144919
High school degree	20095	43238	2099	9543	17996	33695
College degree	3148	9774	318	1826	2830	7948

Table 12.3: *Ratio of high to low educated workers by sector, 1990–2002*[198/199]

Sector/Period	1990–1993	1995–1998	1999–2002	Change
Sugar growing	0.01	0.03	0.06	359%
Sugar processing	0.07	0.12	0.56	701%
Agriculture other than sugar	0.04	0.05	0.08	92%
Industry other than sugar	0.45	0.56	0.85	90%
– Food Industry	0.89	0.97	1.20	35%
– Beverages	1.21	1.72	2.55	111%
Services	1.01	1.36	1.94	93%

The average level of education among workers in the sugar sector (3.7 years) is higher than in the rest of the agricultural sector (2.8 years), but substantially lower than the average for the economy as a whole (6.4 years). The sugar sector has traditionally been relatively intensive in low-skilled labor. Table 12.3 shows the ratio of high-educated workers (defined as those with more than 9 years of education) to low-educated workers (defined as those with less than 5 years of education) in different sectors in Brazil. The sugar growing and processing sectors employ a relatively small share of high-educated workers relative to other sectors –with the exception of other agricultural sectors. Note that sectors that are heavy sugar consumers such as food and beverages industries are relatively intensive in high-educated workers, which suggest that these type of general equilibrium linkages would only reinforce the relatively low-educated intensity of the sugar sector. However, over the last decade the share of high-educated workers in the sugar processing and growing sectors grew drastically relative to the rest of the economy, growing on average 6 times more (last column of Table 12.3).

[197] Source: Moraes, 2004.
[198] Source: PNAD surveys, 1990–2002. See data appendix for more details.
[199] The ratio is taken as the average number of workers in the sector with 9 or more years of education divided by the number of workers in the sector with less than 5 years of education. Similar patterns are found when using the number of workers below and above the average education level in the survey which is around 7 years.

This is partly due to the transformation that the sector has undergone over the past decade. Reforms resulted in a transformation of the sector from being primarily family owned to an industry dominated by larger, technologically advanced factories. Sugar cane loading, transport and cultivation is 100 percent mechanized and harvesting is around 35 percent mechanized.[200] The mechanization has reduced the demand for workers (Guilhoto *et al.*, 2002), especially for those with low skills. The sector has become relatively capital intensive (labor costs representing around 25 percent of value-added for an average of 35 percent in manufacturing).

These changes led to growing demand for high-skilled workers. The Escola Superior de Agricultura "Luiz de Queiroz" (ESALQ) and the Ribeirão Preto Economics College (FEARP), both at the University of São Paulo, have graduated several MBA classes, and offer shorter technical courses, which target the sugar sector. The fact that MBA courses are being targeted to the sugar sector seems to suggest that there is a certain level of sector specific skills that need to be acquired. Thus, one may expect that changes in sugar prices would have a higher impact on wages of skilled workers in the sugar sector if these have relatively more sector specific skills.

EMPIRICAL FRAMEWORK

To assess the impact of world sugar prices on household income we proceed in three steps. First, we estimate the extent of price transmission from world sugar prices to local markets. Second, we estimate the impact of local sugar prices on wages and employment in different categories of the labor force.[201] Finally, using these estimates, we simulate for each income quintile the impact of a 10 percent increase in world prices on household income.

The extent of price transmission from world to local markets depends on how well integrated these markets are with the world market. Distance to ports, road infrastructure, and access to information all play a role. These characteristics are likely to vary from one region to another affecting the impact that changes in world prices will have on earnings in each region. We use an Engle-Granger residual-based test to determine the long-term cointegrating relationship between each of the local prices and the world price. This is done by regressing the price in each state on the world price:

$$\ln p_t^d = \alpha + \gamma \ln p_t^w + \mu_t \qquad (1)$$

[200] According to Ricci *et al* (1994), this mechanization was prompted by the sector reforms that created incentives for firms to undertake cost reducing investments and the legislation banning cane burning as a detrashing method.

[201] One may wonder why we do not estimate the impact of world prices on wages and employment in one step. The reason is twofold. First, we are interested in understanding the mechanisms behind the transmission from world prices to wages and employment, and in particular the role played by the transmission from world prices to local prices. Second, and more pragmatically, price data varies by month both at the local and world level, but world prices do not vary by region. On the other hand, wage and employment data is annual, but varies by region. Merging the two steps would result in a loss of degrees of freedom with which the price coefficient is identified in the wage and employment equation.

If in fact a cointegrating relationship between the price pairs exists, the OLS estimator is consistent despite the apparent problem of nonstationarity of the price-time series and the problem of replacing a simultaneous-equation model for all states with a single equation (Greene, 2000). Equation (1) is estimated for each of the states using a Seemingly Unrelated Regression (SUR) to control for any exogenous shock that may be affecting prices in a similar way in all regions. The prices used in the analysis are in log form, which allows us to interpret the coefficients of cointegration as long-term elasticities of the local prices with respect to the world price. We will use these estimates when simulating the impact of a 10 percent increase in world prices on local wages and employment. To establish cointegration, the residuals μ_t are tested for unit roots using the Augmented Dickey-Fuller (ADF) procedure.[202]

In addition to estimating the cointegrating vectors we estimate an error-correction model to explain the dynamics around the long-term cointegrating relationship. The response of domestic prices to changes in the world price is decomposed into an immediate change following the shift in prices and an adjustment to the long-term equilibrium in the following period:[203]

$$\ln p_t^d - \ln p_{t-1}^d = \eta + \delta\left(\ln p_t^w - \ln p_{t-1}^w\right) + \theta\left(\ln p_{t-1}^d - \alpha - \gamma \ln p_{t-1}^w\right) + \varepsilon_t \qquad (2)$$

where p_t^d is the domestic price in period t and p_t^w is the corresponding world price; δ captures the instantaneous response of domestic prices to changes in world prices, and θ is the error-correction parameter, which captures the speed of adjustment of p_t^d to its long-run equilibrium γp_t^w. Recalling that the OLS estimates of (1) are asymptotically efficient, we then use as the error-correction term: $1np_{t-1}^d - \hat{\alpha} - \gamma 1n\hat{p}_{t-1}^w$.[204] Again, SUR is used to estimate 11 equations of type (2): one for each of the states in our sample. Prior to estimation we ensure that the first differences of the price time series used in the error-correction model (1) are stationary using an ADF test.

From local sugar prices to wages and employment

To estimate the impact of local prices on wages and employment in Brazil, we use a Heckman sample selection model where we only observe the wages of the respondents that have been employed during the survey period. The wage

[202] The ADF test for a unit root without trend involves estimating the following equation for a time-series variable y_t: $\Delta y_t = \beta + \lambda y_{t-1} + \sum_{j=1}^{k} \eta_j \Delta y_{t-j} + v_t$: where k is the number of lags of the first differences used. The null hypothesis is that each of the time series follows a nonstationary process with a unit root, i.e., $\lambda = 0$ (which is tested against $\lambda < 0$). If the null of unit root is rejected, we proceed as if the domestic and world price series are cointegrated.

[203] See Baffes and Gardner (2003) for a detailed derivation.

[204] And the asymptotic properties of the estimator are valid regardless of whether we use the OLS estimator or the leads and lags à la Stock and Watson (1993) in case we are worried about endogeneity bias in the estimation of (1). Given that p^w is integrated of order 1, using the leads and lags of p_t^w around time t is equivalent to introducing all random determinants of p^w as control variables, which ensures that the error term of (1) is orthogonal to p_t^w.

equation estimates the impact of sugar prices (as well as individual and regional characteristics) on a person's wage. We allow the impact of sugar prices to vary according to individual characteristics including sector of employment and geographical location of the household. Note that even workers in non-sugar sectors in non-sugar producing regions can see their wage change, if labor markets are integrated or if sugar is a complement or a substitute in the production or consumption of other goods.[205]

The Heckman model corrects for the potential selection bias that OLS estimation would produce due to the fact that we only observe the wages of those individuals that were employed. Correction is done by specifying a selection equation that describes the latent variable z_i^*:

$$z_i^* = \xi' x_i + \varepsilon_i; \tag{3}$$

$$z_i = \begin{cases} 1 & \text{if } z_i^* > 0 \\ 0 & \text{otherwise} \end{cases} \tag{4}$$

where ξ is a vector of parameters and x_i is a vector of independent variables determining the employment status of individual i (time period subscripts are dropped for simplicity). This can be written as a probit model. The probit equation describes employment as a function of individual and regional characteristics. The variables included in this equation are real price of sugar, number of children below age 15 in the household, age of the worker and age squared, education level, race and gender of the worker, a dummy for urban/rural household location and interaction terms where real price of sugar is interacted with education level and the dummy for being located in a major sugar producing region. The coefficients on sugar prices will allow us to capture the impact that changes in sugar prices have on the employment probabilities of different individuals. Thus, changes in sugar prices affect both individuals reservation wage and the demand for jobs by firms. We are not able to disentangle between the two in this setup.[206]

The second equation in the labor market model is the wage regression:

$$\ln w_i = \beta_0 + \sum_s \beta_s S_{s,i} + \sum_c \beta_c C_{c,i} + \beta_p \ln p_s^d + \sum_k \beta_k K_{k,i} \ln p_s^d + e_i \tag{5}$$

where w_i is the hourly real wage of individual i, $S_{s,i}$ are state variables for individual i (such as the share of sugar employment in the state, and the evolution of food prices other than sugar), $C_{c,i}$ are individual characteristics variables for individual i (such as gender, age, education, etc.) and p_s^d is the real local price of

[205] In the case of consumption one would need the complement or substitute good to be a non-traded good so that its price is not exogenously determined by world markets.

[206] In a related paper Porto (2008) is able to disentangle whether individuals deciding to participate in the labor market are offered a job. This allows him to distinguish between demand and supply side variables affecting the equilibrium level of employment and unemployment.

sugar in state s (prices normalized by CPI in each state). The last term (the sum over k) captures the interaction term between real sugar prices and a subset K_k of individual and state characteristics variables.

The wage equation is estimated using the observations for which wage data exist (i.e. observations on individuals that were employed at the time of the survey). The explanatory variables are the same variables as in the selection equation (except the number of children, and its interaction with gender which are likely to determine labor market participation but not wages)[207] with the addition of some employment specific variables such as sector dummies (sugar growing, sugar processing, agriculture other than sugar, industry other than sugar and services) and dummies for the type of employment (hired worker, self-employed and employer). Sugar prices are also interacted with these additional variables to capture the heterogeneity of the sugar price impact along these dimensions (see Porto, 2005, 2006, 2008, or Nicita 2009 for a similar approach).

The interaction terms that are used in both the selection and wage equations imply that the elasticities of wage and labor market participation with respect to sugar prices vary from one individual to another, according to his or her level of education, geographic location, and the sector where he or she works, as well as the type of employment. This proves to be important in estimating the impact of changes in sugar prices on household income at different points of the income distribution.

The Heckman selection model is estimated using maximum likelihood. The estimates from this model allow us not only to calculate how wages would change following a change in the price of sugar, but also to measure the impact that changes in sugar prices may have on the labor market participation of each individual. Thus, we can estimate the impact of changes in local sugar prices on both wages and employment.

In order to correct for possible correlation of the error terms within survey sample strata in each year, we use cluster robust error terms, where the clusters are defined by sample strata/year. All regressions include year and state dummies.

Impact on household labor income

The third step consists of simulating the impact of a 10 percent increase in world sugar prices on households' labor income. For this task we use the estimates from

[207] The idea is that the number of children may have different effects on men and women's labor market participation decisions. Women may be more likely to stay at home, whereas the household's need for income increases pushing men into the labor market. One may worry that our exclusion restrictions are a bit weak, and may lead to biased estimates in the wage equation. We therefore also run the wage and employment equation separately, assuming that there is no correlation between the error terms and compared the estimated coefficients with those of the Heckman estimates. These results are available from the authors upon request. They show that the estimates are not statistically different from the ones reported in Table 6 below, which gives us some confidence in the reported estimates. See Panizza and Zhen-Wei Qiang (2005) for a similar approach.

the first and second steps.[208] The change in sugar prices will affect labor income through two channels: wages and employment. We first calculate the predicted change in wages using the individual specific wage elasticity of sugar prices. We then calculate the change in expected income which includes both predicted changes in wages and employment for each individual. Define the wage elasticity of individual i as ω_i. Then using (5)

$$\omega_i \equiv \frac{\partial \ln w_i}{\partial \ln p_s^d} = \beta_p + \sum_k \beta_k K_{k,i} \tag{6}$$

These elasticities are computed for different groups of individuals in Table 12.4 of the results section. But we are actually interested in the wage elasticity with respect to world prices, not domestic prices. Using the estimates in (1) we have that $\partial \ln p_s^d / \partial \ln p^w = \gamma_s$. Thus, the percentage change in real hourly wages experienced by individual i following a 10 percent increase in the world price of sugar is given by:

$$\hat{\omega}_i = 0.10 \gamma_s \omega_i \tag{7}$$

These percentage changes in wages are reported in Table 12.5 in the results section. Before turning to the change in expected income following a world sugar price change, denote $\bar{w}_i$ the predicted real hourly wage of person i before the sugar price change. Then the predicted real hourly wage after the 10 percent sugar price increase is $\bar{w}_i' = (1+\hat{\omega}_i)\,\bar{w}_i$.

