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Author: Margaret S. McMillan, Alix Peterson Zwane, Nava Ashraf

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My Policies or Yours
Does OECD Support for Agriculture Increase Poverty in Developing Countries?

Margaret McMillan, Alix Peterson Zwane, and Nava Ashraf

> The rural poor [in Mexico] growing maize for subsistence saw their livelihoods destroyed by a flood of cheap U.S. imports.
> —Oxfam briefing on agricultural subsidies, 2002

> It must be acknowledged that unqualified assertions by many, including the heads of some multilateral institutions, that subsidies and other interventions in agriculture in the OECD countries are hurting the poor countries are not grounded in facts. . . . The claim that the change will bring net gains to the least developed countries as a whole is at best questionable and at worst outright wrong.
> —Economist Arvind Panagariya, 2002

5.1 Introduction

Rich countries are under increasing pressure from around the world to end support to agriculture. Agricultural subsidies and price supports allow Organization for Economic Cooperation and Development (OECD)

Margaret McMillan is an associate professor of economics at Tufts University and a research associate of the National Bureau of Economic Research (NBER). Alix Peterson Zwane is assistant cooperative extension specialist in the Department of Agricultural and Resource Economics at the University of California, Berkeley. Nava Ashraf is an assistant professor at Harvard Business School.

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countries to sell their agricultural products on world markets at prices that are below the cost of production.[1] Critics claim that these policies inflict harm on poor countries by depressing world commodity prices.[2] They argue further that these policies are likely to hurt the poorest residents of the poor countries because poor people are often farmers. Thus, eliminating support for rich-country farmers will raise world prices and the incomes of the poor. Our goal in this paper is to evaluate these claims systematically by measuring the impact of OECD agricultural policies on poverty in developing countries.

Because of the diversity both within and among developing countries, the extent to which rich-country support policies translate into lower incomes in developing countries is an empirical question. Many least developed countries, especially in Africa, are net importers of food. As net food importers, they may be hurt by higher commodity prices (Panagariya 2002, 2004a; Valdes and McCalla 1999). Some countries may import cereals, such as maize and rice, but export other agricultural products, such as sugar or cotton. Higher prices for exports and imports will have net effects that are difficult to predict ex ante. Even within importing countries, the poorest members of society may be net sellers of food.

We begin our analysis with an investigation into the relationship between income per capita and the value of net cereal, food, and agricultural (food plus nonfood) exports for each of the three decades leading up to 2000. We find that—on average—the poorest countries have historically been net importers of cereals and food, the products most heavily supported by the OECD countries, just as they are today. That this pattern has not changed over the past thirty years casts some doubt on the notion that "dumping" turned exporters into importers. We also find that the poorest countries are—on average—net exporters of all agricultural products. However, with the important exception of cotton, the nonfood agricultural products are typically not the products supported by the OECD.[3]

What about the poor people in poor countries? To determine whether OECD policy hurts the poorest residents of the poor countries, we use a cross-country regression framework in which the head count poverty rate

1. Transfers to agricultural producers from consumers and taxpayers as a result of income and price support policies equaled $21,000 per farmer in the United States and $16,000 per farmer in the European Union (EU) in 1998–2000 (OECD 2001). This is almost 100 times greater than per capita incomes in the least developed countries.

2. James D. Wolfensohn, president of the World Bank, has stated that rich countries are "squandering" $1 billion a day on farm subsidies that hurt farmers in Latin America and Africa. Stanley Fischer, who was the deputy managing director of the International Monetary Fund (IMF) in the 1990s, has said the United States, Europe, and Japan pursue agricultural protection policies that are "scandalous" because of the harm they inflict on poor countries (Andrews 2002). Some also argue that these subsidies increase the volatility of commodity prices since support policies that are countercyclical with respect to domestic prices or shocks provide incentives for increased production when world prices are relatively low.

3. Panagariya (2004b) has recently made a similar point.

(or average income) is the dependent variable. Our innovation is to include as an explanatory variable a measure of rich-country support for the agricultural products produced in the developing country in question.[4] To our knowledge, this is the first use of this strategy to quantify the impacts of rich-country agricultural support policies on poor countries.[5] Also using this framework, we assess the relative importance of own-country characteristics and policies. We find no support in the cross-country analysis for the claim that—on average—OECD policies worsen poverty in developing countries.

To better understand the within-country distributional implications of rich-country agricultural subsidies, we complement our macro work with a case study of Mexican corn farmers using data at the farmer and household level. This case is instructive for several reasons. First, Mexico is often offered as a cautionary example of the impacts of agricultural trade liberalization on rural poverty. Second, the case of Mexico raises a number of issues, such as the importance of domestic policy, which can help to inform our cross-country analysis. Finally, we choose Mexico because rich nationally representative and previously unexploited data sets are available.[6]

Evidence from Mexico confirms the importance of domestic policies relative to international policies that affect commodity border prices, and highlights the importance of distributional issues masked by the cross-country analysis. In the mid-1990s the Mexican government initiated the liberalization of the corn sector in Mexico. As anticipated, this liberalization led to a sharp decrease in the producer price of corn and an increase in Mexican corn imports from the United States. Because this liberalization took place in the context of U.S. corn subsidies that lower border prices, the United States is sometimes held responsible for the price decline and increased poverty among Mexican corn farmers. Contrary to this

4. We introduce a new variable into a standard cross-country regression framework previously employed by others including Easterly and Levine (2003); Rodrik, Subramanian, and Trebbi (2002); Acemoglu, Johnson, and Robinson (2001); and Frankel and Romer (1999).

5. There is some evidence that terms of trade can affect incomes and poverty in developing countries. Sarel (1997) presents evidence that improvements in terms of trade are significantly negatively correlated with changes in income inequality in an ordinary least squares (OLS) regression. He argues that since "policies can rarely affect directly terms of trade dynamics," the implications of this finding are limited. However, policy changes in the OECD can directly affect the magnitude and nature of agricultural support, which in turn may affect commodity prices and developing countries' terms of trade. Acemoglu and Ventura (2002) present evidence that terms of trade may be quantitatively important for explaining cross-country income differences using an instrumental variables approach to account for the endogenous relationship between growth and changes in terms of trade.

6. Our data on Mexico come from INEGI (the Mexican Statistical Agency) and are drawn from two different surveys, the Encuesta Nacional de Empleo (ENE), an individual-level national employment survey, which includes a rich agricultural supplement, and the Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH), a household-level income and expenditure survey. Both surveys were conducted both pre- and post-NAFTA, though not always for the same years.

popular view, our evidence suggests that U.S. corn subsidies have had a limited impact on the border price of corn. In addition, because the majority of the poorest corn farmers do not sell corn in the market, their incomes were not directly affected by the decline in the producer price of corn. By contrast, a majority of the medium-sized and large corn farmers do participate in the market. Medium-sized corn farmers experienced a sharp decline in real income, while the income of the largest corn farmers actually increased. Transfer payments to all corn farmers—also part of the corn market liberalization—increased but were structured so that benefits went disproportionately to the rich farmers.

Our results stand in stark contrast to the large body of literature that has been devoted to examining the *potential* impact of agricultural trade liberalization on developing countries using computable general equilibrium (CGE) models.[7] While the magnitudes of CGE estimates vary, agricultural trade liberalization is typically predicted to increase world commodity prices to the *overall* benefit of developing countries. For example, Beghin, Roland-Holst, and van der Mensbrugghe (2002) estimate that the removal of all agricultural subsidies and trade barriers could increase rural value added in low- and middle-income countries by $60 billion per year, which, as they note, exceeds most targets for development assistance by some 20 percent. Probably the most important reason for the differences in results is that other studies have not focused explicitly on poverty but rather on developing countries as a whole. Additionally, as pointed out by Panagariya (2004b), many studies combine liberalization by developing countries with liberalization by developed countries when estimating welfare impacts. We focus solely on the impacts of rich-country policies on poor countries and the poor residents of these countries.

In interpreting our results, a few caveats are in order. First, our measure of OECD policy is effectively the production-weighted average implicit export subsidy faced by each country in our sample. A variety of other OECD actions such as support for minor crops, import tariffs on products not produced domestically (e.g., coffee), phytosanitary regulations, and discretionary protection applied when imports rise may also be important for developing countries but are beyond the scope of this paper. Second, our measure of OECD policy does not include cotton, a key nonfood product that is heavily subsidized by the United States in a way that harms some very poor countries. Cotton is not included because the OECD calculates support only for the major commodities that make up the first 70 percent of the total value of agricultural production. However, in our view, the inclusion of

7. See, for example, OECD (2002); Economic Research Service/U.S. Department of Agriculture (ERS/USDA; 2002); Trueblood and Shapouri (1999); Hoekman, Ng, and Olarreaga (2002); and Beghin, Roland-Holst, and van der Mensbrugghe (2002). Note that some CGE-based studies of the Uruguay Round agreement found results consistent with the focus of this paper, such as Hertel, Masters, and Elbehri (1998).

cotton is unlikely to change our overall findings because it is only exported by a handful of the poorest countries and makes up a relatively small share of these countries' total agricultural production. Third, while we find that *on average* OECD support does not increase poverty and that *the majority* of poor Mexican corn farmers do not participate in the market, it may still be the case that many poor people are made poorer by these policies. Roughly 60 percent of the poorest Mexican corn farmers do not participate in the market. This means that 40 percent of the poorest corn farmers do participate in the market. For these people, the conclusions about the impacts of depressed corn prices are different. Such nuances help us to understand why different groups may have very different perspectives on these issues.

The remainder of this paper is organized as follows. Section 5.2 establishes the relationships between net exporter status and income for developing countries over time and in the cross section. Section 5.3 describes the data and estimation strategy used in the cross-country analysis and presents these results. Section 5.4 presents an analysis of the impact of a reduction in the price of corn on Mexico's corn farmers. Section 5.5 concludes.

5.2 Are the Poorest Countries Hurt by OECD Support for Agriculture?

We begin with an investigation into the relationship between income per capita (measured in constant 1985 dollars at purchasing power parity [PPP] exchange rates and collected from the Penn World Tables version 6.1) and the value of net cereal, net food, and net agricultural exports including nonfood products as a share of GDP (measured at current prices). This can be thought of as the fraction of current income earned from the sale of these products or spent to purchase these products. Because there are time series data on agricultural imports and exports, as well as income, it is possible to track the behavior of the cohort of developing countries over time.[8]

We identify the countries that may have been most affected historically by OECD agricultural policy as those that have spent (earned) the greatest fraction of income on imports (exports) of supported products. We are particularly interested in comparing how cereal importers differ from food or nonfood agricultural exporters because cereal prices are depressed by OECD agricultural support policies, while the prices of most other food products (with the important exceptions of dairy and sugar) and nonfood products (with the important exception of cotton) are largely unaffected by OECD support.

Figures 5.1, 5.2, and 5.3 present data on income earned from agricultural exports in three different ways. First, we use data from the Food and

8. Other authors have also presented data to highlight the diverse agricultural trade profile of developing countries (Valdes and McCalla 1999; Panagariya 2002, 2004a) but have emphasized cross-sectional patterns only. This snapshot of countries' trade positions may obscure long-run patterns in the data.

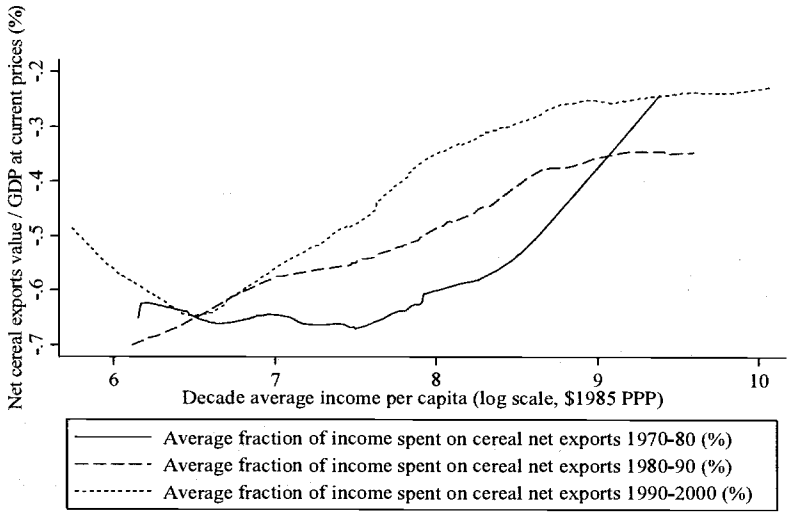

Fig. 5.1 Average income and net cereal exports by decade in a repeated cross section of developing countries

Agriculture Organization (FAO) to calculate the value of annual net cereal exports as a percentage of GDP for a sample of ninety-nine developing countries and take the average value of this number for the periods 1970–79, 1980–89, and 1990–2000.[9] We show the cross-sectional income profile for these three time periods in figure 5.1 by using a locally weighted regression of decadal average cereal export share on the decadal average of the log of income per capita (bandwidth = 0.8). We run the same regressions for food export share and present those results in figure 5.2. Figure 5.3 shows the regressions for agricultural export shares (including nonfood products such as green coffee and fibers).

Figure 5.1 shows that, in each decade, the poorest countries spend the largest percentage of their incomes on cereal imports, suggesting that they may experience net benefits as a result of depressed cereal prices. In fact, so few developing countries are net cereal exporters in any decade that the predicted net cereal export share is negative even at the highest income levels observed in the data.[10]

9. The sample includes three transition economies: Poland, Romania, and Hungary. The FAO definition of cereals includes wheat, paddy rice, barley, maize, popcorn, rye, oats, millet, sorghum, buckwheat, quinoa, fonio, triticale, canary seed, and mixed grains.

10. Among countries for which data are available, Thailand, Argentina, Nepal, Zimbabwe, South Africa, Uruguay, Pakistan, Kenya, and Guyana had positive average net export earnings from cereals in the 1970s. This list expanded to include Vietnam in the 1980s but lost Nepal and Kenya. In the 1990s, Guyana, Argentina, Thailand, Vietnam, Hungary, Paraguay, India, and Pakistan had positive net export earnings from cereals.

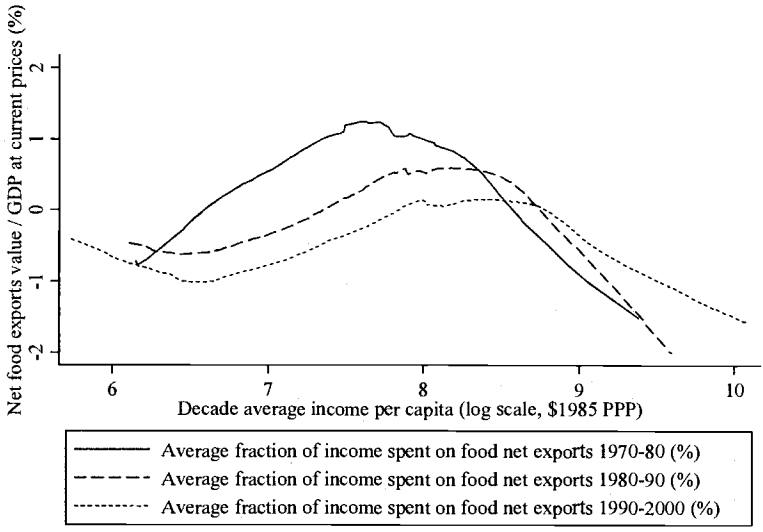

Fig. 5.2 Average income and net food exports by decade in a repeated cross section of developing countries

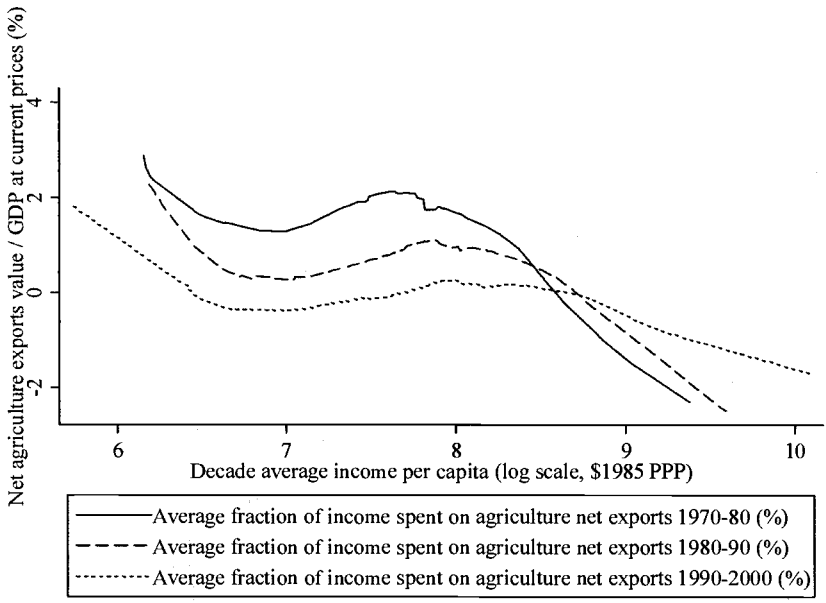

Fig. 5.3 Average income and net agriculture exports by decade in a repeated cross section of developing countries

Since 1970 the poorest countries have also experienced the smallest reduction in net expenditures on cereal exports as a share of GDP. To trace the average cereal export share of a given country experiencing economic growth, points should be connected not within years but across the regression lines, linking up the experience and behavior of a like country in the following decade. Thus, the fact that the regression lines are very close to each other at the lowest levels of income suggests that net export increases experienced at higher income levels largely bypassed the poorest countries in the postcolonial era.

These data suggest that depressed prices for food products may hurt middle-income countries but help the poorest and richest developing countries. As shown in figure 5.2, and unlike in the case of cereals alone, among non-OECD countries only middle-income countries earn income from food exports. The cross-sectional relationship between net earnings from all food exports as a share of GDP is nonmonotonic. This production category includes noncereal products that receive high levels of support in the OECD, including sugar, beef, and dairy products, as well as unsubsidized products such as cocoa and most fruits and vegetables.

The cross-sectional relationship between food export earnings share and income appears to be flattening over time. In the 1970s, a country with an income of $1,100 is predicted to have positive net food exports. A country with this level of income in the 1980s or 1990s is predicted to be a net food importer. The trend in these data appears to be toward zero net earnings from food exports. Although it is not shown here, this impression is even stronger when the sample size is enlarged to include twenty-one high-income OECD member countries.

Poor countries are most likely to be net exporters of agricultural products in total, as shown in figure 5.3.[11] We run the same regressions to create this figure, but we consider all agricultural products, including fibers, industrial seeds, green coffee, and tobacco. In this case we find a downward-sloping relationship between net export earnings and income. Relatively well-off developing countries import agricultural products as a whole. This suggests that depressed prices for nonfood agricultural products like cotton are particularly damaging to the poorest countries.

Figures 5.1, 5.2, and 5.3 together provide evidence that many poor countries import cereals but export agricultural products as a whole, and have been in this position throughout the postcolonial era. As we show in table 5.1,

11. In particular, this category of products includes cotton, an important export crop for several West African countries as well as Brazil, China, and India. Cotton is excluded from our regression analysis because, although production data are available from the FAO, support levels are not calculated for this crop. This support is certainly not trivial; about $2.3 million was provided as assistance to U.S. cotton growers in 2001–2 (International Cotton Advisory Committee 2002). The OECD calculates support only for the major commodities that make up the first 70 percent of the total value of agricultural production.

Table 5.1 **Agricultural trade positions by country (sorted by income)**

	Income per capita 2000, PPP$(1996)	Fraction of population below $1/day (most recent year)	1990–2000 average percentage of income earned on net exports of:		
			Cereals	All food	All agriculture (food + nonfood)
Congo, Democratic Republic of the	322[a]		–0.54	–1.31	–0.88
Tanzania	482	0.49	–0.49	–0.50	1.50
Burundi[d]	523	0.55	–0.16	–0.61	0.98
Ethiopia[d]	635	0.23	–0.43	–0.52	
Guinea-Bissau	688		–2.23	–0.47	–0.88
Nigeria[d]	707	0.70	–0.32	–0.70	–0.68
Malawi[d]	784	0.42	–1.22	–1.11	4.70
Yemen, Republic of	817	0.10	–2.24	–5.29	–5.74
Madagascar[d]	836	0.49	–0.27	0.27	0.75
Togo[d]	870		–0.36	–0.72	1.08
Niger	875	0.61	–0.47	–0.48	–0.66
Sierra Leone	889[a]		–1.64	–2.63	–2.64
Zambia[d]	892	0.64	–0.59	–0.65	–0.51
Rwanda	895	0.36	–0.26	–1.03	–0.42
Chad	909		–0.21	0.28	1.67
Uganda[d]	941	0.85	–0.07	–0.34	1.36
Burkina Faso[d]	957	0.45	–0.66	–1.04	–0.71
Mali[d]	969	0.72	–0.25	0.10	1.95
Central African Republic[d]	992[b]	0.67	–0.24	–0.54	–0.24
Mozambique[d]	1,037	0.38	–0.75	–1.21	–1.47
Benin[d]	1,214		–1.21	–1.97	–0.29
Gambia, The[d]	1,217	0.26	–1.94	–4.38	–5.51
Kenya[d]	1,244	0.23	–0.31	–0.19	2.03
Angola	1,252[a]		–0.51	–2.22	–3.08
Cambodia	1,272[c]	0.34	–0.13	–0.57	–1.40
Sao Tome and Principe	1,314[a]			–1.27	–2.86
Mauritania	1,315[c]	0.26		–3.27	–4.06
Ghana[d]	1,351	0.45	–0.36	1.14	1.11
Nepal[d]	1,459	0.39	–0.02	–0.26	–0.49
Vietnam	1,522[a]	0.04	0.43	0.54	0.71
Comoros[d]	1,578		–1.17	–1.29	–1.51
Lesotho	1,592	0.36	–1.10	–5.07	–5.85
Senegal[d]	1,622	0.22	–1.30	–2.42	–2.43
Bangladesh[d]	1,684	0.36	–0.19	–0.48	–0.52
Nicaragua[d]	1,767	0.59	–0.59	–0.36	0.84
Congo, Republic[d]	1,808		–0.65	–2.22	–2.44
Côte d'Ivoire[d]	1,869	0.16	–0.61	4.07	5.93
Pakistan[d]	2,008	0.13	0.02	–0.29	–0.33
Cameroon[d]	2,042	0.32	–0.22	0.29	1.15
Honduras[d]	2,050	0.21	–0.42	1.06	2.85
Haiti[d]	2,349[b]		–1.30	–2.87	–2.91
India[d]	2,479	0.45	0.04	0.03	0.12
Zimbabwe[d]	2,486	0.56	–0.06	0.26	2.25

(*continued*)

Table 5.1 (continued)

	Income per capita 2000, PPP$(1996)	Fraction of population below $1/day (most recent year)	1990–2000 average percentage of income earned on net exports of:		
			Cereals	All food	All agriculture (food + nonfood)
Bolivia[d,e]	2,724	0.14	–0.33	0.14	0.58
Guinea[d]	2,831		–0.40	–0.74	–0.76
Papua New Guinea[d]	2,922[c]		–0.53	–0.11	0.80
Sri Lanka[d]	3,300	0.07	–0.35	–0.78	0.22
Philippines, The[d,e]	3,425	0.15	–0.25	–0.09	–0.21
Ecuador[d]	3,468	0.18	–0.18	1.98	2.41
Equatorial Guinea	3,604			–0.68	–1.58
Guyana	3,613[c]	0.03	1.97	6.36	6.18
Indonesia[d,e]	3,642	0.07	–0.16	–0.02	0.17
Jamaica[d]	3,693	0.00	–0.90	–0.91	–0.65
Morocco[d]	3,717	0.01	–0.44	–0.32	–0.63
China[d]	3,747	0.17	–0.06	0.04	0.01
Jordan[d]	3,895	0.00	–1.66	–3.52	–3.91
Guatemala[d,e]	3,914	0.16	–0.23	0.80	2.02
Cape Verde[d]	4,027		–1.34	–4.81	–5.73
Syria[d]	4,094		–0.28	–0.21	–0.09
Egypt[d]	4,184	0.03	–0.56	–1.09	–1.30
Romania[d]	4,285	0.02	–0.06	–0.28	–0.55
El Salvador[d]	4,435	0.31	–0.30	–0.71	0.29
Namibia	4,459[c]	0.35	–0.46	0.66	0.77
Peru[d]	4,589	0.18	–0.49	–0.74	–0.60
Paraguay[d,e]	4,684	0.15	0.05	1.29	1.39
Algeria[d]	4,896	0.01	–0.80	–1.85	–2.16
Cuba	5,087[a]		–0.52	1.75	1.68
Swaziland	5,227	0.08	–0.37	4.49	3.80
Dominican Republic[d]	5,270	0.00	–0.46	–0.18	0.03
Colombia[d,e]	5,383	0.08	–0.19	0.03	1.02
Fiji[d]	5,442[c]		–0.73	2.61	2.39
Lebanon	5,786		–0.72	–4.45	–6.11
Costa Rica[d,e]	5,870	0.02	–0.53	4.10	6.51
Iran	5,995	0.00	–0.39	–0.59	–0.70
Panama[d]	6,066	0.07	–0.29	0.48	0.35
Grenada[d]	6,178		–0.66	–3.72	–4.27
St. Lucia	6,330	0.25	–0.80	–0.15	–1.09
Venezuela[d]	6,420	0.14	–0.20	–0.54	–0.67
Belize	6,591		–0.35	5.16	4.37
Tunisia[d]	6,776	0.00	–0.45	–0.34	–0.65
Thailand[d,e]	6,857	0.02	0.46	1.07	1.41
St. Vincent[d]	7,148		0.40	2.70	2.09
Brazil[d,e]	7,190	0.08	–0.13	0.30	0.75
Dominica[d]	7,379		–0.65	2.80	0.25
South Africa[d,e]	7,541	0.11	–0.04	0.18	0.20
Botswana	7,550[c]	0.31	–0.58	–1.90	–2.67
Gabon[d]	8,402		–0.24	–1.27	–1.52
Mexico[d]	8,762	0.10	–0.17	–0.28	–0.28

Table 5.1 (continued)

	Income per capita 2000, PPP$(1996)	Fraction of population below $1/day (most recent year)	1990–2000 average percentage of income earned on net exports of:		
			Cereals	All food	All agriculture (food + nonfood)
Poland[d]	9,217	0.01	–0.08	0.14	–0.15
Uruguay[d,e]	9,622	0.00	0.63	2.27	2.31
Malaysia[d,e]	9,919	0.00	–0.40	1.36	1.89
Chile[d,e]	9,926	0.01	–0.13	0.84	1.00
Seychelles[d]	10,241		–0.90	–5.14	–6.16
Hungary[d]	10,439	0.00	0.29	1.89	1.83
Argentina[d,e]	11,006	0.08	0.56	1.82	2.42
Trinidad and Tobago[d]	11,175	0.04	–0.41	–1.09	–0.87
St. Kitts and Nevis	13,666			–1.06	–1.95
Mauritius[d]	13,932		–0.41	1.43	1.08
Cyprus[d]	16,063[b]	0.00	–0.72	–0.58	–0.32
Barbados[d]	16,415	0.00	–0.36	–1.30	–1.61
Singapore[d]	22,642[b]	0.00	–0.22	–1.75	–1.39
Hong Kong, China[d]	26,699	0.00	–0.15	–2.23	–2.87

Source: FAOSTAT, Penn World Tables, World Bank PovertyNet.

[a]Year of observation 1995.

[b]Year of observation 1998.

[c]Year of observation 1999.

[d]Indicates country included in regression analysis.

[e]Indicates Cairns Group member.

which ranks countries by current income per capita and summarizes the data from the latest decade that are presented graphically in figures 5.1 through 5.3, many poor countries, and even many middle-income countries, that export food products import cereals, particularly in the 1990s. Depressed commodity prices as a result of domestic support for agriculture in the OECD could lower the value of both imported products and exported products for these countries. While it is true that a majority of poor countries are net exporters of agricultural products today (see table 5.1), among the nonfood products cotton stands out as the only nonfood commodity whose price is likely to be significantly depressed by OECD agricultural support.

Of course, the experience of developing countries is diverse, and, because they are regressions, figures 5.1 through 5.3 obscure differences in countries' experiences at any income level. However, these results suggest that it is unlikely that broad agricultural liberalization, which is likely to result in higher world prices for cereals as well as dairy products, sugar, and cotton, will benefit the majority of the poorest countries.

Country-level average values of net cereal or food exports tell us little about what happens to the poor within a country. Even in countries that are net importers of food, the poor may be net exporters of food. Thus, a

poor country might be hurt by higher food prices while the poor within that country benefit from higher food prices. The remainder of the paper is devoted to this issue.

5.3 Does OECD Support Hurt the Poorest People in Poor Countries?

Even if the poorest countries are net importers of products protected and subsidized by OECD governments, it is possible that the poorest people within these countries are net sellers of these cheap imports. If this were the case, then OECD support that benefits the country as a whole could increase poverty in that same country. In fact, this is a common assumption based on the observation that poverty tends to be concentrated in rural areas. We begin this section by describing our approach to testing this hypothesis in a cross-country regression framework. This is followed by a description of our methodology for obtaining country-specific measures of OECD support and a description of our data. We conclude with a presentation of results.

5.3.1 Empirical Strategy

To test the claim that OECD support for agriculture hurts the poor, we begin by estimating the following equation:

$$\log \mathrm{HP}_{it} = \alpha_i + \gamma \log \mathrm{OECDPOLICY}_{it} + \varepsilon_{it}, \tag{1}$$

where HP is the head count poverty rate for country i at time t based on the $1-a-day poverty line, α_i is a country fixed effect, ε is the disturbance term, and OECDPOLICY is a country-specific measure of OECD support that varies over time and whose construction we discuss in the next subsection. This simple specification allows us to preserve the largest number of observations for which data on poverty and OECD support are available. In this specification, γ represents the elasticity of poverty with respect to OECD support. Critics of OECD agricultural policy would expect γ to be positive and significant. To this basic equation we add additional controls for comparability with previous work and to test the notion that own-country policies are more important than OECD support as determinants of poverty.

One potential problem with this specification has to do with the endogeneity between OECD support and world commodity prices. OECD support is a function of commodity price fluctuations and domestic political considerations. Commodity price fluctuations can in turn be affected by OECD policy. Thus, in principle, we need to take care in the interpretation of γ. In other words, we could mistakenly attribute to OECD policy changes in poverty that are being driven purely by changes in commodity prices. Practically, this is a moot issue, since we find no significant relationship between OECD policy and poverty.

A second problem with this approach is the limited availability of the in-

tersection of poverty data and data on OECD support to agriculture. Because these data are sparse and since there is a strong association between average income and poverty reduction, we also consider the impact of OECD support on average income in developing countries by estimating the following equation:

$$\log y_{it} = \delta_i + \beta \log \text{OECDPOLICY}_{it} + \sigma_{it}, \tag{2}$$

where δ is a country fixed effect, σ is the disturbance term, and β represents the elasticity of poverty with respect to OECD policy. The only difference between equation (2) and equation (1) is that in equation (2) we now insert the log of average income per capita as the dependent variable.

One advantage to estimating equations (1) and (2) is that the time-invariant factors that affect poverty and income, such as institutions, geography, and structural measures of integration, are subsumed in the country fixed effects. We also control for time-variant global trends that may affect incomes, such as global weather shocks and energy prices using time fixed effects.

5.3.2 Data

Our main innovation is in constructing OECDPOLICY, a country- and year-specific measure of OECD support to agriculture. Therefore, we devote the majority of this section to describing both how the OECD computes commodity- and year-specific measures of distortionary support and how we aggregate these data into variables that can be included in the regression analysis. We then briefly describe the other variables used in our analysis.