The change in expected income of individual is given by the difference between predicted income after the price change net of predicted income prior to sugar price liberalization. This takes into account the change in wages as well as the change in the probability of being employed, and is more formally given by:

$$\Delta y_i = \left(\bar{\pi}_i' \bar{w}_i' \ell_i + (1-\bar{\pi}_i')U_i\right) - \left(\bar{\pi}_i \bar{w}_i \ell_i + (1-\bar{\pi}_i)U_i\right) \tag{8}$$

where ℓ_i is the number of hours worked by individual i per month, U_i are unemployment benefits,[209] and $\bar{\pi}_i$ and $\bar{\pi}_i'$ are the predicted probabilities of individual i of being employed before and after the sugar price change,

[208] Note that to have the full impact on households' real income we would need to have information on the share of sugar in the consumption basket of each household, as well as the sensitivity of sugar demand to changes in prices (see e.g., Nicita, 2008). This information is not available from labor surveys, so we focus only on the impact on labor income. Because sugar prices are increasing, this means that at least in this sense our calculations overestimate the impact on real income. However, a back-of-the-envelope calculation suggests that overestimation is not a serious problem. The weight that the Brazilian statistical office (Instituto Brasileiro de Geografia e Estatstica – IBGE) puts on sugar in its consumer price index is 0.8. So on average, sugar accounts for 0.8 percent of household expenditure and therefore an upper bound for the real income loss associated with a 10 percent increase in sugar prices (i.e. abstracting from any substitution possibility and frictions in price transmission) is around 0.08 percent.

[209] Note that for individuals that are currently working we do not observe U_i, and therefore assume $U_i = 0$. This is reasonable as in the survey only 18 percent of those unemployed report receiving some form of social benefit.

respectively. The predicted probabilities were obtained using the estimates from the Heckman model. Note that equation (8) assumes that anyone entering the labor force works full-time (40 hours per week) and gets the average expected wage across sectors.[210] It also assumes that other types of income, such as interest and dividends, are unaffected by sugar prices, and therefore do not appear in equation (8).

Finally, in order to disentangle the total income change associated with changes in sugar prices into wage and employment effects, equation (8) can be rewritten as:[211]

$$\Delta y_i = \bar{\pi}_i'\left(\bar{w}_i' - \bar{w}_i\right)\ell_i + \left(\bar{\pi}_i' - \bar{\pi}_i\right)\left(\bar{w}_i\ell_i - U_j\right) \tag{9}$$

where the first term captures wage changes and the second term changes in the probability of being employed. The first term is labeled the wage effect and the second term the employment effect.

In proceding, we first check which of the Brazilian states in our sample are cointegrated with the world market and estimate the parameters of the long-term relationship between the local and the world prices of sugar. The stationarity of the price times series used in the model is tested and the appropriate ADF statistics are reported in Table 12.4. For neither London Daily Price nor the Brazilian prices the ADF test rejects the null hypothesis that the prices follow a unit root process.[212] However, redoing the test in terms of first differences leads to rejection of the unit root hypothesis at 1 percent level for all price time series. Thus, price differentials can be used in the error-correction model.

We then test for a long-term cointegration between the local and the international prices as described by equation 1. The test statistics, also reported in Table 12.4, imply that for all states except Pernambuco and Para, we should reject the hypothesis of no cointegration between the local and the world prices at the 1 percent significance level. In Pernambuco we reject the hypothesis at 10 percent. In Para, the ADF statistic for the residual is very close to the 10 percent critical value, so we estimate an error-correction model for Para along with the other states, although we can not conclude that the prices in that region are closely integrated with world prices.

The results of error-correction estimation for the 11 states are reported in Table 12.5. The long-term cointegration coefficient (γ) was obtained from equation (1).[213] The coefficients of short-term transmission (δ) and adjustment (θ) were estimated using equation (2). In São Paulo, where by far most sugar is produced and traded, a 1 percent increase in the world price of sugar leads to 1 percent

[210] Alternatively one could estimate the impact of changes on sugar prices on hours worked, but Neumark et al. (2006) show that the number of hours worked is not very sensitive to wages in Brazil during this period.

[211] We are indebted to Cristina Terra for this decomposition.

[212] ADF tests with and without trends give similar results.

[213] Results are not sensitive to the use of 4 months lead and lags of changes in world prices as control variable to correct for the potential correlation between the error term and world prices.

Table 12.4: *Prices: Stationarity and Engle-Granger test of cointegration*[a]

	Stationarity		Cointegration	
	Levels	First differentials		
	ADF	ADF	ADF	R^2
World price	−1.74	−4.56 ***		
Distrito Federal	−2.17	−5.35 ***	−3.64 ***	0.49
Goias	−1.93	−5.40 ***	−3.71 ***	0.53
Ceara	−1.76	−5.53 ***	−3.93 ***	0.64
Pernambuco	−2.06	−5.10 ***	−2.81 *	0.43
Bahia	−2.11	−4.95 ***	−3.50 ***	0.47
Minas Gerais	−2.27	−5.68 ***	−3.98 ***	0.56
Parana	−2.40	−5.75 ***	−4.20 ***	0.56
São Paulo	−2.00	−5.22 ***	−3.61 ***	0.56
Rio de Janeiro	−2.15	−5.19 ***	−3.66 ***	0.53
Rio Grande do Sul	−2.40	−5.03 ***	−4.11 ***	0.52
Para	−2.06	−4.50 ***	−2.55	0.47

[a] A *** implies that the null hypothesis of unit root and/or no cointegration is rejected at the 1 percent significance level; ** for rejection at the 5 percent level and * for rejection at the 10 percent level. The critical values of ADF are −2.58 at 10 percent, −2.89 at 5 percent and −3.49 at 1 percent. Six months lag length is used and all prices are in logs. World price is Contract number 5 of the London Daily Price for refined sugar, f.o.b. Europe, spot. Local prices are consumer prices.

increase in the local price in the long run (the elasticity is 1.01).[214] Perfect transmission was also found in Goiás and Minas Gerais, which could be explained by the proximity of these states to São Paulo. In other states transmission varies from 0.75 in Pernambuco and Bahia to 0.94 in Rio de Janeiro. Only in few states an immediate adjustment in prices takes place – in Distrito Federal, Goiás and Ceara immediate adjustment is around 0.25 percent and is significant at the 10 percent level. In the other states adjustment begins after the first period (the first month), as reflected by the parameters on the error-correction term.

The estimated coefficients can be used to calculate the adjustment in local prices *n* periods/months after a one-time change in the world price. With a 1 percent change in the world market price occurring at time t = 0, the initial percentage change in the local price is given by δ. In the following period the error-correction component θ is added; *n* periods after the change in the world price has occurred the domestic prices change by a percentage m_n:

$$m_n = \gamma - (\gamma - \delta)(1 + \theta)^n$$

In most states, a 1 percent increment in the world price would only increase the local prices by 0.4–0.6 percent after 3 months (Table 12.5). However, after a year has passed, the prices in most states become close to their new long-term equilibrium: on average 92 percent of the adjustment occurs within the first year. Given the relatively rapid adjustment, we prefer to use the long-term elasticity of local prices with respect to world prices (γ) to evaluate the impact of the change in the international price of sugar on labor income.

[214] See Mundlak and Larson (1992) for similar estimates of agricultural price transmission across countries and goods.

Table 12.5: *From world to local prices: error-correction model*[a]

	Trend (g)	Immediate adjustment (d)	Adjustment to long-run equilibrium (q)	Speed of adjustment	
				after 3 months	after 1 year
Distrito Federal	0.91***	0.43**	–0.20***	0.66***	0.88***
	(0.070)	(0.167)	(0.025)		
Goias	1.01***	0.37**	–0.20***	0.69***	0.97***
	(0.072)	(0.162)	(0.022)		
Ceara	0.92***	0.24	–0.19***	0.57***	0.87***
	(0.052)	(0.152)	(0.027)		
Pernambuco	0.75***	0.25	–0.19***	0.48***	0.71***
	(0.065)	(0.156)	(0.019)		
Bahia	0.75***	0.27*	–0.15***	0.46***	0.68***
	(0.061)	(0.146)	(0.018)		
Minas Gerais	1.02***	0.32**	–0.20***	0.66***	0.97***
	(0.068)	(0.153)	(0.017)		
Parana	0.86***	0.28*	–0.20***	0.56***	0.82***
	(0.058)	(0.144)	(0.018)		
São Paulo	1.00***	0.33**	–0.18***	0.63***	0.94***
	(0.068)	(0.144)	(0.015)		
Rio de Janeiro	0.94***	0.28*	–0.19***	0.59***	0.89***
	(0.067)	(0.154)	(0.017)		
Rio Grande do Sul	0.77***	0.22	–0.22***	0.51***	0.74***
	(0.057)	(0.139)	(0.021)		
Para	0.87***	0.33**	–0.13***	0.52***	0.78***
	(0.070)	(0.146)	(0.019)		

[a] An error-correction model is run for each State to capture differences in price transmission across regions. A SUR technique is used to correct for common shocks across States. A *** implies that the null hypothesis that the coefficient is equal to zero is rejected at the 1 percent significance level; ** for rejection at the 5 percent level and * for rejection at the 10 percent level. World price is Contract number 5 of the London Daily Price for refined sugar, f.o.b. Europe, spot. Local prices are consumer prices.

A final concern with our estimate of the long run price transmission has to do with reverse causality.[215] As argued in the introduction, Brazil is a big player in world markets and therefore one may be worried that our estimates could be biased due endogeneity of prices in Brazil. To check for this we perform a number of Granger causality tests on world and domestic prices. The null hypothesis in each case is that there is no Granger causality between the variables excluded and the dependent variable. The conclusions are the following. We establish Granger causality from world prices to sugar cane producer prices and to consumer prices of crystal sugar. On the other hand, we reject Granger causality from producer and consumer prices in Brazil to world prices. Thus, the evidence of causality from world to domestic prices is rather strong.

As an alternative to test for the importance of reverse causality we checked the correlation between world prices and Brazilian exports. If the correlation is positive, it means that the movement in exported quantities is mainly along

[215] We are grateful to Andrés Rodriguez-Clare for his suggestions on how to address the issue of reverse causality.

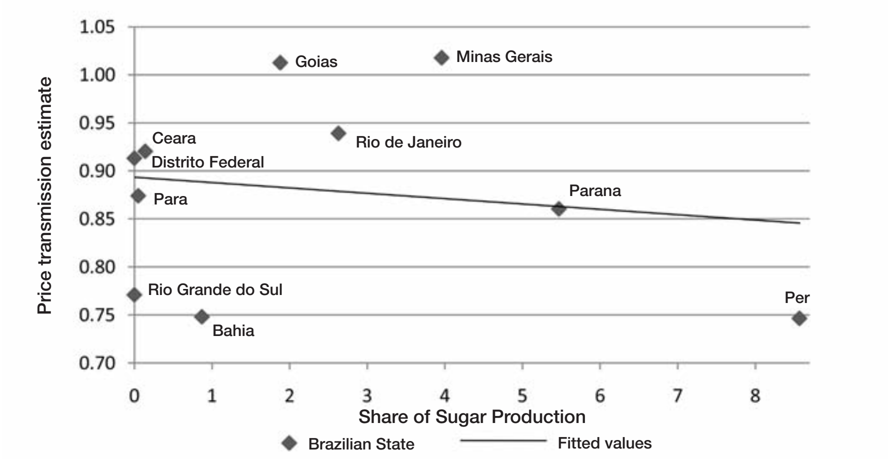

Figure 12.2: *Reverse causality? Correlation between sugar production and long-term elasticity of the domestic price with respect to world price*

Brazil's export supply curve, which is indicative of world prices driving domestic prices and not vice versa. A negative correlation would imply that movements occur along rest of the world's import demand, and therefore it would suggest that Brazil's export quantities drive world prices. The correlation is indeed positive, statistically larger than zero and around 0.16 during the period 1961–2006. As a final and indirect check for the absence of reverse causality, we look at the correlation between our long run price transmission estimates and the share of production in each Brazilian state. If reverse causality was a driving force we should observe a positive correlation between these two variables. Figure 12.2 shows a negative correlation between these two variables in a sample where Sao Paolo is excluded, which suggests reverse causality is probably not an issue in the case of these other Brazilian States. This is not surprising as Table 1 showed that around 70 percent of Brazilian production takes place in Sao Paolo and therefore most other Brazilian states are relatively small players in world markets. In the case of Sao Paolo, reverse causality concerns may be valid, but the average coefficient of long run price transmission is estimated at around 0.9 in other Brazilian states, and is as high as in Sao Paolo in states such as Goias and Minas Gerais who produce 10 times less sugar than Sao Paolo. Thus, even in the case of Sao Paolo, the endogeneity bias cannot be too large.