Since 1987 the OECD has tracked support, by commodity, for agriculture in member countries. The U.S. Department of Agriculture (USDA) has calculated support by commodity and country for the period 1982–90. In order to use these data to develop the variable OECDPOLICY, we need to select a measure of domestic support and identify a means of aggregating support measures across commodities to develop a country-specific measure of other countries' agricultural policies.

The producer support estimate (PSE) is the most commonly used measure of domestic support for agriculture. The PSE measures the annual monetary value, at the farm gate, of gross transfers from consumers and taxpayers to agricultural producers arising from policy measures to support agriculture.[12] The PSE for a commodity is usually presented as a fraction of the value of total gross farm receipts for the commodity. This is re-

12. The PSE includes domestic subsidies to agriculture, barriers to market access, and export subsidies. It does not include food aid (OECD 2001). The PSE includes implicit payments, such as those that arise from commodity-specific price gaps created by trade barriers, but excludes gaps between domestic and border prices that may arise because of transportation costs, quality differences, or marketing margins.

ferred to as the "percent PSE" and measures the portion of farmer receipts attributable to policy.[13]

An alternative definition of trade-distorting support is the producer nominal protection coefficient (NPC), which is defined as the ratio between the average price received by producers (at farm gate) and the border price (net of transportation costs and marketing margins). This is conceptually equivalent to the implicit export subsidy necessary to export the observed quantity produced. An NPC equal to one implies that producers receive border prices for their output after adjusting for transportation costs and thus do not receive production-distorting signals from agricultural support policies. The NPC is calculated on a commodity-by-commodity basis for the OECD as a whole by taking a production-weighted average of producer prices and a common border price.

A third measure of support calculated by the OECD is the producer nominal assistance coefficient (NAC), which is defined as the ratio of the value of total gross farm receipts, including support, and production valued at world market prices, without support. The NAC is related to the PSE, but it calculates support independent of exchange rate effects. When the NAC is equal to one, receipts are entirely derived from the market.

All three measures of support for agriculture are highly correlated within countries and correlated across countries, both in aggregate and by commodity. In the main regression specifications discussed in this paper, we measure support for agriculture in the OECD by commodity using the NPC. However, our results are robust to alternative measures of support. Figure 5.4 reports the NPC by commodity for the OECD for the periods 1986–88 and 2000–2. Milk, sugar, and rice receive the highest levels of production-distorting support.

In order to estimate equations (1) and (2), we must identify which OECD support policies are relevant to country i in period t by matching support policies to countries in a way that reflects the relative importance of support by commodity for each country. That is, for a non-OECD country i, we must identify a set of weights to use to combine measures of the NPC for the following products: wheat, maize, rice, other grains, oilseeds, sugar, milk, beef, sheep meat, wool, pig meat, poultry, and eggs. These are the products for which the NPC is calculated by the OECD and USDA. We must also appropriately account for the fact that countries produce other agricultural products for which the NPC is equal to one.

13. The percent PSE has several potential shortcomings when considering how it might be used in econometric analysis (Masters 1993; Wise 2004). It is possible that total support for agricultural producers as measured by the PSE could be increased by policy changes, while the distortionary effects of support are reduced by changes in the policy mix used to support agriculture (e.g., if export subsidies were replaced with decoupled income or production support). This is because the PSE is made up of several categories of transfers that have differing impacts on production, consumption, and trade. Thus, the most common measure of support may not be the most appropriate for our analysis; we do not expect policies that do not affect trade to impact developing countries.

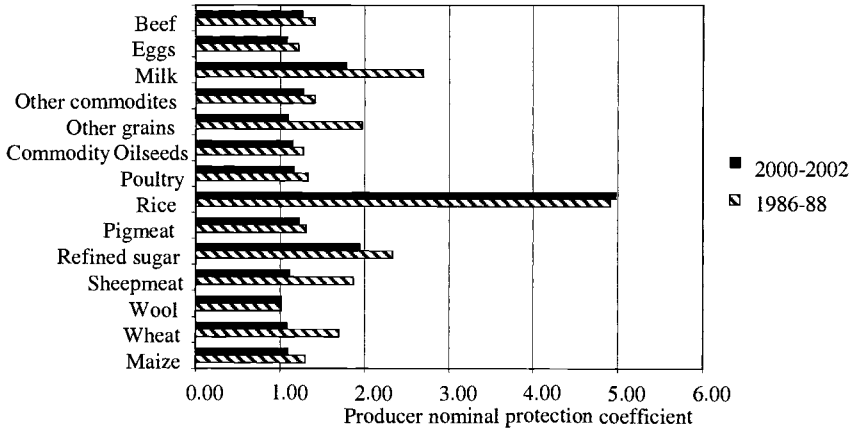

Fig. 5.4 Producer nominal protection coefficients by commodity

We create the variable OECDPOLICY as a weighted average of support provided by rich-country governments to growers of these products (or similar commodities that are likely substitutes for it) in each year for the period 1982–2000, where weights are defined by the share of each product in the developing country's agricultural output in 1970.[14] This approach should avoid the problem that current production choices are partly determined by current subsidy levels. In addition, some African countries have severely discriminated against agriculture in the past; we want to consider their potential exports (as measured by their sectoral structure in 1970) rather than their actual exports or production. For commodities that have a calculated NPC we use FAO data on 1970 total production of the following products: wheat, maize, rice, other grains (calculated as total cereals less wheat, maize, and rice), oilseeds (including cake and meal), sugar (refined, cane, and beet), milk (condensed, dry, and fresh), beef and veal, sheep meat (fresh), wool (greasy), pig meat, poultry meat, and eggs. For vegetables and melons, all roots and tubers, all fibers, coffee, cocoa, and all fruits, we set the NPC equal to one.[15]

14. Ideally, this approach would use developing-country agricultural sectoral composition in 1930—before the architecture of modern OECD farm policy was put in place. Data from this period may be of poor quality, however, to the extent that they exist.

15. By assuming an NPC of one for fibers we underestimate the value of OECDPOLICY for cotton producers. Even excluding cotton, bound tariffs for these products are not uniformly equal to zero in developed countries. Thus, our approach underestimates OECDPOLICY. However, tariffs for these products are much lower than bound tariffs for so-called program crops and those commodities for which the OECD calculates an NPC. There are also relatively few megatariffs for these products. For example, the World Trade Organization (WTO) bound tariffs reported by the United States include nineteen tariffs of 100 percent or higher. Only six of these are for products for which we assume an NPC of one, and these are minor products in the nuts and tobacco commodity group.

African countries, which have a relatively large fraction of historical agricultural production in roots and tubers and in coffee and cocoa, tend to have low levels of OECDPOLICY. Small countries that import essentially all their food needs also have low values of OECDPOLICY. Conversely, rice producers have high values of OECDPOLICY. Grain and oilseed exporters, such as Brazil, tend to have values of OECDPOLICY that fall in the middle of the distribution.

We note in table 5.1 the countries included in our regression analysis—a subset of the countries included in figures 5.1 through 5.3. Our largest sample includes seventy-five developing countries for the period 1982–2001. We also identify the countries that are members of the Cairns Group, currently considered to be among the most competitive agricultural exporters. Far more countries in our sample are net food and cereal importers than exporters, which is consistent with our discussion in section 5.2 of the experience of a larger sample of developing countries. Notably, however, the Cairns Group countries are not all historical exporters; Bolivia, Chile, and Indonesia were net importers of food and cereals in the 1970s, for example.

Our data on income per capita, measured in 1996 PPP dollars, come from the Penn World Tables, version 6.1. To control for global weather shocks that impact commodity prices we use a common measure of the El Niño–Southern Oscillation (ENSO) severity called the Southern Oscillation Index (SOI) anomaly.[16] Recent research has shown that ENSO severity can explain as much as 20 percent of annual commodity price variation (Brunner 2002). There is also a positive correlation between ENSO, as measured by the SOI anomaly, and GDP growth. Thus, we expect the coefficient on this variable to be positive.

Table 5.2 reports summary statistics for all of the variables used to estimate equations (1) and (2). We report these statistics for the entire sample and then separately for the Cairns Group and for historical food importers.[17] We define countries that were food and cereal exporters or importers based on data for the 1970s, the decade prior to our analysis. Food-importing countries have higher average incomes than the Cairns Group food exporters because several well-off island countries (e.g., Hong Kong and Singapore) are food importers. However, the variance of incomes in the Cairns Group is significantly lower among food importers. None of the poorest countries in the sample are in this group. These patterns are stable across the two decades that we consider.

16. The SOI anomaly measures deviations between air pressure differentials in the South Pacific and historical averages. For each year, we take the average of the SOI anomaly as measured in January and June. These data are available from the National Oceanic and Atmospheric Administration (NOAA).

17. In table 5.2 and in the regression analysis, Bolivia, Chile, and Indonesia are included only in the Cairns Group sample. They are not included in the historical food-importers sample.

Table 5.2 Summary statistics for cross-country regressions

	No. of observations	Mean	Standard deviation	Minimum	Maximum
A. All developing countries in pooled cross section 1982–2001					
Head count poverty rate ($1/day, PPP $1985)	225	20.23	20.61	0.00	87.67
Income per capita (PPP $1985)	1,485	3,357	3,098	341	20,591
OECDNPC	1,503	1.57	0.48	0.99	3.64
Log consumer price index	1,377	0.19	0.43	–0.12	4.77
Exports + imports/GDP	1,461	0.68	0.39	0.06	2.95
B. Cairns Group in pooled cross section 1982–2001					
Head count poverty rate ($1/day, PPP $1985)	72	9.85	8.87	0.00	47.04
Income per capita (PPP $1985)	281	4,105	1,702	1,580	8,724
OECDNPC	281	1.80	0.45	1.17	3.20
Log consumer price index	281	0.31	0.63	–0.01	4.77
Exports + imports/GDP	281	0.56	0.35	0.12	2.29
C. Cereal and food importers in pooled cross section 1982–2001					
Head count poverty rate ($1/day, PPP $1985)	74	24.20	26.11	0.00	87.67
Income per capita (PPP $1985)	613	3,834	4,065	437	20,591
OECDNPC	621	1.52	0.52	0.99	3.64
Log consumer price index	554	0.14	0.30	–0.12	4.33
Exports + imports/GDP	591	0.71	0.44	0.16	2.95
D. Other developing countries in pooled cross section 1982–2001					
Head count poverty rate ($1/day, PPP $1985)	85	25.41	18.58	0.00	72.29
Income per capita (PPP $1985)	611	2,500	2,064	341	11,783
OECDNPC	621	1.55	0.45	1.01	3.30
Log consumer price index	562	0.17	0.39	–0.10	4.64
Exports + imports/GDP	609	0.71	0.32	0.06	1.59

Source: World Development Indicators (trade share and CPI), Penn World Tables (income), and World Bank PovertyNet (head count), FAOSTAT, and SourceOECD (OECDNPC).

Notes: Cereal and food importers defined as countries that had negative values of net exports of cereals and food on average in 1970s. The average Southern Oscillation Index anomaly has an average value of –0.58 (standard deviation 1.18).

Because our specification includes country dummies, our measures of a country's own policies were chosen to reflect trade and macro policies that vary significantly over time within countries. Therefore, the variables we use to control for own-country policies are trade share (exports plus imports divided by GDP) and inflation. Table 5.2 shows that the Cairns Group countries are richer than the rest of the countries in the sample. They also have a significantly smaller share of the population below the poverty line. The trade share of GDP is actually lower for the Cairns Group, which is likely to be explained by the differences in GDP. OECDPOLICY is slightly higher for the Cairns Group, implying that these countries are slightly more vulnerable to OECD subsidies. The rate of inflation in the Cairns Group is nearly double that in the rest of the sample. This is

because nine of the fourteen Cairns Group countries are in Latin America, where inflation has been notoriously problematic.

5.3.3 Results

Tables 5.3 and 5.4 present the results of estimating equations (1) and (2), respectively. In both tables, the estimates are separated into three panels. Panel A presents results for the entire sample. There is good reason to believe that the coefficient on OECDPOLICY will vary across countries. Specifically, the effect of changes in commodity prices on poverty (income) is likely to depend on whether a country is a net importer or net exporter of the product in question. Therefore, in panels B and C we relax the assumption of a constant elasticity of poverty (income) with respect to OECD policy. In panel B we estimate equations (1) and (2) for members of the Cairns Group, and in panel C we estimate these equations for countries that are historical net food importers.

We begin by looking at the results of the estimation of equation (1) for the entire sample. The regressions in columns (1) and (2) report the simple correlation between OECDPOLICY and poverty. In column (1) we control only for country fixed effects; in column (2) we add time fixed effects. In columns (3) through (6) we add a measure of average income and a measure of weather fluctuations, and in columns (5) and (6) we add two measures of domestic policy: trade as a share of GDP and the log of inflation. The only robust result across specifications is the relationship between average income and poverty documented by Besley and Burgess (2003).

Imposing the assumption of a constant elasticity across countries is one reason that we might not find any relationship between OECD policy and poverty. We check this by estimating equation (1) separately in panel B for the Cairns Group, the group of countries pushing for agricultural liberalization and most expected to benefit from agricultural liberalization. The results in panel B are not much different from those in panel A. We turn next to the group of countries expected to lose as a result of higher food prices, historical food importers. Once again, the coefficient on OECD policy is insignificantly different from zero. For this subsample of countries, reducing inflation is associated with poverty reduction.

Why do we find no relationship between OECD policy and poverty? The most obvious explanation is the lack of data. Our entire sample consists of a little over 200 observations for most countries because the poverty data are only available for two or three years. We can partially address this issue by redefining our dependent variable to be average income per capita. To obtain the link between OECD policy and poverty, we can then rely on the link between average income and poverty documented by Besley and Burgess (2003) and evident in our table 5.3.