RESULTS: WAGE AND EMPLOYMENT EFFECTS

The results of the maximum-likelihood estimation of the Heckman model are presented in Table 12.6. The first part contains the coefficients of the wage equation and the second part contains the results of the sample selection equation that determines whether or not the person was employed. The standard errors are

Table 12.6: *Wage and Employment: Heckman selection model*[216]

	Wage equation		Employment equation	
	Coef.	**Std. Error**	**Coef.**	**Std. Error**
Real price of sugar (log)	–0.028	0.036	0.083**	0.023
Interaction with sugar prices[217]				
Years of schooling	0.009**	0.002	–0.019**	0.002
% of employment in sugar sector	–4.364**	1.102	4.980**	1.660
Sugar growing sector	0.326**	0.055		
Sugar processing sector	0.395*	0.189		
Agriculture other than sugar	0.136**	0.019		
Industry other than sugar	0.120**	0.010		
Employee	–0.038	0.026		
Self-employed	–0.048	0.027		
State characteristics				
% of employment in sugar sector	–0.496	0.711	1.140	0.872
Real price of food	0.006**	0.001	0.011**	0.001
Worker characteristics				
Age	0.122**	0.001	0.168**	0.000
Age squared	–0.001**	0.000	–0.002**	0.000
Race (1=white)	0.098**	0.002	–0.079**	0.003
Gender (1=male)	0.585**	0.004	0.866**	0.002
Urban/rural (1=urban)	0.154**	0.005	0.039**	0.007
Years of schooling	0.133**	0.001	0.045**	0.001
Number of children[218]			–0.029**	0.001
Number of children × gender			0.040**	0.001
Sector dummies[219]		**		
Sugar growing sector	0.162**	0.034		
Sugar processing sector	0.355**	0.119		
Agriculture other than sugar	–0.169**	0.012		
Industry other than sugar	0.123**	0.007		
Employment category dummies[220]				
Employee	–0.652**	0.017		
Self-employed	–0.621**	0.018		
State and year dummies	Yes			
Constant	–4.074**	0.081	–4.460**	0.058

Number of obs = 2106448
Censored obs = 1094867
Uncensored obs = 1011581
Wald test of independent equations ($\rho = 0$) = 4295.45 (rejected)

[216] The Heckman selection model is estimated using maximum likelihood. ** stands for significance at the 1 percent level and * for significance at the 5 percent level. Standard errors are clustered by state × year.
[217] Each of the variables is interacted with the log of the real price of sugar.
[218] Measure as the number of children in the household who are 14 years old or younger.
[219] Services is omitted.
[220] The “employer” category is ommitted.

adjusted for clustering, where the clusters are state/years. Real sugar prices appear to have a significant and positive effect on the average conditional probability of being employed, but not a direct significant impact on wages (after controlling for changes in other food prices by state). However the interaction of sugar prices with state, sector and worker characteristics have statistically significant impact on both the wage and employment equation, which implies that the wage elasticity of sugar prices varies across various demographic groups, depending on the level of education, among other things.

Regarding worker characteristics, both wages and employment are increasing and concave in age and are positively correlated with education, being a male and living in an urban area. Having young children affects labor market participation negatively in the case of women, but positively in the case of men: the interaction of number of children and the gender dummy for male has a large positive coefficient in the employment equation suggesting that the presence of young children affects differently the labor market participation decision of men and women. Whites earn higher wages than non-whites, but non-whites participate more actively in the labor force.

When it comes to sectoral differences, wages in sugar processing sectors are substantially higher than in all other sectors, while wages in agriculture, other than sugar growing, are the lowest. More interestingly, and as mentioned above, the impact of a change in sugar prices on wages is stronger in the sugar growing sector and the sugar processing industry, which signals some sector specificity. Also, changes in sugar prices affect the wages of well-educated people more than those with less education,[221] but there are greater employment opportunities associated with sugar price increases among people with fewer years of schooling.[222]

To further understand how sugar prices affect different demographic groups in Brazil we compute wage elasticities with respect to prices for persons with different characteristics. These elasticities and their standard errors are reported in Table 12.7. Clearly, workers in the sugar growing and processing sectors gain most from sugar price increase – their wage would increase by approximately 0.1 to 0.4 percent (depending on their level of education), if sugar prices rise by 1 percent. [223] Other sectors, apart from services, benefit as well and, well-educated workers seem always to have a larger wage elasticity. Workers in the service sector, on the other hand, seem to lose from increases in the price of sugar, especially those that have a low level of education and are located in major sugar producing areas.

[221] Because one may argue that there are unobserved time varying shocks which are simultaneously affecting sugar prices and returns to education, we run a similar specification, introducing an interactive term between education and a time trend, but dropping year dummies to avoid multicollinearity with the time trend. The coefficient on the interaction of education and sugar prices remains positive and significant, while the point estimate is a bit lower (0.009), but it is not statistically different from the one reported in Table 6.

[222] This may also explain why the interaction of sugar prices with % of employment in sugar growing or processing by state appears to have a negative impact on wages and a positive impact on employment.

[223] See Pavcnik *et al.* (2004) for evidence of imperfect intersectoral mobility in Brazil's labor markets.

Table 12.7: *Estimated wage elasticities with respect to local sugar prices*[a]

	Employee		Self-employed		Employer	
	Low-ed[b]	High-ed[c]	Low-ed[b]	High-ed[c]	Low-ed[b]	High-ed[c]
In major sugar region[d]						
sugar growing	0.15	0.23	0.14	0.22	0.19	0.27
	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)
sugar processing	0.22	0.30	0.21	0.29	0.26	0.34
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
agriculture other than sugar	−0.04	0.04	−0.05	0.03	0.00	0.08
	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)	(0.04)
industry other than sugar	−0.06	0.02	−0.07	0.01	−0.02	0.06
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
services	−0.18	−0.10	−0.19	−0.11	−0.14	−0.06
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Not in major sugar region[e]						
sugar growing	0.24	0.32	0.23	0.31	0.27	0.36
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
sugar processing	0.30	0.39	0.30	0.38	0.34	0.42
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
agriculture other than sugar	0.05	0.13	0.04	0.12	0.08	0.17
	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
industry other than sugar	0.03	0.11	0.02	0.10	0.07	0.15
	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
services	−0.09	−0.01	−0.10	−0.02	−0.05	0.03
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)

[a] Obtained using the estimates provided in Table 6 and taking averages over group of individuals (using sample weights). Numbers in parenthesis are standard errors. The standard errors were calculated as the square roots of the corresponding variance:

$$\mathrm{Var}(a_1\beta_1 + \ldots + a_n\beta_n) = \sum_{i=1}^{n} a_i^2 \mathrm{Var}(\beta_i) + \sum_{i=2}^{n} \sum_{j=1}^{i-1} a_i a_j \mathrm{Cov}(\beta_i \beta_j)$$

where $\beta_1 \ldots \beta_n$ are the parameter estimates on the interaction variables in the wage equation of the Heckman model and $a_1 \ldots a_n$ are indicators that signal whether a person belongs to a particular group (all a_1 s, except years of education, are either zero or one).

[b] Low-educated individuals are defined as those with less than 5 years of education. Elasticities are computed at the average level of education within this group: 2.3 years.

[c] High-educated individuals are defined as those with more than 8 years of education. Elasticities are computed at the average level of education within this group: 11.8 years of education.

[d] States with an average of 3% employment in the sugar sector.

[e] States with an average of 1% employment in the sugar sector.

Simulating a 10 percent increase in sugar prices

To estimate how a 10 percent increase in the world price of sugar would affect wages,[224] we use the actual survey data to calculate the predicted change in wages for each person employed and aggregate the results for various groups. The results by sector and education level are presented in Table 12.8. Again, workers in sugar growing and sugar processing stand to gain the most. The only workers that are likely to experience losses are low and average-educated workers in the service sectors who would experience declines in wages of 0.80 and 0.28 percent respectively after a 10 percent increase in sugar prices. All other types of workers will experience wage increases varying from 0.3 to 3.7 percent, depending on the level of education and the sector where the worker is employed.

Table 12.9 reports results by income quintile using the decomposition into wage and employment effects provided by Equation (9). The first column of Table 12.9 provides an estimate of the percentage change in income associated with changes in wages, and the second column shows the employment effect. The wage effect is uniformly increasing in income. The poorest households gain 0.23 percent of their income when the world price of sugar increases by 10 percent, while the richest gain 0.52 percent. On the other hand, the employment effect is larger at the bottom of the income distribution and is actually negative for three top quintiles. As expected the contribution of the wage effect to changes in total labor income is larger at the top of the income distribution. It is 153 percent of the total change in income in the top income quintile, but only 61 percent of the total change in income in the bottom income quintile. In other words, the poor gain mostly through expansions of employment opportunities, and the rich gain mainly through wage increases. This result is not surprising, since unemployment

Table 12.8: *Survey data weighted changes in wages by sector and education level after a 10% change in the world price of sugar, %* [a]

	Low-Educated [b]	Average-Educated [c]	High-Educated [d]
Sugar growing	1.71	2.39	2.99
Sugar processing	2.44	2.99	3.74
Other agriculture	0.35	0.90	1.54
Other industry	0.29	0.77	1.34
Services	–0.80	–0.28	0.35

[a] Obtained using the estimates provided in Tables 5 and 6 and taking averages over group of individuals (using sample weights).
[b] Low-educated workers are defined as those with less than 5 years of education.
[c] Average-educated workers are defined as those with more than 4 years of education, but less than 9.
[d] High-educated workers are defined as those with more than 8 years of education.

[224] Note that all changes in income provided in this section are based on a somewhat arbitrary 10% increase in the international sugar price. Dividing the percentage income changes reported here by 10 would produce easily interpretable income elasticities with respect to the world price of sugar. In other words, the percentage change in income is linear in the percentage change in world prices and therefore to obtain the percentage change in income after an x% change in world prices, one can simply multiply the percentage change income reported here by x/10.

Table 12.9: *Changes in household income by income quintiles after a 10% change in the world price of sugar, %* [a]

	Wage effect [b]	Employment effect [c]	Total effect [d]
Bottom quintile	0.23	0.15	0.38
Second quintile	0.29	0.04	0.32
Third quintile	0.38	–0.05	0.32
Fourth quintile	0.46	–0.13	0.33
Top quintile	0.52	–0.18	0.34
Total	**0.46**	**–0.13**	**0.33**

[a] Obtained using the estimates provided in Tables 5 and 6 and taking averages over group of individuals (using sample weights).
[b] This measures the wage effect. It is given by the first term in equation (9).
[c] This measures the employment effect. It is given by the second term in equation (9).
[d] This is (9), i.e., the sum of the first and second column. Differences in totals are simply due to rounding approximations.

is mostly a poor household phenomenon. And if at the bottom of the income distribution one or more household members get a paid job it could translate into a substantial increase in household income.

The effects of the different channels described above are such, that the total gain is almost perfectly homogeneous across quintiles, with the average increase in total labor income approximately 0.33 percent, with the exception of the bottom quintile which experiences a 0.38 percent gain, mainly driven by the employment effect. The total effect on incomes in Brazil is equivalent to some US$2 billion (at 2002 prices).

To evaluate the effects of a potential sugar price increase on poverty rates we adopt a nominal $1 per day per capita poverty line (close to a $2 PPP poverty line) and calculate the predicted number of poor in each state before and after a 10 percent increase in the world price of sugar. We first calculate the share of the population below the poverty line in each state using their observed income: 23.4 percent of the population fell below the poverty line in 2002. We then calculate the predicted income for each individual before and after the price change and calculate the corresponding predicted poverty rates before and after the change. Finally, we recalculate the number of individuals below the poverty line using the predicted change in the poverty rates. On aggregate the impact of 10 percent increase in world prices is smaller: the poverty rate declines from 23.2 to 23.0 percent. This however implies that around 280 thousand individuals raising their income above the poverty line. The largest changes in the number of poor are observed in São Paolo and Parana which experience declines of almost 2 percent.

CONCLUSION

Because domestic markets are closely connected with international markets – we estimate that almost 90 percent of world price changes get transmitted to Brazilian domestic prices – a 10 percent increase in world sugar prices will have significant effects on domestic prices. Changes in domestic sugar prices will in turn have a positive effect on wages and the probability of being employed. Allowing price-wage elasticities to vary according to individual and regional characteristics, we find that workers in the sugar sector will experience larger increases in wages than workers in other sectors, suggesting some sector specificity.

We also find that changes in wages lead to large income gains for highly educated workers, while individuals with low levels of education will tend to benefit relatively more from increases in employment. A potential explanation for this is that the labor supply of unskilled workers is relatively more inelastic due to the presence of a larger pool of unemployed low-educated workers which puts downward pressure on their wages. Thus, in spite of a relatively larger increase in demand for less-educated workers, unskilled wages are relatively unaffected. However, once we aggregate the wage and employment effects the income gains are quite homogenous across income quintiles. This is an important result that highlights the need for correctly modeling labor supply and unemployment when trying to assess the impact of trade liberalization on income inequality.

Our estimates suggest that the average elasticity of labor income with respect to sugar prices is 0.03. Thus, a 10 percent increase in sugar prices will lead to an average increase in the income of Brazilian workers of about 0.3 percent or US$2 billion. This alone would bring 280,000 Brazilians out of poverty.

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DATA APPENDIX

The main source of data used is *Pesquisa Nacional Por Amostra de Domicílios* (PNAD), which are labor market surveys managed by the Brazilian statistical agency IBGE. Surveys have been conducted every year since 1976 with a few exceptions (1980, 1991, 1994 and 2000). PNAD contains extensive information on the wages and other sources of income for each person in the selected household. Sector categories used in replies are highly disaggregated, which allows us to single out workers in the sugar growing sector as well as workers in the sugar processing industry. The data are repeated cross section (samples are redrawn every year for each survey). For this exercise we use the surveys from 1990 to 2002.

Wages used in the regressions are real hourly wages and prices are real prices of sugar by state. Consumer price indices and food prices that were used to convert the variables into real terms were taken from *Indice de Precos ao Consumidor Amplo (IPCA)* collected by IBGE. The data are available for 11 major cities: Goiânia, Belém, Fortaleza, Recife, Salvador, Belo Horizonte, Rio de Janeiro, São Paulo, Curitiba, Porto Alegre and Braslia). The city level data were used to calculate real wages, real income and real sugar prices for 10 states, respectively: Goiás, Para, Ceara, Pernambuco, Bahia, Minas Gerais, Rio de Janeiro, São Paulo, Parana, Rio Grande do Sul, plus *distrito federal*. The world price used in the cointegration analysis are the monthly London Daily Price of refined sugar, contract No. 5 fob which probably corresponds better to consumer prices. The choice of using refined rather than raw sugar is due to the fact that Brazilian sugar prices that are available and that vary by state and time are consumer prices, and not producer prices. The use of consumer prices may seem a bit strange given that we are focusing on the impact of sugar prices on wages (and not on consumption). However, consumer prices are not a bad proxy for producer prices. Indeed as shown in Figure 12.1 there is a strong correlation between world prices of raw and refined sugar prices in the London and New York stock markets, as well as between consumer and producer prices of sugar in Brazil (at the aggregate level). The evolution of producer and consumer prices in Brazil, as well as raw and refined sugar prices in world markets has been quite similar throughout the 1990 to 2002 period. This suggests that consumer prices can be considered as an adequate proxy for producer prices.

State-level consumer prices were constructed for the period 1990 to 2002 using two sets of data: monthly changes in sugar prices reported in IPCA and the 1996 average sugar prices from household budget surveys (Pesquisa de Or camentos Familiares), also reported by IBGE. Since sugar prices could only be constructed for these 11 states, PNAD observations from other states were dropped, resulting in approximately a 25 percent reduction in the number of observations.

The two types of sugar most commonly consumed in Brazil are refined sugar and crystal (direct mill white sugar). Crystal is usually cheaper and inferior in quality. For 5 states for which only the prices of crystal sugar were available from the budget surveys (Distrito Federal, Goiás, Pernambuco, Bahia and Minas Gerais) we converted crystal prices into refined prices by using the average ratio of refined to crystal prices in Brazil. Note that the ratio varies over years.

13

The Cost of Moving out of Subsistence[225]

OLIVIER CADOT, LAURE DUTOIT AND MARCELO OLARREAGA[226]

1 INTRODUCTION

Putting an end to two decades of anti-market policies, in the mid-1990s a wave of reforms swept across least developed countries (LDCs), in particular Sub-Saharan Africa. Some of these reforms were intended to improve the efficiency of agricultural markets by eliminating failed marketing boards and to reduce the distortions affecting producer prices and incentives. Ten years on, however, it is fair to say that those reforms (some of which remain controversial; see e.g. Rodrik 1992, McMillan et al. 2002) have been slow to deliver the expected boost to growth and poverty alleviation. The feeble response of poor farmers to price signals is an old observation in development economics. De Janvry et al. (1991) have demonstrated that weak supply responses to changes in market prices are to be expected in the presence of quantity constraints or "missing markets" in food or labor. Along similar lines, it has been recently argued that reforms affecting market prices can have only indirect effects on poor farmers who live on subsistence farming, out of reach of markets and market reforms. Clearly, the retreat from markets by large numbers of farmers was the result of the old policies; however, once those policies had sufficiently damaged markets, the potential reach of reform was reduced, making poverty persistent.

Brambilla and Porto (2007) have shown that reforms can also have non-monotone effects, with an early phase of market disruption (their case study concerned Zambia's cotton reform, which initially led to widespread moral hazard) followed by a reorganization along a different market structure. Transitory shocks of this sort can send farmers momentarily into subsistence. With a combination of re-entry costs and other market failures such as the unavailability of credit, the retreat of farmers from the market may become permanent, implying potentially large welfare costs. It is thus crucial to understand how large such entry costs are and what individual characteristics they depend on.

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Much has already been said about entry costs in the theoretical literature. In his classic work, Bain (1956) defined them as any cost advantage that incumbents hold over entrants, even if recurring. Those could come from economies of scale, product differentiation, or capital requirements. Baumol et al. (1981) defined entry costs as *"anything that requires an expenditure by a new entrant into an industry, but that imposes no equivalent cost upon an incumbent"*, stressing the importance of sunk costs. The presence of sunk costs has been shown by Baldwin (1989), Baldwin et al. (1989) and Dixit (1989) to lead to hysteresis in market structure and trade flows,[227] something that is close to the observation that entry barriers into commercial farming can lead to hysteresis in poverty.

If the conceptual issues are clear, the search for empirical evidence on the presence of entry costs is still largely limited to high-tech sectors in industrial countries, where, according to Geroski (1995) *"econometric estimates of the height of entry barriers suggest that they are high"*. In the trade and development literature, the focus has been on the existence of barriers to export. Using Colombian manufacturing census data, Roberts et al. (1997) and Sanghamitra et al. (2001) find that sunk costs related to lack of exporting experience affected aggregate export response, leading to hysteresis in trade flows. Porto (2005) attacked the problem from a slightly different angle, looking at how removing government-related barriers to export (transport costs, custom practices, bureaucracy, regulation and corruption) would affect poverty in developing countries. He found those barriers to be a large 24.5% of the value of goods shipped, and that their removal would have a non-negligible effect on poverty.

The informal barriers considered by Porto are likely to be relevant for entry into agricultural markets. Remoteness, whether resulting from geography or infrastructure decay, is likely to be a substantial barrier to entry into commercial farming, as is the lack of credit or intermediaries (sometimes from ethnic groups that were marginalized by nationalistic policies). Individual characteristics such as education and farm size are also likely to matter. The interaction between such factors and the presence of entry costs has been largely untouched in the literature, however. One of the few exceptions is Barrett (1997), who looked into the effect of food marketing liberalization in Madagascar on entry by traders . He showed that liberalization of agricultural product marketing induced entry in some parts of the food marketing channel, but not in those where entry barriers were high. Vakis et al. (2003) measured the transaction costs occurring when a farmer sells his crops on the market. They showed that the level of transaction costs will determine which market (farmgate, local or distant market) farmers enter.

The limited nature of the literature on entry costs in and out of commercial agriculture is understandable given that such costs can be expected to be small in magnitude. Poor farmers are unlikely to switch altogether to sophisticated input-intensive farming. However, what matters is not the absolute magnitude of entry costs but their magnitude relative to the income of subsistence farmers, in particular when credit markets are deficient so that sunk costs must be self-fi-

[227] See also Martin (2002) and Owen et al. (2002) for trade-related issues.

nanced. Moreover, populations on the fringe of markets are likely to be vulnerable ones, and even well-wishing reforms can have the unwanted effect of destroying fragile markets, as changes in relative prices can be too small to cover switching costs or make intermediation profitable. When the trucks of middlemen no longer come, rural roads are left to decay and entire regions can shrink into subsistence. A report by Oxfam (Oxfam-IDS 1999) argued that this is precisely what happened in Zambia after the maize reform (cited in Winters 2000).

This chapter is an attempt to help bridge the gap in the literature. We propose a method to evaluate entry costs based on a simple asset-return model of farm specialization, the gist of which is as follows. Suppose that being in subsistence or in the market depends on a given household characteristic z. High-z farmers are in the market whereas low-z are in subsistence, with cutoff z^+ . Each sector of activity can be thought of as an asset whose dividend is the net value of production (evaluated at market prices for subsistence farmers, leaving aside for the moment the issues involved in that valuation). The asset's price is the present discounted value of future dividends and expected capital gains. If the market asset is worth more than the subsistence one for some $z<z^+$ (i.e. for a subsistence farmer), the difference provides a lower bound on the market entry cost for that farmer. For the marginal (z^+) farmer, it is just equal to the entry cost.

Empirically, our strategy consists of estimating a profit equation for each activity ("profit" meaning the net value of production approximated using the data available in the household survey) using a switching-regression technique. This gives us two expected profits for each farmer i, conditional on i's individual characteristics: one under the "subsistence" regime and one under the "market" regime. For a subsistence farmer, the difference in predicted profits between the market regime (where he is not) and the subsistence regime (where he is) is the opportunity cost of not being in the market, which of course depends on his individual characteristics. The present discounted value of this estimated stream of profit differentials for the marginal farmer is then our estimated entry cost.

As the decision to be in the market or not is endogenous to the profit differential, endogenous switching-regression methods must be used (Maddala and Nelson 1975). An additional difficulty comes from the fact that there is no natural definition of "subsistence farming", as the proportion of farm output sold on the market is, in the data, a continuous variable.[228] Rather than imposing an arbitrary cutoff in terms of proportion of output self-consumed, we let the data determine the best way of splitting the sample using a two-step procedure developed for switching-regression models with unknown switch point. Namely, in the first step we obtain consistent estimates of all parameters for a given value of the unknown cutoff by maximum likelihood, taking endogeneity into account; in the second step, we search for the cutoff value that yields the *maximum maximorum* of the log-likelihood function.

[228] As defined by the Encyclopedia Britannica, "subsistence farming is a form of farming in which nearly all of the crops or livestock raised are used to maintain the farmer and his family, leaving little, if any, surplus for sale or trade." However, most farmers sell some and keep some for home consumption.

The threshold obtained by this method turns out to be at zero. That is, the sample is split between farmers who are completely cut from markets (about 10% of them) and farmers who sell something. This accords with the intuitive idea that indivisibility is involved (purchase of capital equipment, availability of intermediaries, transport cost, etc.). Once those hurdles are overcome, adjustment in terms of quantities sold is smoother. Estimated entry costs are large relative to income —between 124 and 153 percent of a subsistence farm's annual output evaluated at market prices. Interestingly, however, the economic opportunity cost associated with this market failure (i.e. with the fact that subsistence farms with potentially higher returns in the market do not move because of entry costs) adds up to a mere 0.46 percent of GDP, the reason being very low productivity in both sectors. These results, however preliminary, go in the general direction of the literature on trade and poverty, making it difficult to believe that the trade reforms of the 1980s and 1990s were the culprit for the slide into subsistence and poverty of large numbers of Sub-Saharan farmers.