Table 5.4 reports the results of estimating equation (2). In panel A we report estimates for the whole sample. As in table 5.3, there is no evidence of

Table 5.3 **Poverty and OECD agricultural support: Cross-country evidence**

	(1)	(2)	(3)	(4)	(5)	(6)
			A. All developing countries			
Ln OECDPOLICY	0.140	2.439	3.036	3.036	2.203	2.120
	(0.885)	(1.684)	(1.446)**	(1.746)	(1.544)	(1.691)
Ln GDP per capita			–4.300	–4.300	–5.093	–5.135
			(2.104)**	(2.104)**	(2.426)**	(2.487)**
SOI anomaly				–0.326	–0.291	–0.291
				(0.155)**	(0.169)	(0.168)
Ln inflation					–0.382	–0.395
					(0.286)	(0.296)
Trade share						0.375
						(1.244)
No. of observations	223	223	217	217	211	211
R^2	0.67	0.69	0.72	0.72	0.73	0.73
			B. Cairns Group only			
Ln OECDPOLICY	1.307	1.427	1.346	1.346	0.931	0.464
	(1.781)	(1.693)	(0.976)	(0.976)	(1.081)	(1.361)
Ln GDP per capita			–3.570	–3.570	–3.590	–3.766
			(3.148)	(3.148)	(3.189)	(3.142)
SOI anomaly				–0.142	–0.135	–0.112
				(0.186)	(0.189)	(0.190)
Ln					–0.330	–0.347
					(0.411)	(0.426)
Trade share						0.574
						(0.981)
No. of observations	70	70	69	69	69	69
R^2	0.55	0.67	0.69	0.69	0.69	0.70
			C. Historical food-importers only			
Ln OECDPOLICY	–1.372	1.448	1.130	1.130	0.471	0.512
	(1.254)	(2.163)	(2.776)	(2.776)	(2.678)	(2.586)
Ln GDP per capita			–4.154	–4.154	–4.816	–4.842
			(2.088)**	(2.088)**	(2.031)***	(2.069)***
SOI anomaly				0.715	0.739	0.686
				(0.643)	(0.619)	(0.563)
Ln inflation					–0.622	–0.647
					(0.229)**	(0.228)**
Trade share						1.042
						(1.340)
No. of observations	74	74	74	74	72	72
R^2	0.83	0.88	0.91	0.91	0.92	0.92

Notes: Robust standard errors in parentheses. All estimates include country fixed effects. Estimates in columns (2)–(6) also include year dummies.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

Table 5.4 Income and OECD agricultural support: Cross-country evidence

	(1)	(2)	(3)	(4)	(5)
			A. All developing countries		
Ln OECDPOLICY	0.102	0.136	0.136	0.131	0.128
	(0.043)**	(0.082)	(0.082)	(0.085)	(0.082)
SOI anomaly			0.033	0.033	0.030
			(0.012)***	(0.012)***	(0.013)**
Ln inflation				–0.006	–0.007
				(0.022)	(0.023)
Trade share					0.032
					(0.118)
No. of observations	1,410	1,410	1,410	1,299	1,282
R^2	0.97	0.98	0.98	0.98	0.98
			B. Cairns Group only		
Ln OECDPOLICY	0.176	0.469	0.469	0.462	0.323
	(0.117)	(0.256)	(0.256)	(0.255)	(0.243)
SOI anomaly			0.015	0.016	0.018
			(0.041)	(0.042)	(0.042)
Ln inflation				0.010	0.000
				(0.027)	(0.027)
Trade share					0.263
					(0.116)***
No. of observations	267	267	267	267	267
R^2	0.87	0.94	0.94	0.94	0.94
			C. Historical food importers		
Ln OECDPOLICY	0.123	0.168	0.168	0.204	0.213
	(0.060)**	(0.090)	(0.090)	(0.101)	(0.113)
SOI anomaly			0.036	0.023	0.018
			(0.016)**	(0.011)***	(0.013)
Ln inflation				–0.048	–0.045
				(0.021)***	(0.022)***
Trade share					–0.062
					(0.135)
No. of observations	582	582	582	524	507
R^2	0.98	0.98	0.98	0.98	0.98

Notes: Robust standard errors in parentheses. All estimates include country fixed effects. Estimates in columns (2)–(5) also include year dummies.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

any robust relationship between OECD policy and average income per capita in developing countries. We do find that good weather has a small effect on average income (as previously documented by Brunner 2002). In panel B of table 5.4 we present the same sequence of regression results for the smaller sample of Cairns Group countries. Recall that some of these countries were actually food importers in the 1970s. These are the countries for

which we predict a negative correlation between OECDPOLICY and income per capita. Again, the sign on OECDPOLICY is opposite to what we'd predict, but the coefficient is so imprecisely measured that we cannot distinguish it from zero. We examine the impact of OECDPOLICY on historical food importers in panel C. This is the group for which we predicted a positive relationship between OECDPOLICY and income per capita. The sign on OECDPOLICY is as predicted, but again the result is insignificantly distinguishable from zero in all but one instance. There is a dichotomy between the Cairns Group sample and the historical food importers in that trade share is positively correlated with income for the Cairns Group but has no relationship to income for the historical food importers. By contrast, inflation is negatively correlated with income for historical food importers and does not appear to matter for the Cairns Group countries.

5.3.4 Discussion

In summary, we find no evidence in our regression analysis that—*on average*—OECD policies help or hurt the poor. Several caveats are in order. First, for each country, we are looking at a package of policies that includes all of the products produced by the developing country. It is possible for a country to be a net exporter of one commodity and a net importer of a second commodity, both of which are subsidized by the OECD countries. The effects of a price decline would have different effects in the different sectors, and we are unable to capture this in our current framework, which focuses on aggregate effects. Second, looking at average income might be misleading if—as many of the advocates for the poor suggest—the poor are the net sellers of these products and the relatively well-off are the net consumers of these same products. In this case, OECD policy, by depressing commodity prices, could make the poor worse off and the rich better off, leaving average income unchanged. We would capture this in our poverty regressions, but, as we mentioned, these data are sparse. Finally, the poverty data are likely to include government transfers in some cases and not in others. This is problematic because it makes it difficult to isolate the impact of OECD policy on poverty.

5.4 Do U.S. Corn Subsidies Hurt Poor Mexican Corn Farmers?

In this section of the paper, we evaluate the claim that U.S. support to corn farmers—by depressing Mexican producer prices—has been largely responsible for the increase in rural poverty in Mexico.[18] We begin by doc-

18. For example, in a recent policy brief Oxfam (2003) argues that NAFTA has been responsible for a surge in U.S. corn exports to Mexico and the associated decline in the real producer price of corn. Moreover, the brief argues that Mexican corn farmers are at a distinct disadvantage vis-à-vis U.S. corn farmers because of the huge subsidies paid out by the U.S. government. The result of this flood of cheap U.S. imports has been an increase in poverty of the 15 million Mexicans who depend on corn as a source of income.

umenting the decline in the Mexican producer price of corn. Next we consider the reasons for this decline: was it primarily Mexican policy or U.S. policy? We also consider the possibility that the majority of corn farmers living far from the border in states like Chiapas are sheltered from changes in the world price of corn. Finally, we analyze the impact of the decline in producer prices on Mexican corn farmers and their families.

Mexican corn is an ideal case study for our purposes for a number of reasons. Mexico is an importer of corn and has been for several decades. Corn is also a product heavily subsidized by the OECD countries and in particular the United States, a major trading partner of Mexico. We have national employment surveys and household data that include detailed information on corn expenditures and sources of income, including income received in the form of government transfers. These data are available for the period 1990–2000—the period over which the real Mexican producer price of corn declined by more than 50 percent. Thus, we can learn a great deal about the impact of depressed commodity prices on the poor by studying the case of Mexico. We also have time series data on regional producer prices and reference prices that allow us to explore the determinants of the decline in producer prices, including the extent to which producer prices move with world prices. We rely on existing work that examines the link between world corn prices and U.S. corn subsidies to estimate the relative importance of U.S. corn subsidies as a determinant of the Mexican producer price of corn.

As we discussed extensively in the first half of this paper, the impact of a price decline on poverty depends on whether the poor are net buyers or net sellers of the commodity in question. This is as true for households as it is for countries, but it has largely been ignored in discussions of the impact of corn trade liberalization on Mexico (see, for example, Nadal 2001 and World Bank 2004).[19]

Using nationally representative survey data for the years 1991 through 2000, we study the *actual* impact of a reduction in the price of corn on poverty among corn farmers in Mexico. Like de Janvry, Sadoulet, and Gordillo de Anda (1995), we are interested in identifying net sellers of corn. Because detailed data on income and expenditure are not recorded

19. Two papers written prior to the implementation of NAFTA do consider the possibility that poor Mexican corn farmers might actually be net consumers of corn. Using household survey data from 1990 for three states in Mexico, de Janvry, Sadoulet, and Gordillo de Anda (1995) find that the majority of small and medium-sized corn producers do not produce for the market. They predict therefore that most corn farmers' income will not be directly affected by the decline in the price of corn associated with NAFTA, while a significant share will benefit as consumers. Using a general equilibrium framework, Levy and van Wijnbergen (1995) quantify the impact on household welfare, the labor market, and the land market of liberalizing the Mexican corn sector. This paper makes the important point that even subsistence farmers who do not sell corn are likely to sell labor. Thus, to the extent that the drop in corn prices reduces rural wages, subsistence farmers are likely to be hurt by the liberalization of the corn sector.

in the same survey, making it difficult to identify households that are net sellers, we use information from the National Employment Survey to document over time by measures of living standard (size of land holdings) the share of corn farmers who report that they sell corn and the changes in these farmers' income. This exercise allows us to determine the share of the poorest corn farmers whose income has been directly affected by changes in the price of corn because they sell corn.

Of course, even if individual farmers' earnings from corn farming have fallen, it could be that total household expenditures on corn products have fallen by even more, in which case the household to which the corn farmer belongs would be a net beneficiary of the reduction in the price of corn. Since the National Employment Survey only tracks income from the respondents' primary job, we use household survey data to document, by measures of living standard, changes in income and expenditure on corn products of families with family members who report that their primary or secondary source of income is corn farming. While the household survey does not specifically ask for the amount of income derived from corn farming, it does ask whether the household members' primary source of income is corn farming. In addition, the survey asks each individual member of the household whether their income is derived from labor (work income), from business (profit income), from remittances both domestic and international (income from remittances), from government programs (income from transfers), or from other sources, such as rental income (other income). For those households that report that their primary source of income is corn farming, the work and profit share of income reported is derived primarily from corn farming. Thus, a comparison between changes in income and changes in expenditure on corn products allows us to determine whether households that rely on corn farming as a primary or secondary source of income (and in particular the poorest corn farmers) have on net benefited from a reduction in the price of corn.[20]

To determine the relative impact of domestic policy and international policy on the producer price of corn, we examine the extent to which U.S. subsidies have depressed Mexican producer prices, and we study the pattern of corn prices across time and across states. Our primary goal here is to determine the reason for the dramatic decline in the producer price of corn over the period 1986–2002. First, we consider the impact of domestic policy ("my policies") on the producer price by comparing Mexican producer prices to border prices pre- and post-1994, the year the North American Free Trade Agreement (NAFTA) between Canada, Mexico, and the United States was signed. We focus on NAFTA because it marks the be-

20. One complication that we do not address is the fact that corn is purchased in many different forms. Thus, it is harder to argue that the expenditure patterns are attributable solely or even primarily to NAFTA.

ginning of the liberalization of the corn market. Importantly, NAFTA encompasses both policies designed to align Mexican producer prices with world prices (such as tariff liberalization) and domestic policies designed to soften the negative consequences of this liberalization. We extend this analysis to a comparison of prices at the state level to determine whether—as some claim—states farthest from the border have been shielded from trade liberalization. To obtain an estimate of the impact of U.S. subsidies on border prices, or how much higher border price would be in the absence of U.S. subsidies ("your policies"), we rely on a recent survey of this issue by Wise (2004).

One important caveat is in order. Our data do not track the same households over time, and therefore we are unable to document what has happened to the income of farmers and households who relied heavily on corn farming prior to liberalization and who then switched out of corn farming into some other activity. To understand whether in fact our results suffer from a serious selection bias, we examine farmer (and corn-farming household) characteristics over time to determine whether these have changed substantially. In future work, we will use regression analysis and correct for selection bias.

The remainder of this case study is organized as follows. We first describe the policy environment in Mexico. Next we assess the relative importance of "my policies" (NAFTA) or "your policies" (U.S. corn subsidies) in determining the Mexican producer price of corn. We then consider the impact of these policies on poverty among Mexican corn farmers. We conclude with outstanding issues and directions for future research.

5.4.1 The Policy Environment in Mexico

This section of the paper is devoted to describing the package of policies known as NAFTA. The critics claim that NAFTA has exposed poor Mexican corn farmers to cheap U.S. imports. However, it is important to remember that NAFTA included several policy reforms beyond the removal of tariffs. It is also worth noting that NAFTA was freely agreed to by the Mexican government and thus should be counted among "my policies" in the parlance of this paper.

Since the implementation of NAFTA, tariffs on imported corn have been dramatically reduced. The Mexican over-quota bound tariff on corn has been reduced from 206.4 percent to 72.6 percent, and the tariff-rate quota (TRQ) has increased from 2.5 million metric tons to 3.36 million metric tons. At the same time, Mexico has converted its import licensing system to a transitional TRQ that will remain effective until 2008 with a 3 percent annual increase in quantity. Over the first six years of the agreement, an aggregate 24 percent of the tariff was eliminated. The remainder will be phased out by 2008.

NAFTA included several policy reforms beyond the removal of tariffs

that affected corn farmers. The reforms in the agricultural sector that most directly affected corn farmers are the removal of price supports and the implementation of direct income transfers. Other reforms that would have had an impact on corn farmers are an extension program aimed at raising productivity, changes in credit, and land reform. We discuss each of these below, drawing on a recent evaluation of the effect of NAFTA on Mexico's agricultural sector (Yunez-Naude and Barceinas Paredes 2002).

According to Yunez-Naude and Barceinas Paredes (2002), it is widely agreed that the most important domestic policy reform has been the elimination of price supports to producers of basic crops. The producer price of corn was supported through government procurement by CONASUPO (the National Basic Foods Company). The 1991 nominal rate of protection to corn was 77 percent, and the producer subsidy equivalent (PSE) amounted to $92 per tonne for white corn and $71 per tonne for yellow corn, compared to $28 in the United States and $21 in Canada. Consumer prices were also subsidized, but mainly for urban consumers through access to CONASUPO stores. In these government-run stores, consumers could purchase cheaper corn that the government had acquired from producers at inflated prices. However, few farmers live close enough to such stores to sell corn at the high support price and then buy their consumption needs at the low subsidized prices (de Janvry, Sadoulet, and Gordillo de Anda 1995).

CONASUPO's role in the corn market was substantially diminished in 1995 as a result of the Mexican peso crisis. The peso devaluation in 1995 allowed the Zedillo government to transform CONASUPO into a buyer of last resort and eliminate price supports to corn farmers. However, because of the drop in corn prices in 1996, the government of Mexico reinstated an intermediate scheme of price fixing whereby prices were fixed on a regional basis at a level between the guaranteed price and the international price. This scheme was abolished in 1999.[21]

Some Mexican corn producers currently receive a fixed subsidy per ton of marketable surplus under the Marketing Support Program. In order to participate in this program, producers must have a marketable surplus. Relatively few farmers (around 10 percent) fit this description (Zahniser and Coyle 2004). PROCAMPO was initiated in the winter of 1993–94, a few months before the beginning of NAFTA. The program was designed to supplement farmers' income and moved support in the direction of income transfers. Payments were based on area under cultivation. Its main purpose was to help farmers facing stiff competition from U.S. and Canadian farmers make a transition to more competitive crops. It is intended to

21. CONASUPO also subsidized tortilla processors and maize millers by selling to these processors the maize purchased from farmers at a price that would allow the processors a "reasonable" profit.

last until 2008, when full trade liberalization under NAFTA will be complete.

There are several other reforms that took place during the 1990s not specifically aimed at corn farmers but that would nevertheless impact them. The first is the Alliance for the Countryside (Alianza para el Campo). It includes PROCAMPO as well as other programs. One of the most important programs is PRODUCE, which is an extension program designed to increase productivity via improved technology. Liberalization of the agricultural sector also entailed the elimination of subsidized inputs such as seeds fertilizer and credit. Finally, the Salinas government amended the constitution in 1991 to liberalize property rights in the *ejidal* sector. Until this time, peasants who benefited from land redistribution, *ejidatarios,* were by law not allowed to associate, rent, or sell their land. The constitutional amendment abolished this provision and is expected to develop rural land markets by allowing farmers to participate in private credit markets and by promoting direct investment.

Based on the preceding discussion, it should now be clear that when we refer to NAFTA we are not simply referring to a removal of tariffs on imported corn. NAFTA was much broader than that. In what follows, we use NAFTA to represent domestic policy changes ("my policies") that impact the Mexican producer price of corn.

5.4.2 What Determines the Mexican Producer Price of Corn: My Policies or Yours?

There is no doubt that NAFTA is having an impact on United States–Mexico corn trade. Figure 5.5 confirms the findings of others that U.S. corn

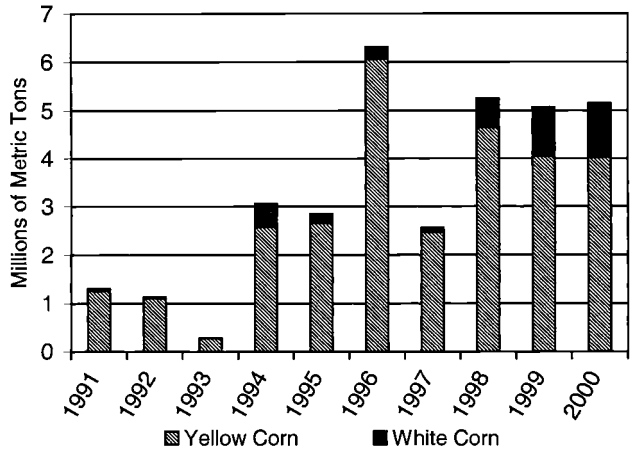

Fig. 5.5 U.S. corn exports to Mexico
Source: USDA (www.//www.ers.usda.gov/Briefing/Corn/trade.htm).