2 THE MODEL

Suppose that farmers can decide whether to participate in the market or not; if not, their farms are called "subsistence" ones. The numbers of farms in each sector are S and M respectively, both functions of time (argument omitted). Time is continuous and the horizon is infinite. Let Π_j ($j = S, M$) be the instantaneous flow of return to farming in sector j; in the subsistence sector, it is measured by valuing self-consumed crops at market prices. Let also z be a time-invariant individual characteristic affecting profits (for now taken as a scalar, although it will be multidimensional in the empirical part), so $\Pi_j = \Pi_j(z)$. Note that Π_M and Π_S are distinct functions, although mapping the same argument (z) into profits. We will suppose that

$$\frac{\partial \Pi_M}{\partial z} > \frac{\partial \Pi_S}{\partial z} \quad \forall z. \tag{1}$$

This single-crossing condition will, in equilibrium, lead to partial sorting of farms between subsistence and market as a function of z.

Farmers in M are periodically thrown into S by idiosyncratic events (say, the household head falls sick) happening at a constant and exogenous hazard rate s. [229] Once thrown back into subsistence, farmers can either jump back to the market by incurring a sunk cost c (common to all) or stay in subsistence. We assume for simplicity that there is no lag between the event of being thrown into subsistence and the opportunity to get back to the market.

Given (1), the individual-characteristic variable z will sort farms in S between those that decide to move back into the market (high-z ones relative to the rest

[229] Alternatively, one could think of the shock as affecting the terms of trade in a way that makes commercial agriculture less attractive. Such shocks would however be aggregate (correlated across farmers) and would complicate the dynamics without much additional insight.

of the S sub-population) and those that don't (low-z ones). We will call z^- the critical value of z that separates these two sub-populations and z^+ the highest value of z in S. Thus, we have in steady-state three sub-populations: market farmers, subsistence farmers who are constrained to stay there by the sunk cost needed to get out, and subsistence farmers who do better by staying in subsistence. For the latter, sorting is completely voluntary and reflects comparative advantage.

Let p be the proportion of farmers in S who would switch were it not for the switching cost; p and the steady-state values of M and S are endogenous, reflecting differential rates of return between market participation and subsistence farming (like in migration models where migration is driven by earnings differentials) whereas s is exogenous.

Let $N = M + S$ be the total number of farms, kept fixed throughout. Using hats to denote proportional rates of changes ($\hat{S} = dS/S$), the evolution of stock variables S and M is determined by entry and exit rates and adding up:

$$\widehat{S} = sM - pS. \tag{2}$$

In steady state, $\hat{S} = 0$, so equation (2) becomes

$$M^* = \frac{pS^*}{s} = \frac{p}{s}(N - M^*) \tag{3}$$

or

$$M^* = \left(\frac{p}{s+p}\right) N. \tag{4}$$

The stock of farms in subsistence is

$$S^* = \left(\frac{s}{s+p}\right) N$$

and the frequencies of each of the three subpopulation are respectively $p/\ (s + p)$ for market farms ($z > z^+$), $sp/\ (s + p)$ for constrained subsistence farms ($z^- < z < z^+$) and $s\ (1 - p)\ /\ (s + p)$ for non-constrained ones ($z < z^-$). Note that, in steady state, all farmers with $z^- < z < z^+$ have already been thrown out of the market, so only high z remain there.

Let r be the interest rate.[230] Let also V_M and V_S be value functions corresponding to the present discounted value of future profit streams and capital gains in each sector, given an infinite horizon. All value functions are evaluated at the system's steady state. Farming in sector j can be thought of as holding an asset whose price is determined by a standard no-arbitrage condition. For a market farm,

$$rV_M = \Pi_M(z) - sc. \tag{5}$$

[230] With perfect credit markets, the interest rate used in the calculation of NPVs should be the economywide interest rate. However, under credit constraints, it should be instead the shadow interest rate defined by the opportunity cost of funds for farmers.

In (5), the first term on the RHS is a "dividend" term —the instantaneous flow of profits— whereas the second one is an expected capital-loss term equal to the product of the re-entry cost c by the exit's hazard rate s. The simplicity of the capital-loss term is due to the assumption of immediate re-entry. One could easily add a waiting time to the story, but the end formula for the entry cost would be unchanged. For a subsistence farm, the expression is even simpler:

$$rV_S = \Pi_S(z). \tag{6}$$

Inequalities between these value functions determine three segments of the farm population. For the lowest-z segment ($z < z^-$),

$$V_M < V_S;$$

that is, sorting is voluntary. For the intermediate-z segment ($z^- < z < z^+$),

$$V_M - c < V_S < V_M;$$

that is, sorting is involuntary: farmers in that segment would rather be in the market ($V_S < V_M$) but can't because of the entry cost ($V_M - c < V_S$). Finally, high-z farmers voluntarily sort themselves in the market, because

$$V_S < V_M - c.$$

Observationally, farmers in the first and second segments are indistinguishable and are characterized by the same expected return conditional on their individual characteristics, as the function mapping characteristics into farming return depends only on the actual sector of activity (market or subsistence). Therefore, in terms of the relationship between characteristics and returns, there is only one switchpoint at z^+. For the marginal farm ($z = z^+$),

$$V_M(z) - c = V_S(z).$$

Using (5) and (6), this gives immediately

$$c = \frac{\Delta\Pi}{r+s} \tag{7}$$

where $\Delta\Pi = \Pi_M - \Pi_S$. That is, the entry cost is equal to the net present value (discounted at a rate reflecting both the cost of funds and the probability of having to re-incur it) of the profit differential between the two sectors. This simple expression will guide our empirical exploration.

There are two caveats to keep in mind. First, note that were the assumption of risk-neutrality to be relaxed, the returns differential might as well include a risk premium. This might be important empirically if there was some reason to believe that market farming is inherently riskier than subsistence farming. (This would be the case, for instance, if producer prices were volatile and negatively correlated with consumer prices, implying volatility in real income.) To our knowledge, there is no evidence to back up such conjecture. In the absence of a away of assessing the farmers' degree of risk aversion and hence of deriving a measurable proxy for the risk premium, there is no real point in modeling it explicitly. Second, Barrett (1996) provides evidence that the absence of credit markets forces some farmers to participate in the market in order to obtain the cash necessary for other transactions even though $V_M < V_S$. These two caveats imply that our measure of entry cost will underestimate the true entry costs, and should therefore be seen as a lower bound estimate, as discussed later.

3 ESTIMATION

We now turn to an attempt at estimating c following the logic of expression (7). There are two difficulties. First, as the model's logic rests on a comparison of financial returns, we must find a way of valuing the return to subsistence activity. We do so in the simplest possible way, by using market prices to value output. However we do not have farm accounting data to assess profits as precisely as if we used corporate balance sheets. In principle, one would want to measure profits as the difference between output value (actual sales plus self-consumed output valued at producer prices) and intermediate consumption. However farmers typically report their income with considerable error, and cost data is non-existent. We go round these difficulties by taking consumption expenditures (reported much more accurately than income in household surveys) net of other (non-agricultural) revenue.[231]

Second, farms must be classified as "subsistence" or "market" ones on the basis of a reasonable criterion. The most natural one is the proportion of farm output that is sold vs. self-consumed. However this settles only half the issue, because the cutoff must then be set somewhere.[232] We choose, as explained in section 3.2 below, to let the data generate the cutoff value endogenously.

3.1 Data

The data are from Madagascar's four household surveys (1993, 1997, 1999 and 2001), called in French *"Enquête Permanente des Ménages"* (EPM). Each is made of a household survey perse covering about 5,200 households on average and a "community questionnaire" collecting data on villages. The EPM uses multi-stage sampling, splitting observations into strata and clusters. Strata are identified by province ("Faritany") and by urban vs. rural area; clusters are identified by administrative units ("Fokontany") randomly drawn in each stratum. The sample in this chapter includes 5,951 agricultural housholds. Although repeated, the EPM is not a panel as only a small number of households were sampled repeatedly in 1997 and 1999.

[231] We also estimated our model using the output value only, assuming zero cost (since the data on costs is not available). The results we found are similar to the results we get with our measure of profits (consumption expenditures-non-agricultural revenue).

[232] See Hotchkiss (1991) for a similar discussion of part-time vs. full-time work.

Commune data (collected in 2001 and covering 1'385 communities at the level of administrative units above Fokontany) is from the commune census of Cornell University's ILO program. It includes, inter alia, data on the commune's level of development, infrastructure and aggregate agricultural production.

Producer prices are taken from the Food and Agriculture Organization (FAO), for all years between 1991 and 2001. Prices are in current Malagasy francs (MGF). Climatic data was taken on the one hand from the Ministry of Agriculture, Livestock and Fisheries of Madagascar and on the other hand from a paper on climatic perturbations (Rambeloalijaona & Randrianarivelo, 2003).

The first column of Table 13.1[233] shows descriptive statistics computed allowing for the sample design (weights, strata and clusters[234]). The first striking feature of the data is agricultural household's extreme poverty.[235] With a yearly income of US $566 for a family of five (implying about 30 cents per day per person) the average Malagasy household lives well under the international dollar-a-day poverty line.

The second is the degree of farm specialization. On average, a farm's first crop accounts for 80 percent of agricultural income, and about 70 percent of total income comes from crop sales. With 7.5 percent of full income[236] from livestock sales, the diversification of sources of income is somewhat limited.

At about 1.6 hectares, the average Malagasy farm is very small, which means that all but the simplest capital equipment is prohibitively costly to buy at the farm level, and hence that labor productivity can only be very low.

Land ownership is widespread at about 80 percent of all land.[237] Of that part of land that is not owned, sharecropping accounts for 4% and tenancy for 3.6%. The interest in the distinction between sharecropping and tenancy is that under the former, the farmer owes a fixed percentage of the harvest to the landowner, which provides partial insurance through risk-sharing between the farmer and landowner. Tenants, by contrast, must pay a fixed rent, implying that they bear the entire burden of crop-variability risk. One may therefore expect more risk-taking under sharecropping than under tenancy.[238]

Finally, if all crops, sold or self-consumed, are evaluated at producer prices, potatoes and rice contribute respectively 55% and 26% of "full" agricultural revenue. In fact, only 26 percent of the potato harvest is marketed vs. about 60 percent for rice. In terms of cash revenue, rice contributes about 36 percent of the total. Overall, about two thirds of farm output evaluated at market prices is self-consumed.[239]

[233] The second and third columns will be commented on later.

[234] For more on that, see Deaton (1997).

[235] A thorough analysis of poverty trends in Madagascar can be found in Paternostro et al. (2001).

[236] By "full"income we mean that our measure of income includes the value of the total harvest (evaluated at producer prices) and not only the value of what is sold in the market.

[237] The 15 percent of lands that are neither owned, nor in sharecropping, nor in tenancy are either lent to the household without rent or given by the village to develop it.

[238] Sadoulet et al. (1993) discuss the efficiencies or inefficiencies of sharecropping contracts and show that under extreme poverty or gift exchanges, contract are in fact efficient.

[239] This sticks to Barrett's (1997) number, that suggests that in the province of Antananarivo, only 25–30% of agricultural production is marketed.