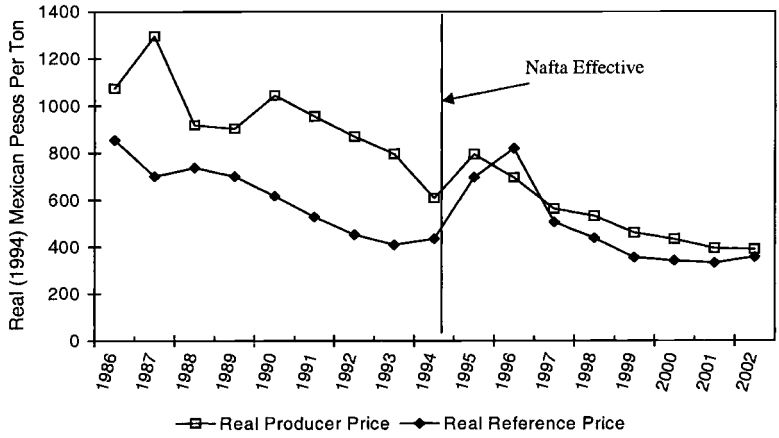

Fig. 5.6 Corn producer prices and world prices
Source: OECD Producer Support Estimate database.

exports to Mexico (the United States is the only country that exports significant amounts of corn to Mexico) have increased dramatically since the signing of NAFTA.[22] Moreover, prior to NAFTA, the United States exported virtually no white corn—the type of corn typically grown by Mexican corn farmers—to Mexico. However, as figure 5.5 shows, the amounts of both yellow and white corn exported from the United States to Mexico increased substantially after the signing of NAFTA.[23] As a share of Mexican corn production, U.S. imports increased from an average of 8.4 percent of total production in the eight years leading up to NAFTA to an average of 32.6 percent of total production in the eight years following NAFTA.

Figure 5.6 shows that the average real price paid to producers of corn in Mexico dropped significantly between 1986 and 2002. Part of the drop in Mexican producer prices has to do with the drop in the world price of corn; the Mexican producer price follows fairly closely the border price. In figure 5.6 we plot the annual average Mexican producer price in real 1994 pesos against the annual average border price, also reported in real 1994 pesos. The border price was obtained from the OECD's PSE database (http://www.oecd.org/dataoecd/33/54/32361406.xls) and reflects the cost of importing U.S. corn at the border, including freight charges to the border but not within Mexico. U.S. dollars are converted to pesos using an annual av-

22. See, for example, Zahniser and Coyle (2004).

23. The distinction between yellow corn and white corn is an important one. Mexican corn farmers primarily grow white corn, which is used to make food products. Yellow corn is typically used to feed animals. However, there is some substitutability between yellow and white corn. Food-grade yellow corn is used to make cornflakes, tortilla chips, beer, and other foods, and white corn can be used as animal feed (Zahniser and Coyle 2004).

erage of the official exchange rate. Both series are converted to 1994 pesos using the national consumer price index.

There are two important pieces of evidence to take away from figure 5.6. First, although the two price series moved closely together throughout the 1990s, 1996 was an exception. In 1996, the two series diverge as U.S. prices increase and Mexican prices drop. Indeed, in 1996 Mexican producers were actually taxed, and were receiving only 88 percent of the U.S. price for their product. Thereafter, the two series continue to move closely together. Second, prior to NAFTA, the gap between the Mexican price and the U.S. price is significantly greater than the gap post-NAFTA. Indeed, the average NPC (the ratio of the Mexican producer price to the border price) for the period 1986–95 is 1.61, while the average NPC for the period 1996–2002 is 1.17.[24]

We test the patterns suggested by figure 5.6 more formally in a regression framework and report these results in tables 5.5 and 5.6. For U.S. prices, we use the same price series shown in figure 5.6. For Mexican producer prices, we now use a separate price series for each of Mexico's thirty-two states. Our time series covers only 1991–2000 since these are the years for which we have price data at the state level. Also in tables 5.5 and 5.6, we explore the possibility that states further from the border, where the poorest corn farmers live, are less affected by changes in world prices and NAFTA. Following Nicita (2004), we assign states to four groups depending on their distance from the U.S. border.[25]

Table 5.5 presents the results of regressions of the real Mexican producer price for each state on real border prices. To eliminate the common time trend, we first difference both price series. In column (1) we report the results of the simple correlation between Mexican and U.S. prices. Not surprisingly, the correlation is positive. In column (2) we test whether this relationship has changed significantly as a result of NAFTA. The weak and negative sign on the interaction term is counterintuitive and suggests that the relationship between Mexican and U.S. prices weakened after NAFTA. However, in column (3), we introduce a control for the sudden shift in policy in 1996 and find that the coefficients on the NAFTA terms are now insignificantly different from zero. We interpret this as evidence that, except in 1996, Mexican and U.S. prices moved closely together both before and after NAFTA. In column (4), we restrict the sample by dropping 1996 and

24. The results are even more pronounced if we do not include 1995 in the pre-NAFTA average.

25. Border states are Baja California, Sonora, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas. Northern states are Sinaloa, Nayarit, Zacatecas, Aguascalientes, San Luis Potosi, and Durango. Central states are Jalisco, Colima, Michoacan, Guanajuato, Queretaro, Estado de Mexico, Hidalgo, Distrito Federal, Tlaxcala, Morelos, Puebla, and Veracruz. Southern states are Guerrero, Oaxaca, Chiapas, Tabasco, Campeche, Yucatan, and Quintana Roo.

Table 5.5 **Is globalization driving the trends in Mexican producer prices? (1991–2000; dependent variable: Mexican producer price in first differences)**

	(1)	(2)	(3)	(4)
Real U.S. price	0.204	0.322	0.322	0.313
	(4.00)***	(5.40)***	(5.37)***	(2.22)
USPrice · Nafta		–0.177	–0.045	
		(1.63)	(0.10)	
Nafta		37.142	64.000	
		(2.17)**	(2.71)***	
USPrice · Break			–0.706	
			(2.01)	
Breakdum			–10.272	
			(0.09)	
USPrice · North				0.068
				(0.38)
USPrice · Central				0.095
				(0.55)
USPrice · South				0.013
				(0.07)
North				23.243
				(0.85)
Central				30.863
				(1.15)
South				17.821
				(0.66)
Constant	–63.912	–95.931	–95.931	–76.424
	(7.38)***	(8.86)***	(8.82)***	(3.39)***
No. of observations	224	224	224	192
R^2	0.08	0.11	0.14	0.16

Notes: Robust *t*-statistics in parentheses. Mexican producer prices are annual by state and were obtained from SAGARPA. They were deflated to real 1994 prices using the national CPI. U.S. prices were obtained from the OECD Producer Support Estimate database and are the c.i.f. import price of corn not including transport or processing costs from the Mexican border to Mexican consumers. U.S. prices were converted to Mexican pesos using the annual average official exchange rate. Mexican and U.S. prices are in first differences to eliminate the common time trend. NAFTA is a dummy equal to 1 for the years 1996–2000. Results are robust to defining the NAFTA dummy equal to 1 also in 1995. The omitted category is border states. These are Baja California, Sonora, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas. Northern states are Sinaloa, Nayarit, Zacatecas, Aguascalientes, San Luis Potosi, and Durango. Central states are Jalisco, Colima, Michoacan, Guanajuato, Queretaro, Estado de Mexico, Hidalgo, Distrito Federal, Tlaxcala, Morelos, Puebla, and Veracruz. Southern states are Guerrero, Oaxaca, Chiapas, Tabasco, Campeche, Yucatan, and Quintana Roo.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

Table 5.6 **Is globalization driving the differential between Mexican and U.S. corn prices? (1991–2000; dependent variable: ratio of Mexican to U.S. corn price)**

	(1)	(2)	(3)
Nafta	–0.440		–0.493
	(9.42)***		(6.37)***
North		–0.019	–0.078
		(0.35)	(0.79)
Central		0.033	–0.010
		(0.53)	(0.10)
South		0.020	0.001
		(0.22)	(0.09)
North · Nafta			0.093
			(0.87)
Central · Nafta			0.069
			(0.58)
South · Nafta			0.001
			(0.02)
Constant	1.619	1.339	1.647
	(38.82)***	(32.49)***	(23.01)***
No. of observations	256	256	256
R^2	0.30	0.00	0.31

Notes: Robust *t*-statistics in parentheses, Mexican producer prices are annual by state and were obtained from SAGARA. U.S. prices were obtained from the OECD Producer Support Estimate database and are the c.i.f. import price of corn not including transport or processing costs from the Mexican border to Mexican consumers. U.S. prices were converted to Mexican pesos using the annual average official exchange rate. NAFTA is a dummy equal to 1 for the years 1996–2000. Results are robust to defining the NAFTA dummy equal to 1 also in 1995. The omitted category is border states. These are Baja California, Sonora, Chihuahua, Coahuila, Nuevo Leon, and Tamaulipas. Northern states are Sinaloa, Nayarit, Zacatecas, Aguascalientes, San Luis Potosi, and Durango. Central states are Jalisco, Colima, Michoacan, Guanajuato, Queretaro, Estado de Mexico, Hidalgo, Distrito Federal, Tlaxcala, Morelos, Puebla, and Veracruz. Southern states are Guerrero, Oaxaca, Chiapas, Tabasco, Campeche, Yucatan, and Quintana Roo.

***Significant at the 1 percent level.

test for the possibility that Mexican prices might follow more closely the world price in states closer to the border; we find no evidence of this.

In table 5.6, we test whether a relaxation of tariffs on imported corn reduced the wedge between the Mexican producer price of corn and the border price. In column (1), we do this by regressing the ratio of the Mexican price to the U.S. price on a NAFTA dummy. The results indicate that prior to NAFTA Mexican prices were 1.62 times the U.S. price and that post-NAFTA Mexican prices were only 1.18 times the U.S. price. These numbers are consistent with the simple calculations based on the annual data used to plot figure 5.6. In column (2) we test whether this differential is any smaller for states closer to the border and find no evidence of this. In col-

umn (3) we test whether the differential changed more (less) in states close to (far from) the border. Since the only term of any significance is the NAFTA dummy, we conclude that this is not the case.[26]

These results suggest that while the Mexican producer price has always moved in tandem with the world price, NAFTA squeezed the differential between Mexican producer prices and border prices. How much higher would the border price be if the United States were not subsidizing corn? Unfortunately, there is no consensus on this issue, as commodity prices are notoriously difficult to predict. However, though the estimates vary depending on the methodology, the bottom line seems to be that the magnitude of the price difference would actually be quite small. Wise (2004) summarizes these results and reports that the largest estimate of 2.9 percent comes from a study by the International Food Policy Research Institute (IFPRI). The smallest estimate (–3.0 percent) is from a study by the Agricultural Policy Analysis Center (APAC) and implies that removing U.S. subsidies would actually raise producer prices! In 2000, a 3 percent increase in the producer price of corn would increase the poorest farmers' monthly income by at most six pesos (Mex$6, or US$0.63).[27]

In summary, the sharp drop in Mexican producer prices over the period

26. Since these results are at odds with a recent publication by the World Bank (Fiess and Lederman 2004), we note a few differences between our study and the World Bank study. The World Bank study performs a cointegration analysis using monthly price data at the national level. They report that the results are unchanged if they use annual data. Like us, they find a high degree of comovement between U.S. prices and Mexican prices. However, unlike us, they report that the differential between Mexican and U.S. prices is the same pre- and post-NAFTA. They also plot their price series, but a comparison between our figure 5.6 and their figure 4 is difficult because they take logs of nominal prices whereas we plot levels of real prices. The most confusing thing about the World Bank study is the fact that they report that their results do not hold unless they include a dummy variable for the period 1995–97. They justify this on the grounds that this was a period of severe drought during which Mexico imported record amounts of U.S. corn. There are at least two problems with this. First, while it is true that Mexico imported record amounts of corn in 1996, this is not the case for 1995, nor is it the case for 1997 (see figure 5.1). Therefore, it is unclear why the dummy should take a value of one in 1995 and 1997. Second, the dummy variable captures half the post-NAFTA period, so to include it but not incorporate it in the constant term that the authors report to be the price differential seems misleading.

27. Finally, we consider the possibility that the steep decline in the real producer price might be partially due to the large devaluation of the Mexican peso in 1995. The direct effect of the devaluation would have been to offset the decline in tariffs on imported corn, thus protecting Mexican corn farmers. However, there are two indirect effects that must be considered. First is the inflation that was a by-product of the devaluation. Second is the strain on the government budget. We note that the average rate of inflation over the period 1986–94 was 43 percent, while the average rate of inflation from 1995 to 2000 was only 22 percent. Therefore, it is difficult to argue that the inflation was the root cause of farmers' problems. Additionally, the government has continued to support corn farmers, albeit not directly. These programs are expensive and have managed to keep farmers' real income (including transfers) from falling dramatically over the period 1990–2000. Based on this evidence, we conclude that the change in farmers' income from corn farming is directly tied to the changes in the price of corn at least partially brought on by NAFTA.

1990–2000 corresponds almost exactly to NAFTA's effective date. Although it is possible that Mexican producer prices would be higher if the United States did not subsidize corn, the magnitude of this effect seems small both in comparison to the effect of trade liberalization and in absolute terms. In addition, since there was no dramatic change in U.S. farm policy over this period, Mexican prices would have been higher throughout the entire period. Thus, it seems unlikely that U.S. corn subsidies are driving poverty in Mexico unless one takes the stand that U.S. corn farmers as an interest group were largely responsible for NAFTA.

5.4.3 How Did the Drop in Mexican Producer Prices Affect Poor Corn Farmers?

In this section we turn to analyzing the distributional consequences of the drop in producer prices that we documented in section 5.4.2. We can think of this analysis as answering two distinct questions. The first is the focus of this paper: who in poor countries bears the brunt of rich-country support to agriculture? The second is the focus of this volume: how does trade liberalization affect the poor?

Data

Our data on corn farmers come from the agricultural supplement of the Encuesta Nacional de Empleo (ENE) collected by the Instituto Nacional de Estadística, Geografía e Informática (INEGI) in Mexico. This survey covers 453,503 individuals in rural areas, is nationally representative, and was undertaken in 1991, 1993, 1995, 1996, 1997, 1998, 1999, and 2000. The agricultural supplement is rich in detail about crop production, land quality and size, wages, hired labor, dwelling characteristics, and total farm output—thus providing a detailed description of the production side of corn farming—as well as containing demographic, employment, and income information from the broader employment survey. This data set has rarely been exploited, and this study is the first, to our knowledge, to use the ENE agricultural component to analyze welfare effects on Mexico's rural sector. The data set is not a panel, as each subject is only interviewed once, but is a repeated cross section. INEGI did not, however, alter its sampling procedures over the years in question, so it is relatively safe to conclude that changes we see among sectors is due to compositional changes in the population, as opposed to compositional changes in the sample.

The ENE data, however, only include income from the respondents' primary occupation and do not include consumption data. To allow a broader analysis of welfare, we complement the ENE data with data from the Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH). This survey covers 21,117 rural households and covers the years 1992, 1994, 1996, 1998 and 2000. These data are also nationally representative repeated cross

sections and do not follow the same households over time.[28] At the household level, the survey asks for a measure of total household income and income from transfers including remittances (domestic and international), and subsidies from PROCAMPO and other government programs. At the individual level, the survey asks each member of the household how much he or she earns and whether these earnings are derived from wages, the individual's own business enterprise, or other sources such as rental income. We aggregate individual incomes by household to come up with the following breakdown of the household's total income: profit income, work or labor income, income from remittances, income from transfers, and other. In addition, the survey asks whether a household's primary or secondary source of income is corn farming. The survey also has a detailed consumption module, which recounts household expenditure on food, including corn and corn products, education, health, housing, clothing, and so on.