Table 13.1: *Descriptive statistics*

Statistics	Total	Market	Subsistence
Sample size	5951	5502	449
Family size			
Mean	5.09	5.08	5.14
Std. Error	*0.05*	*0.05*	*0.14*
Household's head, percentage by sexe			
Male	85.60	85.88	81.86
Female	14.40	14.12	18.14
Household's head age distribution (% population)			
15–30 years	23.29	23.53	19.99
30–45 years	38.74	38.93	36.18
45–60 years	24.85	24.52	29.23
60 years and more	12.99	12.88	14.59
Household's head highest level of education attained (% population)			
Primary	84.73	84.69	85.21
Std. Error	*0.6*	*0.6*	*1.8*
Secondary	14.97	15.00	14.61
Std. Error	*0.6*	*0.6*	*1.8*
University	0.29	0.3	0.17
Std. Error	*0.1*	*0.1*	*0.2*
Cropland surface (ha)			
Mean	1.61	1.65	1.06
Std. Error	*0.05*	*0.06*	*0.07*
Percentage of owned land			
Mean	79.94	80.08	76.48
Std. Error	*0.8*	*0.8*	*2.4*
Percentage of land in sharecropping			
Mean	4.06	3.96	5.47
Std. Error	*0.3*	*0.3*	*1.12*
Percentage of rented land			
Mean	3.64	3.56	4.64
Std. Error	*0.3*	*0.27*	*0.9*
Percentage of households with outstanding agricultural loan			
Mean	4.15	4.26	2.66
Std. Error	*0.39*	*0.4*	*0.1*
Remoteness (% population being)			
Least remote	34.83	34.57	38.29
Std. Error	*2.01*	*1.7*	*3.0*
Fairly remote	43.19	43.02	45.41
Std. Error	*2.33*	*1.9*	*3.2*
Most remote	21.96	22.39	16.27
Std. Error	*2.02*	*2.1*	*2.9*
Annual expenditures (mean)			
MGF	389230.82	397496.50	278969.91
Std. Error	*9794.90*	*10224.74*	*12846.21*
\$, PPP	566.52	578.55	406.03
Std. Error	*14.88*	*15.71*	*18.70*

Statistics	Total	Market	Subsistence
Annual profts (mean)			
MGF	626374.10	639355.54	453208.10
Std. Error	*13344.29*	*13728.22*	*27877.13*
$, PPP	911.67	930.57	659.63
Std. Error	19.42	19.98	40.57
Share of income of livestock sales in full income (mean)			
Mean	7.46	6.55	19.70
Std. Error	*0.27*	*0.23*	*1.12*
Share of crop sales in total income			
Mean 71.0 76.30 0			
Std. Error 0.8 0.63 0			
Share of crop sales in crop harvest (in value)			
Mean	38.05	40.90	0
Std. Error	*0.67*	*0.6*	*0*
Share of crop sale in total crop sales (mean)			
Main crop	80.50	80.50	0
Std. Error	*0.55*	*0.55*	*0*
Second main crop	15.25	15.25	0
Std. Error	*0.37*	*0.37*	*0*
Third crop	3.46	3.46	0
Std. Error	*0.18*	*0.18*	*0*
Fourth crop	0.78	0.78	0
Std. Error	*0.06*	*0.06*	*0*
Share of crop harvest in harvest of all crops (mean)			
Main crop	56.54	55.58	69.28
Std. Error	*0.77*	*0.8*	*1.6*
Second main crop	24.09	24.37	20.47
Std. Error	*0.45*	*0.5*	*1.0*
Third crop	13.56	13.99	7.76
Std. Error	*0.39*	*0.4*	*0.8*
Fourth crop	5.81	6.06	2.49
Std. Error	*0.27*	*0.3*	*0.3*
Most cultivated crops (share of crop's total harvest in population total harvest)	Potato 55.22	Potato 57.18	Rice 68.76
	Rice 25.84	Rice 24.87	Yam 16.39
	Cassava 6.47	Cassava 6.09	Sweet potato 9.55
	Coffee 2.65	Coffee 2.65	Maize 5.16
	Maize 1.78	Maize 1.66	Coffee 4.04
Most cultivated crops in value (% crop's population total sales in population total sales)	Rice 36.39	Rice 36.39	–
	Coffee 11.49	Coffee 11.49	–
	Vanilla 10.56	Vanilla 10.56	–
	Cassava 7.98	Cassava 7.98	–
	Tobacco 4.26	Tobacco 4.26	–

3.2 Analysis

Following the logic outlined above, we assume that the function mapping individual characteristics into the return from farming is sector-specific, i.e. is not the same for market vs. subsistence farms. For instance, transportation costs, access to credit and inputs, or any factors affecting the output's quality are likely to matter more for commercial than for subsistence agriculture.[240] This calls for the use of a switching-regression framework. As per the previous section's model, however, we assume that rational farmers base their decision to "migrate" from subsistence to market on a comparison of returns, implying that the switchpoint is endogenous.

Let Π_{ji}, $j = M, S$, be farmer i's "profits" (precise variable definitions are discussed below) in sector j, and let $\pi_{ji} = \ln\Pi_{ji}$. Let X_i be a vector or individual characteristics affecting profits in both sectors (in general, these RHS variables need not be the same in both regimes, but here they are). The model is

$$\pi_{Mi} = X_i'\beta_M + u_{Mi}, \tag{8}$$

$$\pi_{Si} = X_i'\beta_S + u_{Si}, \tag{9}$$

$$= (\pi_{Mi} - \pi_{Si})\,\delta + Z_i\gamma - v_i \tag{10}$$

where u_{Mi}, u_{Si} and v_i are error terms. In (8)–(10), π_{Mi}, π_{Si} and I^*_i are latent (unobserved)
variables; the observed level of (log) profits is

$$\pi_i = \begin{cases} \pi_{Mi} & \text{if } I_i^* > 0 \\ \pi_{Si} & \text{if } I_i^* \leq 0. \end{cases}$$

The presence of π_{Mi} and π_{Si} on the RHS of (10) is what makes the switching endogenous, whereas the assumption that the entry cost is the same for all households ensures that (10) holds, the entry cost being subsumed in the equation's constant term. Substituting from (8) and (9), we can write

$$\begin{aligned} I_i^* &= X_i'(\beta_M - \beta_S)\,\delta + Z_i'\gamma - \varepsilon_i \\ &= W_i'\alpha - \varepsilon_i \end{aligned} \tag{11}$$

where $W_i' = [X_i', Z_i']$, and

$$\epsilon_i = (u_{Si} - u_{Mi})\,\delta + v_i.$$

[240] For evidence on productivity differentials between subsistence farmers and market participants, see Brambilla and Porto (2007).

Consistent estimates of all parameters can be obtained by maximum likelihood. We follow here a procedure set up by Hotchkiss (1991) to deal with situations involving both selectivity and an unknown cutoff.

In order to describe the procedure in some detail, we introduce some more notation. Let ϕ and Φ denote respectively the density and CDF of the standard normal distribution. We write the inverse Mills ratio as

$$\varphi_j(.) = \begin{cases} \phi(.)/\Phi(.) & j = M \\ -\phi(.)/[1-\Phi(.)] & j = S, \end{cases}$$

with the minus sign in the bottom expression to facilitate the use of the regime index j later on. For future use, let also ρ_j be the coefficient of correlation between u_{ji} and ϵ_i, and

$$\eta_{ji} = \left[\frac{W_i'\alpha - \rho_j(\pi_{ji} - X_i'\beta_j)/\sigma_j}{\sqrt{1-\rho_j^2}}\right], \quad j = M, S. \tag{12}$$

Lee (1979) showed that

$$E(u_{Mi}^2 | I_i^* > 0) = \sigma_M^2 - \sigma_{M\epsilon}^2 W_i'\alpha\,\varphi_M(W_i'\alpha)$$

and

$$E(u_{Si}^2 | I_i^* \leq 0) = \sigma_M^2 - \sigma_{S\epsilon}^2 W_i'\alpha\,\varphi_S(W_i'\alpha).$$

Thus, letting ξ_{ji} and μ_{ji} be error terms and using φ_{ji} as shorthand for $\varphi_j(W_i'\alpha)$, we can write

$$\pi_{ji} = X_i'\beta_j - \varphi_{ji}\,\sigma_{j\epsilon} + \xi_{ji}, \quad j = M, S \tag{13}$$

and

$$u_{ji}^2 = \sigma_j^2 - W_i'\alpha\,\varphi_{ji}\,\sigma_{j\epsilon}^2 + \mu_{ji}, \quad j = M, S. \tag{14}$$

Using this, steps 1 and 2 of our procedure, which follow Lee (1979), provide consistent estimates which we use as initial values for the ML estimation of step 3. From then on we follow Hotchkiss's procedure (Hotchkiss 1991), which consists of estimating the model's parameters by maximum likelihood for a given (endogenous) cutoff and then searching for the cutoff yielding the *maximum maximorum* of the log-likelihood function, re-optimizing all parameters at each step:[241]

[241] Hansen (2000) proposes a somewhat similar method for situations without selectivity; however his first step is a set of OLS regressions, each for a given threshold value, the second being the minimization of the sum of squared residuals by choice of the threshold. Note that Hotchkiss's procedure differs from an early one proposed by Quandt (1958) in which the first step maximizes the likelihood function and the second step searches for the best cutoff value *holding all other parameters constant.*

Step 1 An initial (arbitrary) cutoff λ^* is set in terms of the share of a farm's output that is sold on the market (an observable variable). Farms are sorted in either regime using this cutoff and a probit is run on (11), yielding an estimate of α, $\hat{\alpha}$. Let $\hat{\varphi}_{ji} = \varphi_{j,}\ (W_i' \hat{\alpha})$

Step 2 Estimates $\hat{\varphi}_{ji}$ from the first-stage probit are used in OLS regressions of (13), yielding estimates $\hat{\beta}_j$ and $\hat{\sigma}_{j\epsilon}$. Plugging the former into (8)–(9) yields a vector of residuals $\hat{u}_{ji}$. Using $\hat{u}_{ji}^2$, $\hat{\sigma}_{j\epsilon}^2$, $\hat{\alpha}$ and $\hat{\varphi}_{ji}$ in lieu of $\hat{u}_{ji}^2$, $\sigma_{j\epsilon}^2$, α and φ_{ji} respectively in an OLS regression of (14) finally gives an estimate of σ_j^2.

Step 3 All parameters being consistently estimated, they are used as initial values for the maximization of

$$\begin{aligned} \ln \widetilde{\mathcal{L}} &= \sum_{i=1}^{n} \left\{ q_i \left[\ln \phi \left(\frac{\pi_{Mi} - X_i' \beta_M}{\sigma_M} \right) - \ln \sigma_M + \ln \Phi \left(\eta_{Mi} \right) \right] \right. \\ &\quad \left. + (1 - q_i) \left[\ln \phi \left(\frac{\pi_{Si} - X_i' \beta_S}{\sigma_S} \right) - \ln \sigma_S + \ln \left[1 - \Phi(\eta_{Si}) \right] \right] \right\} \end{aligned} \tag{15}$$

where η_{ji} is defined in (12). With this method, every parameter of (8), (9) and (10) is estimated consistently and asymptotically effciently. The value of the maximum likelihood is recorded.[242]

Step 4 The procedure starts again from Step 1 with a different value of λ^* and is repeated until the *maximum-maximorum* of the log-likelihood function is found.

Step 5 Finally, the entry cost faced by subsistence farmers willing to switch to the market is estimated by

$$\begin{aligned} \widehat{c} &= \frac{1}{r+s} \Delta E \left(\Pi_{ji} \middle| \widetilde{W}_i' \right) \\ &= \frac{1}{r+s} \left\{ \exp \left[\widetilde{X}' \widehat{\beta}_M - \widehat{\sigma}_{M\epsilon} \varphi_M (\widetilde{W} \widehat{\alpha}) \right] - \exp \left[\widetilde{X}' \widehat{\beta}_S + \widehat{\sigma}_{S\epsilon} \varphi_S (\widetilde{W} \widehat{\alpha}) \right] \right\} \end{aligned} \tag{16}$$

where $\widetilde{X}$ and $\widetilde{W}$ are evaluated at the marginal farm (the one with the highest predicted probability of being in the market while actually being in subsistence), all parameter estimates are based on the "best" sample split, and suitable proxies (discussed below) are used for the interest rate r and exit rate s.

[242] The maximization was performed in Stata (Lokshin and Sajaia 2004). Note that Lokshin and Sajaia's procedure allows for weights and clusters, but not for strata. However, as omitting strata generally biases upward the estimated standard errors, this is working against us.

3.3 Results

3.3.1 Endogenous classification of farms

The log likelihood was maximized at $\lambda^* = 0$ (no market participation at all). This splits our sample into 449 households in subsistence and 5502 on the market (equivalent to 0.3 and 3.8 million households respectively). For robustness, a bootstrap procedure was applied to λ^*: 60 samples were drawn from the sample with replacement; for each of these samples, the model was re-estimated and the value of λ^* maximizing the log likelihood was retrieved. The mean value of λ^* over the bootstrap was 0.00256, with a standard error of 2.26E-04. The corner solution ($\lambda^* = 0$) therefore seems to be a good estimate of the true value of λ^*.

As a further check on how reasonable it is to set λ^* at zero, the last two columns of Table 13.1 report descriptive statistics conditional on sectoral sub-samples constructed using this value. As for gender, the proportion of female household heads is 18% in subsistence vs. 14% in the market, consistent with the common observation that female-headed households are also often poorer. Average age is slightly higher in subsistence, but education shows no difference.