Table 5.7 presents means of socioeconomic characteristics of the rural population from ENE for the entire sample period. All means were computed adjusting for population weights. For purposes of comparing corn farmers with the rest of the rural population, we have divided our summary statistics into four panels. Panel A reports statistics for all rural dwellers. Panel B reports statistics for all rural dwellers involved in agriculture, identified as those respondents who report that the industry of their primary occupation is agriculture. This category includes farm laborers as well as those who own or rent the land. Panel C reports statistics for farmers, where *farmer* is defined as someone who takes part in agricultural activities and owns, occupies, or rents land (as opposed to agricultural laborers). Finally, panel D reports statistics for a subset of the farmers in panel C who report that their primary occupation is the cultivation of corn and beans. In each panel, we report mean monthly income in real 1994 pesos. Income is defined as total household income, and the majority of respondents (97.5 percent) report that their income comes in the form of profits and family consumption. The measure of income in ENE does not include remittances or transfers. We also report mean age, years of schooling, hours worked, and total usable land occupied by the respondent. To determine the relative importance of corn farming, we report the percent of respondents in each year who claim that their primary occupation is corn

28. For the years 1992–2000, the conceptual framework of the survey is the same. Therefore, we are able to compare results across years. The survey is a stratified sample according to urban and rural location, and sampling is done to ensure that households are representative of geographic clusters, with the probability of being included proportional to cluster size. However, a comparison of national accounts data and the ENIGH survey data suggests that up to 60 percent of income goes unreported in the ENIGH survey. However, Damian (2001) and others report that this problem derives primarily from the difficulty of including the very wealthy Mexicans in the survey. Since our analysis focuses largely on the rural poor, we believe that our results are not significantly affected by this problem (Salas 2003).

Table 5.7 **Means of socioeconomic characteristics of rural dwellers across time**

	1991	1993	1995	1996	1997	1998	1999	2000
A. All rural dwellers								
No. of observations	15,216	15,017	20,861	100,411	28,967	95,321	76,441	99,901
Real income (1994 pesos)	702.75	637.66	657.29	595.91	576.26	581.80	554.01	649.50
Age	33.18	33.77	33.82	33.60	34.34	34.31	34.72	34.60
Years of schooling	4.63	4.66	5.17	5.57	5.74	5.74	5.48	5.87
Hours worked	33.94	33.94	20.94	22.33	22.97	22.52	22.80	21.90
Total land (in hectares)	0.98	0.89	0.67	0.71	0.58	0.68	0.73	0.50
Involved in agriculture	0.32	0.32	0.28	0.26	0.28	0.27	0.28	0.24
Farmer	0.14	0.14	0.11	0.10	0.10	0.10	0.09	0.09
Corn occupation	0.20	0.15	0.15	0.13	0.14	0.13	0.14	0.10
Corn subsistence	0.11	0.12	0.09	0.08	0.07	0.08	0.08	0.07
Corn selling	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01
B. Rural dwellers involved in agriculture								
No. of observations	5,134	5,074	6,467	25,977	6,858	25,735	18,538	22,887
Real income (1994 pesos)	585.04	495.31	502.94	434.60	427.04	411.30	405.81	425.72
Age	35.25	35.74	35.73	35.58	36.32	36.04	36.40	36.67
Years of schooling	3.81	3.75	3.96	4.23	4.46	4.38	4.30	4.42
Hours worked	33.73	33.41	35.14	38.13	38.33	34.80	37.85	35.54
Total land (in hectares)	3.04	2.75	2.37	2.72	2.07	2.47	2.64	2.08
Corn occupation	0.63	0.46	0.54	0.50	0.49	0.48	0.50	0.40
Corn subsistence	0.35	0.36	0.32	0.30	0.26	0.29	0.29	0.27
Corn selling	0.05	0.05	0.06	0.08	0.08	0.07	0.07	0.06
C. All farmers								
No. of observations	2,258	2,241	2,596	10,420	2,504	9,888	7,011	8,703
Real income (1994 pesos)	582.81	480.74	515.13	450.81	447.93	415.38	389.37	394.70
Age	46.56	47.67	46.79	47.11	48.82	48.20	47.98	48.50
Years of schooling	2.78	2.63	3.05	3.34	3.54	3.38	3.48	3.46
Hours worked	37.96	37.02	40.36	43.87	45.27	41.34	44.50	40.87
Total land (in hectares)	7.10	6.21	5.91	7.00	5.63	6.63	6.95	5.59
Corn occupation	0.62	0.46	0.64	0.59	0.60	0.60	0.61	0.54
Corn subsistence	0.81	0.82	0.80	0.76	0.72	0.78	0.75	0.73
Corn selling	0.12	0.12	0.14	0.20	0.22	0.19	0.18	0.16
D. All corn farmers								
No. of observations	1,420	1,003	1,628	6,047	1,481	6,017	4,185	4,900
Real income (1994 pesos)	516.81	349.63	277.89	267.68	270.01	256.84	207.64	49.23
Age	47.85	48.73	47.35	47.58	50.11	48.97	48.50	49.23
Years of schooling	2.44	2.22	2.62	2.79	2.93	2.79	2.98	2.94
Hours worked	37.11	36.09	39.66	43.93	45.70	41.05	45.23	40.18
Total land (in hectares)	6.25	3.85	4.09	4.40	4.16	4.94	4.09	3.90
Corn occupation	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Corn subsistence	0.86	0.90	0.91	0.85	0.84	0.90	0.87	0.88
Corn selling	0.15	0.16	0.16	0.25	0.27	0.23	0.24	0.22

Source: ENE 1991–2000.

Notes: "Farmer" is defined as someone who takes part in agricultural activities and owns, occupies, or rents land (as opposed to agricultural laborer). "Corn farmer" is defined as a farmer who identifies his primary occupation as the cultivation of maize and beans. "Corn subsistence" is the percentage of farmers who respond that their primary crop for subsistence is maize and beans. "Corn selling" is the percentage of farmers who respond that their main crop for selling is corn. Medians are not reported because they are virtually identical to means.

Table 5.8 Summary statistics for families with corn farmers

	1992	1994	1996	1998	2000
Real monthly corn consumption					
Value (1994 pesos)	77.50	62.87	73.44	61.05	55.20
As a share of food expenditures	0.20	0.16	0.19	0.19	0.17
As a share of total expenditures	0.10	0.07	0.11	0.10	0.09
Quantity (kilograms)	16.39	15.30	16.21	15.61	17.10
Real monthly income					
Income from work	221.57	228.14	209.99	172.43	179.98
Income from profits	479.06	420.24	327.12	339.03	355.92
Income other	21.93	6.62	10.90	10.32	13.11
Income from transfers (other)	102.19	143.43	175.70	145.97	206.64
Income from transfers (remittances)	83.14	98.99	109.97	88.13	100.69
No. of observations	1,141,718	1,249,234	1,368,191	1,204,051	990,784

Source: ENIGH 1992–2000.

Notes: Consumption figures include corn purchases, corn produced for household's consumption, and in-kind payments and gifts of corn. "Corn farmer" is defined as someone who reports that his or her primary occupation is the cultivation of corn and beans.

farming (Corn occupation), that their primary crop for subsistence is corn (Corn subsistence), and that their main crop for selling is corn (Corn selling).

These data highlight several important facts. The share of rural dwellers who consider themselves farmers has fallen from 14 percent of the rural population in 1991 to 9 percent of the rural population in 2000. Corn farmers make up 20 percent of the rural population in 1991 and only 10 percent of the rural population in 2000. Among farmers, a majority are corn farmers—although this dropped from 62 percent in 1991 to 54 percent in 2000. Three-quarters of all farmers say they grow corn as their primary crop for subsistence. However, very few farmers (between 12 percent and 22 percent) say that corn is their primary crop for selling.

Thus, most farmers are corn farmers, and this has not changed very much over the past ten years. This is important because it implies that there has not been a significant amount of diversification into other farming activities away from corn farming. Corn farmers have on average more land than the average rural dweller and are poorer than other farmers and than the rest of the population. The *average* real monthly income from corn farming in 2000 was only Mex$206 (US$21.79), or US$261.48 per year.[29] Finally, corn farmers also have less schooling and work longer hours than the rest of the rural population.

Table 5.8 presents means of real household variables for families in

29. The average annual exchange rates (Mexican pesos per dollar) beginning in 1990 are 2.84, 3.02, 3.1, 3.12, 3.39, 6.42, 7.6, 7.92, 9.15, 9.55, and 9.45.

which at least one individual identifies his or her primary occupation as the cultivation of corn and beans. In the top panel of table 5.9, we report real monthly household expenditure on corn, expenditure on corn as a share of total food expenditure, expenditure on corn as a share of total expenditure, and the quantity of corn purchased. Corn includes corn tortillas, grain, flour, *masa,* and starch; corn consumption includes corn purchases, corn produced for household consumption, and in-kind payments and gifts of corn. There are two important aspects of these data worth mentioning. First, we are not looking only at expenditure on corn grain but expenditure on corn grain and all derivative products, allowing us to capture the impact of imported grain on all of these products. In particular, our expenditure data include corn tortillas, whose price went up sharply during the 1990s for reasons unrelated to NAFTA. We include tortillas on the grounds that prices would have risen even more had the price of corn grain not fallen. Second, both our income and our expenditure data include the value of home consumption, in-kind payments, and gifts. Therefore, the change in consumption expenditure can be viewed as an upper bound on the increase in real income associated with the drop in the price of corn.

In the bottom panel of table 5.8, we report total real monthly household income as well as real monthly income derived from work (labor income), profits, government transfers, and remittances. Since the income reported in table 5.8 is household income and the income in table 5.7 is income derived from the respondents' primary occupation or individual income, the two numbers are not directly comparable. However, the income data from the national employment survey (ENE) derive primarily from profits and home consumption and would fall under "income from profits" at the household level. Therefore, by comparing the national employment survey income data with the ENIGH household survey income data we can get a sense for both how important profits from corn farming are and also how important supplementary sources of income are to corn-farming families. For example, in 1996 the profit share of income for corn-farming families was roughly Mex$327 per month. According to the national employment survey data, the average real income earned from corn farming by the corn farmer was roughly Mex$268 per month. This is equal to 82 percent of the profit share of income reported in the household data or 32 percent of the average corn-farming families' total real monthly income. Thus, profits from corn farming are on average the most important source of income for families of corn farmers, but work income and income from transfers are also important, at 23 percent and 19 percent of total income, respectively.

The means in table 5.8 reveal that—for the *average* corn-farming family—aggregate corn consumption and aggregate income have not changed remarkably between 1992 and 2000. Real monthly expenditure on corn fluctuates between Mex$77 and Mex$55 per month. The average family spends around 19 percent of its food budget on corn products and around

Table 5.9 **Means of corn farmer characteristics by standard of living across time**

	1991	1993	1995	1996	1997	1998	1999	2000
A. Small corn farmers (<5ha land)								
No. of observations	920	813	1,260	4,768	1,135	4,810	3,252	3,976
Real income (1994 pesos)	437.51	323.17	245.26	199.77	205.61	162.49	155.19	152.79
Age	46.64	48.98	46.51	46.90	49.77	48.56	48.05	48.52
Years of schooling	2.37	2.22	2.60	2.75	2.81	2.67	2.83	2.86
Hours worked	36.32	35.59	39.46	43.37	45.20	39.90	44.93	39.77
Total land (in hectares)	2.39	2.23	2.10	2.20	2.17	2.19	2.12	2.08
Corn subsistence	0.89	0.92	0.93	0.89	0.88	0.93	0.92	0.92
Corn main crop for selling	0.10	0.11	0.11	0.19	0.23	0.18	0.19	0.19
Do not produce to sell	0.67	0.77	0.73	0.65	0.68	0.68	0.63	0.63
Occasionally sell corn	0.16	0.13	0.12	0.13	0.13	0.12	0.10	0.10
Never sell corn	0.56	0.67	0.64	0.57	0.59	0.60	0.57	0.57
B. Medium corn farmers (5–15ha land)								
No. of observations	387	173	288	1,010	264	948	714	731
Real income (1994 pesos)	636.55	452.16	367.47	485.34	485.46	477.46	376.56	52.52
Age	51.55	47.56	52.71	50.44	50.91	51.19	50.50	52.52
Years of schooling	2.58	1.86	2.65	2.81	3.36	2.97	3.43	3.24
Hours worked	36.59	37.74	40.83	45.50	47.54	43.71	47.05	42.53
Total land (in hectares)	8.59	8.26	8.55	8.32	8.36	8.35	8.43	8.52
Corn subsistence	0.80	0.84	0.83	0.70	0.73	0.79	0.67	0.70
Corn main crop for selling	0.27	0.31	0.39	0.46	0.42	0.41	0.47	0.37
Do not produce to sell	0.33	0.47	0.35	0.23	0.35	0.29	0.24	0.33
C. Large corn farmers (>15ha land)								
No. of observations	96	17	59	240	63	259	219	193
Real income (1994 pesos)	845.46	529.43	649.68	753.77	743.45	1,031.82	725.53	949.71
Age	48.13	48.32	52.86	50.54	55.41	48.95	50.71	53.89
Years of schooling	2.50	4.76	4.00	3.66	3.83	4.08	4.53	3.66
Hours worked	45.75	41.78	42.19	51.20	52.74	50.94	44.92	41.39
Total land (in hectares)	34.15	28.40	44.71	38.88	33.97	37.46	32.22	32.31
Corn subsistence	0.78	0.49	0.75	0.49	0.36	0.62	0.51	0.58
Corn main crop for selling	0.16	0.69	0.47	0.58	0.62	0.61	0.54	0.37
Do not produce to sell	0.25	0.14	0.13	0.19	0.15	0.16	0.14	0.18

Source: ENE 1991–2000.

Notes: "Farmer" is defined as someone who takes part in agricultural activities and owns, occupies, or rents land (as opposed to agricultural laborer). "Corn farmer" is a farmer who identifies his primary occupation as the cultivation of corn and beans. "Corn subsistence" is the percentage of respondents who answer that their main crop for subsistence is corn. "Corn main crop for selling" is the percentage of respondents who answer the question "what is your main crop for selling?" as "corn." "Do not produce to sell" is the percentage of respondents who answer the question "what is your main crop for selling?" as "I don't produce to sell." "Occupationally sell corn" is the percentage of respondents who answer the question "how much of your subsistence crop do you sell?" with "corn." "Never sell corn" is the percentage of respondents who answer they do not produce to sell when asked "what is your main crop for selling?" but who answer "which of your subsistence crops do you sell?" with "corn." Medians are not reported because they are virtually identical to means.

10 percent of its total budget on corn products. The average family's real monthly income was Mex$907 (US$292) in 1992 and Mex$856 (US$90.58) in 2000. Note that, to the extent that these families purchase imported products, the peso values understate the drop in real income.

While expenditure on corn did not change significantly following NAFTA for the average corn-farming family, there has been a marked change in the composition of income. In 1992 the profit share of income was roughly 53 percent, and this fell to around 39 percent in 2000. The work share of income also fell from around 24 percent in 1992 to around 20 percent in 2000. The drop in these two sources of income was largely offset by an increase in income from transfers (11 percent in 1992 and 23 percent in 2000).

In the next two sections, we examine the data from the national employment surveys (ENE) and the household surveys (ENIGH) on corn farmers and families with corn farmers by standard of living, as measured by land holdings. Our primary goal is to determine how the drop in the price of corn has impacted the poorest corn farmers and the poorest corn-farming families in Mexico.