Cropland size is 64% smaller in subsistence than in the market, and a slightly lower proportion (76% vs 80%) is owned. Access to credit is also lower (2.66% of farms in subsistence vs. 4.26% in the market) although both proportions are extremely low, suggesting largely non-existent rural credit markets. Counter-intuitively, market farmers are more remote than subsistence ones, but export crops are known to be grown in relatively isolated areas in Madagascar (see Stifel et al., 2003).

In terms of "full income", a market farm's main crop accounts for about 56 percent of the total. In terms of cash income, the proportion is 80%, the difference coming from the large proportion that is self-consumed even by market farms (see supra). If market farms seem more specialized in terms of cash crops than food ones, interestingly subsistence farms are also heavily specialized with the first crop accounting for 70% of the total evaluated at market prices (the top two crops account for a whopping 90% of the total). In other words, subsistence farmers mostly rely on two crops only.

The bottom of the table shows that whereas farmers on the market produce mainly potatoes and rice, subsistence farmers mainly produce rice and cassava, which accords with evidence that rice and cassava are Madagascar's most important food crops.[243]

3.3.2 Profit equations, selection equation and entry costs

The first column in Table 13.3 shows results for the profit equation of market farms[244], the second for that of subsistence farms (recall that we are talking here of full income, including self-consumption valued at producer prices), and the third for the selection equation, that is, for equation (10). The dependent variable

[243] The main food crops of Madagascar are rice, maize, cassava, sweet potatoes and groundnuts and the most important cash crops are coffee, vanilla, cloves, sugarcane, cotton and cocoa.

[244] The definition of the explanatory variables is in Table 13.2.

Table 13.2: *Description of variables*

Variable	Signification
Profits	Household's annual agricultural profits. The profits are composed of the agricultural sales and of the value of crop autoconsumption.
HH size	Number of people in the family outside the household's head.
HH head age 2	Household's heads' age (squared age), in logs.
HH head schooling	Household's head's last achieved school year. 1–6: primary school: 7–13, secondary school, 14–18: university.
Members age	Household's members' average age.
Cropland size	Number of squared meters of land the household crops or has in fallow, in logs[a]
Owner	Proportion of owned cropped land.
Tenant	Proportion of rented cropped land.
Sharecropper	Proportion of cropped land in sharecropping.
Outstanding loan	Dummy indicating whether the household has a loan meant for agriculture. 1=yes, 0=no.
Inputs	Dummy indicating whether the household used inputs in its production. 1=yes, 0=no.
Price index	Price index for long term crops, in logs.
SE. Price index	Standard error of the price index for long term crops, in logs.
Temp. amplitude	Temperature amplitude: range between the highest recorded temperature and the lowest one.
Disturbances	Index indicating the risk of atmospheric disturbances. Goes from 0=low risk to 5=high risk.
Transport cost	Cost of transporting 50 kg of rice to the nearest town.
Farmers association	Dummy indicating whether the village where the household lives has an association of farmers. 1=yes, 0=no.
Share agri. Pop.	Share of the population of the community in the agricultural sector.
Fertilizer use	Share of the farmers of the community who use fertilizers. 0=0%, 1=¡5%, 2=5–25%,., 5=¿75%.
National road	Dummy indicating if a national road runs throughout the community. 1=yes, 0=no.
Steer	Number of steers in the community.
Important crop	Dummy indicating if the household's first or second crop corresponds to the most important crop (in surface or in value) in the community. 1=yes, 0=no.
Number of rich	Percentage of rich people in the community.
Number of poor	Percentage of poor people in the community.[b]
Remoteness index	Index indicating how remote the community is. This index takes into account the infrastructure of the community and transport facilities. For more details, see the Ilo census of the Cornell University. Goes from 1=least remote to 5 most remote.
Livestock	Number of cows and pigs in the community.
Regional dummies	Dummies for the 6 Faritanys (provinces). Each dummy equals to 1 if the village is in this province and 0 otherwise.
Year dummies	Dummies indicating to which EPM the household belong. 1=yes, 0=no.

[a] For variables that have zero values, we added 1 to the variable so that the log is always feasible.
[b] Number of rich and number of poor do not add to 1, since the data gives in addition the number of middle-rich and of middle-poor.

Table 13.3: *Switching regression results, λ = 0*

	Inprofit$_1$	Inprofit$_0$	occupation
HH size	0.07***	0.04**	−0.01
	[14.15]	*[2.07]*	*[0.85]*
HH head age	0.672	4.76***	1.66
	[1.04]	*[2.69]*	*[1.09]*
HH head age 2	−0.08	−0.63***	−0.25
	[0.94]	*[2.63]*	*[1.19]*
HH head schooling	0.04***	0.04***	0.02
	[10.33]	*[3.79]*	*[1.45]*
Members age	0.14***	−0.02	0.05
	[6.54]	*[0.93]*	*[0.72]*
Cropland size	0.19***	0.21***	0.13***
	[11.29]	*[2.77]*	*[3.24]*
Outstanding loan	0.18***	0.29***	0.10
	[2.99]	*[2.57]*	*[0.46]*
Inputs	0.17***	0.07	0.8
	[3.90]	*[0.80]*	*[0.64]*
Fertilizer use	−1.54E−03	−0.02	0.04
	[0.12]	*[0.88]*	*[1.03]*
Steer	4.89E−07	−3.42E−06	−6.04E−06*
	[0.24]	*[1.13]*	*[1.80]*
Owner	0.02	−0.13	0.17
	[0.50]	*[0.80]*	*[1.44]*
Sharecropper	0.01	−0.26	−0.13
	[0.07]	*[1.07]*	*[0.70]*
Tenant	0.15*	0.29	−0.05
	[1.93]	*[1.38]*	*[0.22]*
Temp. amplitude	0.01	0.01	−0.01
	[1.19]	*[0.64]*	*[0.46]*
Disturbances	0.02	0.07	−0.15***
	[0.61]	*[0.89]*	*[2.69]*
Transport cost	3.40E−07	−1.54E−06	−4.31E−06
	[0.19]	*[0.46]*	*[1.51]*
National road	0.08*	−0.01	0.04
	[1.85]	*[0.14]*	*[0.43]*
Farmers association	0.07	−0.13	0.13
	[1.49]	*[1.62]*	*[1.21]*
Share agri. pop.	−1.72E−03*	−2.08E−03	−3.89E−03
	[1.65]	*[0.81]*	*[1.50]*
Important crop	−4.09E−03	−0.05	−0.15
	[0.12]	*[0.61]*	*[1.61]*
Year1993	−0.25***	−0.74**	0.56***
	[3.32]	*[2.48]*	*[2.86]*
Year1997	0.33***	0.19	−0.17
	[5.61]	*[1.33]*	*[1.19]*
Year1999	0.33***	0.21	−0.03
	[5.49]	*[1.44]*	*[0.16]*
Faritany2	−0.20***	0.06	0.10
	[3.28]	*[0.49]*	*[0.74]*
Faritany3	−0.19**	−0.48*	0.55***
	[2.28]	*[1.73]*	*[2.93]*

	lnprofit$_1$	lnprofit$_0$	occupation
Faritany4	–0.15	–0.31	0.65**
	[1.26]	*[1.07]*	*[2.23]*
Faritany5	–0.23***	–0.38**	0.30
	[2.62]	*[1.69]*	*[1.46]*
Faritany7	0.08	–0.15	0.38**
	[1.04]	*[0.66]*	*[2.03]*
Number of poor			–0.01***
			[2.59]
Number of rich			–0.01**
			[2.14]
Remoteness index			0.09*
			[1.81]
Livestock			–1.65E–06
			[0.11]
Price index			2.06***
			[6.74]
SE Price index			–0.04**
			[2.19]
Constant	9.15***	2.06	–2.47
	[8.14]	*[0.62]*	*[0.81]*
Sigma$_1$	0.62***		
	[26.49]		
Sigma$_2$	0.62***		
	[12.53]		
rho$_1$	0.53***		
	[3.62]		
rho$_2$	0.08		
	[0.13]		
$\hat{\sigma}_\lambda$	2.26E–04		
Observations	5951		
Wald chi2(28) 1171.50 Prob > chi2=0.000			
Wald test of indep. eqns. : chi2(1) = –9.7E+06 Prob > chi2 = 1.0000			

Robust *z* statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

of the selection regression, "occupation", is equal to one for a market farm and zero otherwise.

Notice that for the model to be identified, the selection equation must include additional explanatory variables that explain the regime decision only. This is why the variables *changes in past prices, number of rich, number of poor, remoteness index and livestock* are part of equation (10) and not of profit equations. Changes in past prices, whether through price index or price volatility, indeed affect the decision to participate in subsistence or in the market: if a farmer's past prices follow a negative slope, he will change his cropping scheme and this will have an impact on his participation decision. However, there is no evidence that past prices should influence present prices. These two variables are therefore not part of the two profit equations. Finally, *remoteness, number of rich, number of poor* and *livestock* were only included in the selection equation even if they could also influence profits. We exclude them from the profit equations because they were never significant.

Interestingly, household characteristics have a significant effect on profits in both cases (market and subsistence) but less on occupational choice. Unsurprisingly, the household head's schooling has a positive impact on profit in both cases. Age affects subsistence profits along an inverted U-shape but does not affect market profits.

The presence or size of factors of production (cropland size, loan, inputs, fertilizer use and steer) in general have a positive effect on market profits and on subsistence profits; as for occupational choice, larger farms in terms of acreage have a higher probability of being in the market. Ownership structure seems to affects profits only in the market sector, with a positive effect of tenancy. Quite surprisingly, climatic variables only show clear effect on the occupational choice.

Remoteness (national road, transport cost and remoteness index) has the overall expected effect, as the presence of a national road in the village has a positive effect on market profits. Moreover the remoteness index increases the probability of being on the market, as already noted in our discussion of descriptive statistics.

Finally and most interestingly, the evolution of prices as measured by our composite price indices affects occupational choice in ways that accord with intuition.[245] The more a farm's producer prices increased in the past, the greater its probability of being on the market. Conversely, the greater the volatility of those prices, the smaller this probability.

In sum, household characteristics, production factors, community characteristics and, most importantly, prices, generally affect profits and occupational choices in expected ways.

A last comment concerns the statistics indicated at the bottom of the table. $Sigma_1$, and $Sigma_2$ are the square-roots of the variance of the residuals of equa-

[245] The price index and volatility were not included in the profit equations, since these variables reflect the movement of past prices. It is difficult to imagine that past prices can affect present profits. For explanations on the construction of the price index and price volatility variables, see appendix A.3.

tions (8) and (9) and rho_1 and rho_2 are the correlation coeffcients.[246] Only rho_1 (the correlation coeffcient between occupational choice and the market profit equation) is significant. Since it is positive, a farmer on the market has higher profits than those of a “random” one.

Table 13.4 provides the mean conditional profits under the two regimes: $E[\pi_{Mi}|I_i^* \leq 0]$, $E[\pi_{Si}|I_i^* \leq 0]$, $E[\pi_{Mi}|I_i^* > 0]$ and $E[\pi_{Si}|I_i^* > 0]$, for different values of λ^*. Subsistence farmers’ average agricultural profits is 30% lower than the profit of market farmers. This can be explained by higher productivity, access to better inputs, etc. Controlling for their characteristics, the switch from subsistence to market participation could increase subsistence farmers income by 36 percent. Similarly, those farmers out of subsistence could see their income fall by half if they were to move into subsistence.

In order to compute the entry costs going along with a move from subsistence towards the market (equation (7)), we must approximate *r*, the interest rate, and *s*, the probability of exit from the market sector. To be as close as possible to reality, we proxy *r* with the interest rate on microcredit. Yearly microcredit rates in Madagascar typically hover between 27% and 43%. An interest rate of 30% therefore seems to be a good approximation. As for *s*, it was calculated using the survey’s two-year panel[247] by calculating the proportion of 1997 market farms that switched to subsistence between 1997 and 1999. This proportion was then adjusted to find a yearly percentage of farmers switching into subsistence. We find

Table 13.4: *Conditional profits*

		Subsistence, Ii = 0	Market, Ii = 1	Opportunity cost	Entry cost Lower bound	Entry cost Marginal HH	Entry cost Upper bound
$\lambda = 0$	π_{M_i}	210399.5	551470.3				
	Se	(3877.9)	(7688.2)				
	π_{S_i}	387379.1	526704.5	167800.1	481496.9	536385.9	591274.9
	Se	(13999.8)	(12818.9)	(9543.9)		(28004.6)	
$\lambda = 0{:}1$	π_{M_i}	326586.0	563272.6				
	Se	(4947.8)	(7784.7)				
	π_{S_i}	427452.2	531248.9	133216.1	393341.8	429835.5	466329.2
	Se	(10988.6)	(11332.1)	(6345.4)		(18619.2)	
$\lambda = 0{:}2$	π_{M_i}	394503.4	571292.7				
	Se	(6331.5)	(7955.8)				
	π_{S_i}	489019.1	542381.9	103329.2	404515.2	433759.0	463002.8
	Se	(10196.8)	(9393.6)	(5084.8)		(14920.3)	
$\lambda = 0{:}3$	π_{M_i}	463059.6	580895.0				
	Se	(7336.1)	(8705.2)				
	π_{S_i}	513787.9	561932.1	96145.7	400168.3	426384.5	452600.7
	Se	(8424.9)	(8894.3)	(4558.4)		(13375.6)	

246 Since rho_1 and rho_2 are not equal to zero, it means that $\sigma_{1\epsilon}$ and $\sigma_{2\epsilon}$ cannot take the value zero. Recalling the comment of page 5 on these two variables, this means that the switch is indeed endogenous.

247 The data contain a panel over about 1000 households, surveyed in 1997 and 1999.

a value of s of 4.08 percent. From equation (7), the entry cost was computed by dividing the opportunity cost by the sum of r and s, that is, by 0.3408.

Using these, our estimate of the entry cost is 536’385 Malagasy francs i.e. 139% of subsistence farmers agricultural profits. The lower bound for the entry cost estimated with the 95% confidence interval is 481’496 Malagasy francs, or 124% of subsistence farmers’ profits. The upper-bound estimate amounts to 591’275 Malagasy francs, i.e. 153% of profits. The annual economic opportunity cost of subsistence farming is obtained by taking the mean of $E[\Delta\pi_{ji}|I_i = 0]$ over subsistence households that are not moving to the market in each year.[248] The estimate of the opportunity cost is 167’800 Malagasy francs, or 43 percent of profits. Dividing the annual opportunity cost by GDP and taking the weighted sum, we have that moving all subsistence farmers into the market would add an annual 0.46 percent to Madagascar’s GDP. Entry costs and the consequent subsistence of farmers can be very large when measured at the level of the individual facing the cost. However, at the aggregate level, the costs do not seem to be very large, echoing the literature on trade reform and adjustment costs (see Matusz and Tarr, 1999).

3.3.3 Robustness

We have performed a number of robustness checks (not reported). We estimated first stage ML profits for values of λ^* set at 10, 20 and 30 percent, allowing for some market sales by subsistence farmers. Unsurprisingly, the larger is λ^*, the more different are the regression results. Few changes are observed on the two profit equations, but results seem less robust for the occupational choice equation.[249] Table 13.4 shows that as we raise the value of λ^*, the entry cost associated with subsistence farming declines.

We also tested for production aggregation problems, estimating the switching regression model on a subsample composed of households producing mainly rice,[250] Madagascar’s most common crop. With 84% of Malagasy households producing rice as one of their first two crops, we have a large enough subsample (4996 observations). Regression results show little change between whole-sample and rice-sample estimates, suggesting that crop aggregation does not seem to have a critical impact on our conclusions.

3.3.4 Policy implications

As a market failure, the presence of barriers to entry into commercial farming obviously has potential policy implications. However what corrective measures are appropriate depends on the nature of the barriers. If they are private (say, the need to purchase capital equipment), then one would presume that improved ac-

[248] That way, we estimate accurately the opportunity cost, since we only take into account farmers that are really facing the cost.

[249] These results are available from the authors.

[250] Since in most of the case, households have two important crops (e.g, they mainly produces vanilla for cash, but also a large amount of rice for self consumption), we considered both of them as main crops.

cess to credit would be key to reducing them. If, by contrast, they are collective (say, the quality of the local road infrastructure) then government action is needed.

In order to shed some preliminary light on this question, we show in Table 13.5 the results of a simple regression of $\Delta\hat{\pi} \equiv \hat{\pi}_M - \hat{\pi}_S$, the (predicted) opportunity cost of subsistence farming, on household characteristics. The idea of this regression is to identify individual characteristics correlated with high opportunity costs and hence with large gains from switching to commercial farming. This exercise should be interpreted with caution, however, if only because for all farmers other than the "marginal" one, the negative earning differential measured by $\Delta\hat{\pi}$ (negative because the first term is hypothetical while the second term is actual) is only a lower bound on the actual entry cost.

Large households seem to have higher opportunity costs, possibly reflecting the fact that they have lower per-capita income and hence less surplus to purchase capital equipment to switch to the market. Households with a more educated and younger head and a larger farm have the lowest opportunity cost, suggesting, in accordance with intuition, that they are more reactive to economic incentives.

The presence of a producer association widens the opportunity cost, suggesting that it raises the return to commercial farming (possibly by improving the farmers' bargaining power vis-`a-vis middlemen) without making it easier for subsistence farmers to switch. Access to credit also reduces negative earnings differentials, suggesting that credit does help to overcome barriers to entry in the market. However as discussed elsewhere in this chapter one should not make too much of this given the very low proportion of farms with access to credit. Finally, the presence of a national road in the village raises the opportunity cost of being in subsistence, suggesting that it raises the return to commercial farming (as one would expect) without helping subsistence farmers to do the switch. Taken together, the combination of the effects of credit and transportation leans more in the direction of private than public entry barriers.

4 CONCLUSION

There is little empirical work on entry barriers into agricultural markets. However, these markets are important in poor countries. The extreme poverty of rural households in least-developed countries like Madagascar makes them particularly vulnerable to even small deteriorations in their terms of trade. Recent work on trade and poverty has highlighted the fact that agricultural markets themselves are fragile and can be destroyed when institutions (like intermediation) or infrastructure (like rural roads) are left to decay, which can happen when changes in relative prices are perceived to last. Restoring those markets can be a long and costly endeavour.

This suggests that rural households in the grey zone between market participation and subsistence should receive particular attention in the design of reforms. Of course, the incentives faced by those households can be assessed only

Table 13.5: *Opportunity cost regressions*

	Subsistence farmers
Expenditure per capita	–0.04
	[1.13]
HH size	0.09***
	[9.40]
HH head age	–10.51***
	[9.32]
HH head age 2	1.38***
	[9.01]
HH head schooling	–0.01*
	[1.94]
Members age	0.51***
	[10.54]
Cropland size	–0.04**
	[1.98]
Owner	0.72***
	[7.52]
Sharecropper	1.02***
	[7.58]
Tenant	–0.71***
	[3.37]
Outstanding loan	–1.21***
	[3.01]
Farmers association	0.81***
	[14.14]
Share agri. pop.	0
	[0.34]
Transport cost	0.00***
	[3.72]
National road	0.37***
	[5.91]
Year1993	1.49***
	[10.00]
Year1997	0.47***
	[4.25]
Year1999	0.41***
	[4.42]
Faritany1	–0.31***
	[3.50]
Faritany2	–1.42***
	[9.62]
Faritany3	0.21**
	[2.10]
Faritany4	–0.07
	[0.42]
Faritany5	0.08
	[0.83]
Constant	16.79***
	[7.97]
Observations	371
R-squared	0.71

Absolute value of t statistics in brackets
* significant at 10%; ** significant at 5%; *** significant at 1%

indirectly using the noisy information pf household surveys, and there is no natural definition of subsistence farming. Notwithstanding these difficulties —for which we have no perfect fix— our analysis yields a number of results.

We define the cost of moving out of subsistence as the present discounted value of the expected opportunity cost of not switching for the "marginal farmer" —the one whose fundamentals make him just indifferent between "going commercial" and not. We then approximate this magnitude empirically by comparing the monetary equivalent of the return to subsistence vs. commercial farming.

The most striking insight coming out of our empirical analysis is that the order of magnitude of this entry cost seems to be very large: more than one year of the typical subsistence farmer's output valued at market prices. Such a large entry barrier implies the persistence of relatively large returns differentials between subsistence and market farming. It also makes subsistence farming "sticky", a sort of poverty trap.

Could our entry-cost calculation be biased upward? Because it is essentially an NPV calculation, there are two possible sources of upward bias: either the profit differential appearing on the numerator (the opportunity cost from not being on the market) is too high, or the interest and exit rates appearing in the denominator are too low. We use very high microcredit rates as interest rates, so the interest rate is unlikely to be the problem. There is more uncertainty about the accuracy of our exit rate, which was estimated on a short sample period (1997–99) and may not be representative of long-run exit rates. We have, however, no outside information to benchmark it and so no prior about whether it might be too high or too low. As for the denominator, by contrast, there may be an argument. Because we value subsistence output at producer prices, it is indeed possible that we under-estimate the return to subsistence farming. One might argue for using consumer prices to value output that is for consumption; as consumer prices are above producer prices, this would raise the "shadow" return to subsistence farming and hence reduce the profit differential (the opportunity cost from not being in the market) and the inferred entry cost. This should be kept in mind as a caveat, but the difference between producer and consumer prices is unlikely to change drastically the flavor of our result. Even cut in half, the entry cost would still be several months' worth of production.

One important question for which we can provide only a very preliminary answer is whether entry costs are private (say, the upfront purchase of capital) or public (say, road improvements). Both conjectures are consistent with the evidence we find of unused arbitrage opportunities; yet, they would call for very different policy remedies. We tried to get a first shot at this issue by exploring the correlation between negative earnings differentials and individual characteristics, including access to credit and transport infrastructure. We take the result that access to credit seems to reduce unused opportunities while road infrastructure enlarges them as —very preliminary— evidence that entry barriers into commercial farming seem to have to do with private rather than public goods, although further research is clearly called for.

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APPENDIX

A Construction of variables

The construction of the EPM variables was guided by Appendices 1 and 2 of Paternostro et al. (2001), in which the authors give a comprehensive description of the EPM surveys of 1993, 1997 and 1999 and the differences between them. A description of how variables were created is only provided when the construction was not straightforward or where questions might be raised.

A.1 Expenditures

The expenditures variable was constructed from the expenditure sections of the EPM. Following Paternostro et al (2001), we omitted items that did not appear in all surveys. In the end, this variable is composed of every-day consumption (food, clothes, hobbies....), health expenditures and schooling expenditures.

A.2 Autoconsumption

As noted in Paternostro et al., building a measure of autoconsumption raises many problems. Autoconsumption is a key variable in this chapter as it is a component of the household's profit, the dependent variable of the model. For that reason, we pay particular attention to the construction of this variable. As for the previous variable, only goods that showed in all surveys were included in the autoconsumption bundle. In addition, we limited our measure to autoconsumption of crops, ignoring autoconsumption of livestock and other produce resulting from cattle breeding, of product of fishing or hunting and of processed products.

Autoconsumption is evaluated at both retail price and producer price. It is the latter that is used in the measure of profits, since autoconsumption is compared with sales, which are logically valued at producer prices.

Selling prices are relatively easy to get, since in each survey, farmers are asked how much they sold of each crop and how much money they brought from it. It is then straightforward to calculate unit producer prices for each crop in each farm. However, because of differences in quality of the farmers' products[251], producer prices are regressed on the household's characteristics. The fitted price obtained from this regression is free of quality differences. Autoconsumption is then evaluated at this fitted farmgate price.

We apply the same method as Paternostro et al[252] to compute the retail prices. Since all surveys contain a detailed expenditure section, we could calculate purchase prices for most of the crops. However, as Paternostro et al. explain in their paper, the prices we could derive that way are rather suspect. To circumvent this

[251] Difference in the prices of the same good sold by various farmers will partly be due to dissimilarities in the quality of the goods.

[252] For details, see Paternostro et al (2001), p.79.

problem, we make use of retail prices found in the 1999 community questionnaire. These prices were directly noted down from the displays by the survey investigator, in each community. Comparing these prices with the 1999 selling prices, a markup is calculated. This markup is then applied to the fitted producer prices in the four surveys. The hence calculated retail prices are then used to evaluate autoconsumption.

A.3 Evolution of prices

We would expect that one of the most important decision variable is the changes in prices of the crops the farmer grows. We therefore compute price indexes reflecting the general change in prices of the farmer's crops. A Tornqvist average price index was computed over a 10 year period, when possible[253] . To measure price volatility over time, another Tornqvist index is computed by taking the standard error of the price changes.

[253] As mentioned before, the FAO database contains producer prices from 1991 to 2001. The 1993 price index was thus calculated over the period 1991–1993, whereas the 2001 index was computed over the period 1991–2001. This divergence is certainly not desirable, but inescapable because of the limitation of the data.

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