Results from the National Employment Surveys (ENE)

Here we analyze in more detail the subgroup of the rural population comprising those who identify themselves as corn farmers. Recall that these are individuals who own, occupy, or rent land (as opposed to agricultural laborers) and who claim that their primary occupation is the cultivation of maize and beans. We recognize that farm laborers are an important group of rural dwellers whose wages are likely to be affected by changes in the price of corn. We do not attempt to consider the welfare of these individuals here. Rather, our goal is to determine how the drop in the price of corn affected the poorest corn farmers in Mexico. To do this, we divide corn farmers into three groups—small, medium, and large—depending upon the size of each farmer's land. We then determine whether a majority of the poorest corn farmers, those with the smallest land holdings, are net buyers or net sellers of corn.

Table 5.9 reports corn farmer characteristics by total land holding across time.[30] The mean landholding of the smallest corn farmers (those with less than 5 ha [hectares] of land) is roughly 2 ha. This corresponds to the average land held by the poorest corn farmers identified by de Janvry, Sadoulet,

30. The advantages of splitting the sample based on landholding are that we do not have to worry about measurement issues associated with income and that we can directly compare our results to those of others who also classify corn farmers by landholding. In appendix table 5A.2, we report income-based, monthly per capita measures of poverty. By Mexican standards, only our average small corn farmer is classified as extremely poor. The medium corn farmers earn enough monthly income from corn farming to place them above both the extreme poverty line and the moderate or asset-based poverty line. However, in 2000, by international standards, the medium corn farmers would be considered moderately poor.

and Gordillo de Anda (1995) as "non-participants in the market" and by Levy and van Wijnbergen (1995) as "subsistence" farmers, who primarily farm rain-fed land. The mean landholding of the medium-sized corn farmers (those with between 5 and 15 ha of land) is roughly 8.5 hectares. The mean landholding of the largest corn farmers (those with more than 15 ha of land) is roughly 35 ha. For small, medium, and large corn farmers we report means of real income, age, years of schooling, hours worked, and landholding over time. In addition, we report the percent of the population who say that their main crop for subsistence is corn (Corn subsistence), the percent of the population who say that their main crop for selling is corn (Corn main crop for selling), and the percent of the population who say that they do not produce a crop to sell in the market (Do not produce to sell).[31]

For the poorest farmers (those with less than 5 ha of land), we report statistics for two additional variables. We do this because we are concerned that the poorest farmers (often called subsistence farmers) may occasionally sell corn but nevertheless report that they do not produce corn with the intent of selling. To determine the extent to which this takes place, we first report the percentage of poor farmers who answer the question "which of your subsistence crops do you sell?" with "corn." We label this "Occasionally sell corn." Next we determine the percentage of respondents who report that they never sell corn as the fraction of the poorest who report that they do not produce to sell but nevertheless answer that they sometimes sell the corn they grow for subsistence. We label this variable "Never sell corn." There is no need to do this for the medium and large corn farmers because we already know that a majority of these farmers do sell corn in the market.

A majority of the poor report that they do not produce to sell. In 1991, 67 percent of the small corn farmers reported that they did not produce to sell in the market. This figure peaks at 77 percent in 1993 and falls to 63 percent in 2000. An overwhelming majority of these same farmers, 89 percent in 1991 and 92 percent in 2000, do say that corn is their primary crop for subsistence. When we allow for the possibility that some of these farmers may sell corn on occasion, the percentages fall and we are left with a somewhat stronger conclusion. The majority of the poor report that they never sell corn in all of the eight years for which we have data. For example, in 1991, 56 percent of the poorest farmers report that they never produce to sell, and in 2000, 57 percent report that they never produce to sell.

By contrast, only around 33 percent of the medium-sized farmers and 16 percent of the large farmers say that they do not produce to sell. Therefore,

31. To keep the tables clear and manageable, we leave out the percentage of the population who report that they do not sell any of their subsistence crop. An analysis of this variable leads to the same conclusion that the majority of the poor report that they do not sell any of their subsistence crop.

the drop in the price of corn associated with NAFTA does not directly affect the income of the majority of the poorest corn farmers while it negatively impacts the income of a majority of the medium- and large-scale corn farmers. Although the employment survey does not ask about expenditure, those farmers who report that they do not sell are most certainly net buyers of corn. It is almost impossible to be completely self-sufficient because of the vagaries of the weather. Thus, among the poorest corn farmers, the majority are net buyers of corn and have thus *benefited* from any reduction in the price of corn associated with NAFTA. The opposite is true for the medium- and large-scale corn farmers.

Although it is not shown in the tables, we also analyzed the summary statistics by splitting the samples in panels A, B, and C into those who sell and those who do not sell. In all three cases, the corn farmers who report that they do not produce to sell are poorer, older, and less well educated, and have less land than the farmers who do produce to sell. Additionally, the corn farmers who report that they do not produce to sell also report that the majority of their income comes in the form of family consumption, while those who do produce to sell report that the majority of their income comes in the form of profits (table 5.10). With only one exception, all groups and subgroups of corn farmers saw their real income decline substantially between 1991 and 2000. Only large corn farmers experienced a substantial increase in their income between 1995 and 2000. If we split large farmers into those who produce to sell and those who do not produce to sell, we find that the larger corn farmers who do not produce to sell actually experienced a decline in their real income over the period 1991–2000. However, the increase in the incomes of those large farmers who do produce to sell is even more dramatic (from Mex$684 per month to Mex$1,162 per month) once we remove the large corn farmers who do not produce to sell.

In table 5.10, we check whether there has been a significant change in the characteristics and real income of corn farmers pre- and post-NAFTA. In terms of both magnitude and statistical significance, the most striking changes are the reduction in the real income of small farmers and the increase in the real income of large farmers. Between 1991 and 2000, small farmers' real monthly income dropped by roughly Mex$285, while large farmers' real income increased by around Mex$100. Between 1995 and 2000, small farmers' real income dropped by roughly Mex$93, while large farmers' real monthly income increased by around Mex$300.

The drop in the real income of the small farmers can be explained by the reduction in the price of corn. Although the majority of these farmers do not participate in the market, they do report that their most important source of income from their primary occupation is the value of home consumption. Thus, even for those farmers who do not participate in the market the imputed value of real income will have fallen.

Table 5.10 Differences between corn farmers in 1991 and 2000

Farmer characteristics and income (ENE)	Differences between 1991–92 and 2000			Differences between 1994–95 and 2000		
	Difference	*t*-statistic	*P*-value	Difference	*t*-statistic	*P*-value
		A. All corn farmers				
Age	1.37	2.95	0.00	1.87	4.16	0.00
Years of schooling	0.50	6.20	0.00	0.31	4.08	0.00
Hours worked	3.07	5.41	0.00	0.52	1.05	0.30
Total land (in hectares)	–2.34	–7.07	0.00	–0.19	–0.65	0.52
Income (1994 pesos)	–310.46	–23.51	0.00	–71.54	–6.81	0.00
	Differences between 1991 and 2000			Differences between 1995 and 2000		
	Difference	*t*-statistic	*P*-value	Difference	*t*-statistic	*P*-value
		B. Small corn farmers				
Real income (1994 pesos)	–284.72	–23.84	0.00	–92.47	–9.43	0.00
Age	1.88	3.31	0.00	2.01	3.94	0.00
Years of schooling	0.48	5.22	0.00	0.26	2.93	0.00
Hours worked	3.45	5.15	0.00	0.31	0.56	0.58
Total land (in hectares)	–0.31	–6.09	0.00	–0.03	–0.47	0.64
		C. Medium corn farmers				
Real income (1994 pesos)	–271.79	–8.79	0.00	–2.71	–0.10	0.92
Age	0.97	1.03	0.31	–0.19	–0.19	0.85
Years of schooling	0.66	3.58	0.00	0.60	3.18	0.00
Hours worked	5.94	4.75	0.00	1.70	1.34	0.18
Total land (in hectares)	–0.07	–0.46	0.64	–0.03	–0.17	0.86
		D. Large corn farmers				
Real income (1994 pesos)	104.25	1.03	0.30	300.03	2.09	0.04
Age	5.76	3.22	0.00	1.03	0.50	0.62
Years of schooling	1.16	3.27	0.00	–0.34	–0.77	0.44
Hours worked	–4.36	–1.86	0.06	–0.81	–0.33	0.74
Total land (in hectares)	–1.84	–0.49	0.62	–12.40	–1.70	0.09

Source: ENE 1991, 1995, 2000.

Notes: P-values indicate probability that difference is not equal to zero. "Corn farmer" is defined as a farmer who identifies his primary occupation in the cultivation of corn and beans.

The increase in the income of the large farmers is somewhat more puzzling. However, this could be explained by a number of factors. For example, it is consistent with Levy and van Wijnbergen's (1995) argument that irrigated farmers would experience an increase in net income because the gain they experience as a result of the drop in rural wages outweighs the loss they experience as a result of the reduction in the price of corn. We hope to explore in more detail the reasons for the gain in large farmers' real income in future work.

In summary, the majority of the poorest corn farmers did not sell corn

Table 5.11 **Income and consumption of families of corn farmers in 1992 and 2000 by standard of living**

	1992	1994	1996	1998	2000	Change 1992/2000	Change 1994/2000
A. Low-income corn-farming families							
Real monthly corn consumption (means)							
Value (1994 pesos)	77.15	71.63	79.97	62.73	53.70	–23.45***	–17.93***
As a share of food expenditures	0.28	0.24	0.28	0.26	0.22	–0.06	–0.01
As a share of total expenditures	0.15	0.12	0.17	0.14	0.13	–0.02	0.01
Quantity (kilograms)	17.31	18.86	18.74	17.73	19.68	2.37**	0.82
Real monthly income (means)							
Work income	78.97	99.34	114.35	86.93	89.24	10.27***	–10.10***
Profit income	240.94	242.68	191.42	151.28	114.30	–126.64***	–128.38***
Other income	2.15	1.28	1.25	1.92	1.68	–0.47	0.40
Income from transfers (other)	44.45	62.94	83.51	75.46	121.91	77.46***	58.98***
Income from transfers (remittances)	42.02	58.40	38.69	46.32	39.23	–2.79	–19.17***
No. of observations	438,613	365,409	445,568	470,569	352,983		
B. Middle-income corn-farming families							
Real monthly corn consumption (means)							
Value (1994 pesos)	75.93	63.49	80.64	67.49	62.58	–13.35***	–0.91
As a share of food expenditures	0.19	0.16	0.20	0.18	0.17	–0.03	0.00
As a share of total expenditures	0.10	0.07	0.10	0.09	0.08	–0.02	0.01
Quantity (kilograms)	15.71	15.59	17.85	16.57	18.60	2.90**	3.01**
Real monthly income (means)							
Work income	134.72	189.20	195.81	177.06	187.89	53.17***	–1.31
Profit income	468.93	370.02	255.29	291.64	192.61	–276.32***	–177.41***
Other income	4.30	9.42	13.85	10.52	13.20	8.90	3.78
Income from transfers (other)	111.56	87.33	145.60	110.04	215.28	103.72***	127.95***
Income from transfers (remittances)	97.17	78.50	101.16	60.93	111.61	14.44**	33.11***
No. of observations	324,016	407,348	469,429	353,566	329,765		
C. High-income corn-farming families							
Real monthly corn consumption (means)							
Value (1994 pesos)	79.31	55.63	59.47	52.82	48.83	–30.48***	–6.80**
As a share of food expenditures	0.12	0.09	0.11	0.11	0.10	–0.02	0.01
As a share of total expenditures	0.05	0.04	0.05	0.05	0.04	–0.01	0.00
Quantity (kilograms)	15.90	12.30	12.00	12.01	12.40	–3.49**	0.10**
Real monthly income (means)							
Work income	277.24	316.34	320.04	277.43	286.95	9.71**	–29.38**
Profit income	617.19	599.82	537.21	624.13	807.63	190.44***	207.81***
Other income	60.90	8.34	17.45	20.87	26.12	–34.78**	17.78**
Income from transfers (other)	163.15	253.37	296.93	270.22	294.48	131.33***	41.11***
Income from transfers (remittances)	20.19	147.74	190.17	167.40	159.44	39.25**	11.70***
No. of observations	372,611	475,855	450,238	373,118	298,706		

Source: ENIGH.

Notes: Consumption figures include corn purchases, corn produced for household's consumption, and in-kind payments and gifts of corn. "Corn farmer" is defined as someone who identifies his or her primary occupation as the cultivation of corn and beans. All means computed using population weights. The last two columns report the change in mean between 1992 and 2000 and then between 1994 and 2000.

***Significant at the 1 percent level.

**Significant at the 5 percent level.

in the market prior to NAFTA. Therefore, their income will not have been directly affected by the forces of globalization associated with NAFTA and the devaluation of the peso. By contrast, a majority of the medium and large corn farmers did sell corn in the market prior to NAFTA and continued to do so after the implementation of NAFTA. Thus, we conclude that the medium-sized corn farmers experienced a sharp decline in real income as a result of NAFTA. The income of the largest corn farmers has increased. Without additional information, it is not possible to attribute the increase in the incomes of the large corn farmers to globalization.

Results from the Household Surveys (ENIGH)

We turn now to the families of those individuals who identify their primary occupation as the cultivation of corn and beans. Specifically, we examine household expenditure on corn products and the sources of total household income. Ideally, we would like to have this information for the same individuals interviewed in the employment survey. This would allow us to understand whether the poorest families who say they do not sell any corn rely on other sources of income that might be indirectly affected by the price of corn, such as wage income derived from working on other people's corn farms. Unfortunately, the surveys were not conducted in this fashion. Therefore, we split our sample into three groups based on income from profits on the grounds that income from profits is very closely correlated with the size of the landholding. Thus, we take the families in the bottom tercile of the distribution of income from profits as the representative families of the corn farmers with less than 5 ha of land. Similarly, those in the middle of the distribution represent the families of the medium-sized corn farmers, and those in the top third of the distribution represent the families of the largest corn farmers (those with more than 15 ha of land).

Panel A of table 5.11 reveals that for the average low-income corn-farming family real monthly expenditure on corn decreased by around Mex$20 per month over the period 1994–2000. This amounts to around US$2 per month or US$24 per year for the poorest corn-farming families. We noted in the discussion of these data that this would be an upper bound on the benefits to the poorest corn-farming families as a result of the drop in the price of corn. This is because these families are so poor that they often cannot afford to buy corn and so will go without and because the consumption figures include the value of home consumption. For the poorest corn-farming families, the share of corn in food expenditure stayed roughly constant at around 25 percent, and the share of corn expenditure in total expenditure stayed roughly constant at around 15 percent.

On the income side, the big changes for the poorest families over the period are the drop in the profit share of income and the increase in transfers. Monthly income from profits was around Mex$130 higher in 1992 and 1994 than it was in 2000. On the other hand, transfer income increased

threefold over this same period. The share of income derived from corn farming drops only slightly. Since expenditure on corn changed only marginally and since work income was hardly affected, we conclude that the welfare of those families who do not sell corn in the market—the majority of the poorest corn farmers—has been largely unaffected by the drop in the price of corn. Moreover, these families have benefited from the income support programs associated with NAFTA.

Panel B of table 5.11 reveals a different story; the drop in the price of corn negatively impacted the majority of middle-income families. This is because the majority of these farmers do sell corn in the market. Total monthly expenditure on corn for these farmers has barely changed over time. As with the poorest corn farmers, work income has also not changed much over time. The profit share of income for the middle-income corn farmers fell by Mex$276 between 1992 and 2000 and by Mex$177 between 1994 and 2000. This represents a reduction in real income of almost 50 percent. This was almost entirely offset by the increase in government transfers (Mex$128) and the increase in remittances (Mex$33).

Panel C of table 5.11 demonstrates that both profit income and income from transfers increased substantially over this time period. Other sources of income were largely unaffected. Income from profits for the high-income corn farmers increased by Mex$190 between 1992 and 2000 and by Mex$208 between 1994 and 2000. This amounts to an increase in real income of roughly 33 percent. Thus, the majority of the high-income families benefited from changes in the Mexican corn market.

There are several other interesting trends that stand out in table 5.12. First, households from all income groups witnessed an increase in income associated with government transfers from programs like PROGRESA and PROCAMPO. The largest percentage increase was given to the poorest corn-farming families, whose income from transfers increased by 200 percent, going from Mex$44 a month to Mex$122 a month between 1992 and 2000. Although transfers to the middle- and upper-income corn-farming families increased by less in percentage terms (100 percent), in absolute terms these families receive substantially more than the poorest corn-farming families in transfer payments from the government. For example, in 2000, the average middle-income family received a monthly payment of Mex$215, while the average upper-income family received a monthly payment of almost Mex$300—roughly three times what the poor household received.

Second, the increase in transfer payments may explain part of the mysterious increase in corn production even though the real price of corn has fallen dramatically. Levy and van Wijnbergen (1995) discuss this possibility in great detail. Liberalization of the corn sector under NAFTA creates an incentive problem. Because many corn farmers will be hurt, the government has an incentive to compensate these farmers for their losses. Levy and van Wijnbergen estimate that the efficiency gains associated with

NAFTA would be substantial and that this revenue could be used to compensate the losers. However, compensating farmers pro rata to their corn production will create an incentive to continue to grow corn even in the face of falling market prices.

5.4.4 Discussion

While thought provoking, our analysis suffers from two important shortcomings. First, we consider only the first-order effects of price changes on income and consumption expenditure while ignoring both the partial equilibrium effects of food price changes on quantities demanded and supplied and the general equilibrium effects of the price changes on employment patterns, wages, the price of other factors, and technological innovation. Thus, our analysis is best thought of as a good approximation to what happened in the short run (see, for example, Barrett and Dorosh 1996).

We focus here on short-run impacts of globalization for two related reasons. First, using short-run changes seems to be most appropriate for studying the impact of price changes on the poor, who, as Barrett and Dorosh (1996) say, are "likely to be teetering on the brink of survival" and less able to take advantage of supply-side effects of price changes. And second, our primary goal is to understand whether globalization has affected the poorest corn farmers. In future work, we will incorporate the general equilibrium effects of changes in the price of corn. In particular, an important group that we have not considered here is farm workers. Though not technically corn farmers, these people are likely to be among the poorest of the rural population and their livelihoods significantly impacted by changes in the price of corn.

We are also—in part—limited by our data. Since our data sets are not panels but are repeated cross sections, there is a concern that our results might suffer from selection bias. The composition of small, medium, and large corn farmers could be changing over time, as could the structure of the larger corn-farming sector. This means that we could be picking up a compositional effect rather than the effect of globalization. It is clear from table 5.7 that the absolute number of families in which at least one person reports that his primary occupation is corn farming has fallen over the past decade. Therefore, it is possible that some poor corn farmers left corn farming for other, better-paying jobs and that those particular corn farmers could have been the most able, educated ones. Thus, the negative impact on corn farmers that we observe in the cross-sectional data over time could be partially a result of the corn farmers with the best outside opportunities (something that likely correlates well with present income) leaving corn farming. Any complete statement about changes in the overall welfare of corn farmers would need to take selection into account and to correct for it when studying the impact of globalization on poor corn farmers. It is also independently interesting to study which corn farmers were able to adjust and leave corn farming when the price of corn decreased, and which were

not able to leave but adjusted in other ways, possibly by increasing their production of corn.

However, our conclusion that the majority of the poorest corn farmers and their families have not been hurt by globalization is likely to hold regardless of the shortcomings of our analysis. This is because these people were so poor to begin with that it is hard to imagine them being worse off as a result of globalization. They were not selling corn in the market, and they did not rely heavily on income from work. Hence, for these people there is really only upside potential.

5.5 Conclusion

This paper documents the historical impacts of OECD agricultural policies on developing countries. We first provide evidence that the majority of poor countries are net importers of both cereals and food but net exporters of agricultural products as a whole. This has been true throughout the postcolonial era. Even middle-income countries that export food products are net importers of cereals, particularly in the 1990s. Thus, to the extent that OECD support policies depress the price of cereals and food, these programs benefit consumers in poor countries. Of course, even if a country is a net importer, competition from subsidized imports will hurt the net sellers of these products within the importing countries. However, there is a growing body of evidence—consistent with our evidence from Mexico—indicating that the poorest individuals in the poorest countries are actually net buyers of cereals and food and therefore benefit from lower food prices.[32]

Our econometric results are consistent with this evidence and suggest that in many food-importing developing countries, OECD support policies are not correlated with the poverty rate or with income, even after controlling for domestic policies such as openness to trade. Consequently, the results suggest that OECD agricultural policies do not have a uniform impact on developing-country incomes; net food-importing countries are likely to gain, while food exporters are likely to be hurt.

In the high-profile case of Mexico, we find that NAFTA reduced the wedge between the real producer price and the border price, making corn production less profitable. We also find that the poorest corn farmers are net food buyers, since they have little land per person and so are forced to earn cash income in other ways in order to buy food. Therefore, the reduction in corn prices was unambiguously good for the majority of the poorest corn farmers. However, we also find that middle-income corn farmers have been hit hard, as their real income from corn farming fell by more than 50 percent while the average income of the largest corn farmers increased by almost 40 percent. Although the price of corn is no longer di-

32. See, for example, Levinsohn and McMillan's piece on Ethiopia (chap. 13 in this volume).

rectly supported by the Mexican government, transfer payments to corn farmers at all levels of income increased substantially between 1991 and 2000. Because these payments are often tied to amount of land cultivated with corn, their increase may explain the puzzle of increasing corn production in the face of falling corn prices.

Our findings may be taken as a note of caution in the context of arguments for wholesale multilateral agricultural trade liberalization in industrial countries as a means of alleviating poverty in developing countries. The aggregate efficiency gains associated with trade liberalization, a topic not addressed in this paper, may mask negative impacts for many developing countries, particularly the poorest. Trade negotiators may need to consider means of protecting these countries from the negative effects of higher commodity prices, at least in the short run, and developing countries may find it advantageous to advocate for more far-reaching liberalization in the cotton, dairy, and sugar markets rather than in the markets for bulk grain commodities that they import.

Appendix

Table 5A.1 **Description of variables and data sources**

Variable name	Source	Description
Head count poverty rate	World Bank PovertyNet	Constant US$(1985); fraction of population with income less than $1 per day
Log average income per capita	Penn World Tables 6.1	Constant US$(1985), real GDP per capita
SOI anomaly	National Oceanic and Atmospheric Administration data, available at ftp://ftp.ncep.noaa.gov/pub/cpc/wd52dg/data/indices/soi	Southern Oscillation Index anomaly
OECDPOLICY	SourceOECD agriculture support estimates, available at http://oecdpublications.gfi-nb.com/cgi-bin/OECDBookShop.storefront/EN/product/512002093C3 USDA Economic Research Service Trade Issues data, available at http://usda.mannlib.cornell.edu/	OECD average nominal protection coefficient. Data included in regression as weighted average across commodities where weights are production shares for major commodity classes. These commodity classes are wheat, maize, rice, other grains, oilseeds, sugar, milk, beef, sheep meat, wool, pig meat, poultry, eggs, coffee, cocoa, roots and tubers, fruits, and vegetables (including melons). Data available from OECD for period 1987–2000 and ERS/USDA for period 1982–87.

(*continued*)

Table 5A.1 (continued)

	FAOSTAT data on agricultural production of primary crops, available at http://faostat.fao.org/faostat/collections?subset=agriculture	Data included in regression as weighted average across commodities where weights are production shares for major commodity classes listed above in 1970. Production share data from FAO.
Exports + import/GDP	World Development Indicators	Exports and imports in constant US$(1985) at market exchange rate. GDP is in PPP$(1985)
Ln (1 + inflation rate)	World Development Indicators	Log of rate of inflation plus one

Table 5A.2 **Rural poverty lines for Mexico**

Monthly per capita poverty lines (1994 pesos)	1994	1996	1998	2000
Food poverty/extreme poverty	43.29	87.61	117.52	139.78
Asset poverty/moderate poverty	82.78	159.21	208.76	254.50
$1/day poverty line	68.51	124.29	173.8	219.24
$2/day poverty line	137.02	248.58	347.6	438.48

Sources: ENIGH, ENE, World Bank (2004).

Notes: Food poverty is defined as the income required to purchase a food basket to satisfy minimum nutritional requirements. Asset poverty uses Engel coefficients to estimate the nonfood component of income. Since our income data are in real 1994 pesos and the poverty line estimates were originally in 2000 pesos, we used the general CPI to convert the poverty lines to real 1994 pesos. Income from corn farming is only reported in the last three years because the available data for the earlier years do not correspond to the years available household data.

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Comment Mitali Das

McMillan, Zwane, and Ashraf (hereafter MZA) have written an interesting paper, which asks whether large agricultural subsidies in rich countries affect rural incomes in poor ones. Many observers will agree that an answer to this question is imperative in resolving the debate over and designing the appropriate WTO policy on OECD agricultural subsidies. The simplest story for a link is as follows: subsidies allow rich farmers to sell on the world market at below-cost prices; these are transmitted to producer prices in poor nations; and these in turn affect the incomes of the agrarian population. Under this transmission from rich farmers' subsidies to poor farmers' incomes, net exporters among poor nations would realize lower agrarian incomes while net importers would benefit from higher ones. MZA test this hypothesis empirically.

There are three key results of MZA that I note. First, MZA find that agriculture subsidies in OECD nations do indeed affect rural incomes in poor nations. They affect them in a nonlinear manner, but not in the expected manner: rural incomes among net importers are found to be de-

Mitali Das is an associate professor of economics at Columbia University.

creasing as OECD support increases, while rural income for net exporters is falling as OECD support for the commodities they grow increases. A second result I discuss is ancillary to the paper (admittedly, it is also not discussed by the authors) but is implied by a robustness test that MZA carry out. It suggests that once OECD subsidies are accounted for, growth (to misquote Dollar and Kraay 2002) is no longer good for the poor. Finally, a third finding is that in post-NAFTA Mexico, corn farmers' incomes fell substantially following the flood of heavily subsidized corn imports from the United States.

The first result is the most tenuous. It is logically inconsistent with the theoretical predictions of any reasonable model. Apart from poor data quality, measurement error, and small sample size (which MZA point to), the methodological implementation raises issues that very plausibly lead to the unexpected results. These are elaborated upon below.

The second result is less tenuous but is nevertheless surprising. It is overlooked in the paper but merits discussion for this simple reason: the approximate unit elasticity of the lowest quintile's income to average income is an empirical regularity that apparently withstands controls for country fundamentals (GDP, exports/imports, inflation rates), social development (secondary school enrollment, rule-of-law indexes), and financial-sector development; see Dollar and Kraay (2002). Yet MZA's inclusion of controls for OECD support policy attenuates this elasticity until it is indistinguishable from zero. While this is possible in principle, the paper is void of any discussion on this by-product of the empirical results. Explanations for this finding will be suggested here.

I am in general agreement with the third result. There is broad consensus about agrarian incomes in post-NAFTA Mexico, in both popular and academic circles.[1] The raw data in MZA support this consensus. Causality is still difficult to establish, however. There are two suggestions I will make. One is to supplement their descriptive statistics with minimal regression analysis or statistical tests of equality. The second is to balance the discussion of income losses with the economic gains due to NAFTA (DeLong 2000) and discuss net welfare gains.

A more detailed discussion of the first two results follows. To this end, it is useful to specify the model MZA estimate, which can be succinctly summarized as

$$\text{(1)}\quad \text{Income of lowest quintile}_{it} = \text{OECDpolicies}_{it}\beta_1 + \text{OECDpolicies}_{it}^2\beta_2 + X'_{it}\gamma + \varepsilon_{it},$$

where OECDpolicies represents a measure of the OECD subsidy policies that are relevant for (poor) nation i at time t, and X denotes controls.

1. See, e.g., "Dumping without Borders" (Oxfam 2003).

Result 1: From Rich Farmers' Subsidies to Poor Farmers' Incomes

To approximate OECD subsidies on the commodities produced in poor ones (i.e., to measure "OECDpolicies"), MZA adopt a quite reasonable approach, using a weighted average of the net protection coefficient (NPC) for each commodity produced by the rich nations. Commodities not produced get a zero NPC, and weights are the share of the commodity in the poor nation's output. Using this measure, instrumental variables estimates are derived from the model in equation (1). Estimates of β_1 and β_2 are found to be negative and positive respectively, leading to the unexpected U-shaped response of income of the lowest quintile to OECDpolicies mentioned earlier. Below, I suggest what could lead to this result, and I also suggest methodological changes that could recover the expected result.

Point A: Net Importers and Net Exporters

How in fact might OECD subsidies be viewed from a poor nation's perspective? It depends. For a net exporter, agrarian incomes are decreasing in OECD subsidies ($\beta_1 < 0$, $\beta_2 \leq 0$), while for a net importer the opposite ought to be true ($\beta_1 > 0$, $\beta_2 \geq 0$). Without separating net exporters from importers, therefore, a null hypothesis on β_1 and β_2 in equation (1) cannot be formulated. This is a potentially leading cause of confounding the estimates obtained in equation (1).

To address this, two approaches come to mind. One is to weight the NPC nonmonotonically (from –1 to 0 for importers and 0 to 1 for net exporters). This would fit nicely here because the relevant partial effect is evaluated at a particular level of OECDpolicies, which is negative for net importers and positive for exporters. With this specification, one could expect that the sign of the effect on the lowest quintile's income in net importers would be, in general, inverted from that for net exporters.[2] A limitation of this approach is that it would a priori require that the absolute effect of OECD policies is identical for net importers and exporters. An alternative is inclusion of an interaction between the subsidy variable and an indicator for exporter/importer status:

$$\begin{aligned}(2)\ \text{Income of lowest quintile}_{it} = {} & \text{OECDpolicies}_{it}\beta_1 + \text{OECDpolicies}_{it}^2\beta_2 \\ & + \text{NetEx}_{it} \cdot \text{OECDpolicies}_{it}\beta_3 + \text{NetEx}_{it} \\ & \cdot \text{OECDpolicies}_{it}^2\beta_4 + X'_{it}\gamma + \varepsilon_{it},\end{aligned}$$

where NetEx is an indicator for net exporters.

Here, the null hypotheses are $\{\beta_1 > 0, \beta_2 \geq 0, \beta_2 + \beta_4 \leq 0, \beta_1 + \beta_3 < 0\}$. Additionally, an interesting testable hypothesis is for symmetry in responses—that is, whether the reduction in poverty for net importers from

2. It would depend on the magnitude of the coefficient for the linear part.

a unit increase in OECDpolicies is equivalent in absolute magnitude to the increase in poverty for net exporters. Because net exporters' incomes are directly linked with reductions in price, while net importers' income might be less so, an asymmetric response could be expected. More generally, some evidence indicates that income gains in poor nations accrue largely to the upper quintile (Das and Mohapatra 2003).

I would recommend that MZA reestimate the alternative model in equation (2) and test each of these hypotheses directly.

Point B: Weighting Choices

Weights used in the MZA approach are the shares, *in 1970,* of the OECD-subsidized commodity in the poor nation's output. A potential problem with this dating approach is of misstating the true effect of OECD subsidies, because nations very likely adjust their crop allocation to the most profitable combinations over time. For instance, net exporters might appropriately shift away from commodities that are persistently heavily subsidized in OECD nations, because they lead to lower world prices and lowered profits.[3] Then, even if point A was irrelevant, the estimates would be statistically biased and inconsistent. Because crop allocation and planning do not generally adjust instantaneously to foreign subsidy levels, one suspects that current allocations are less likely to be determined by current subsidy levels (MZA) and more likely to be affected by previous subsidy levels.

To this end, I would recommend that MZA compare the 1970 shares of the commodities in the poor nations' output with more contemporaneous ones, to determine whether it is appropriate to proceed with 1970 shares in construction of the key variable OECDpolicies.

Result 2: Growth Is No Longer Good for the Poor?

I refer here to results obtained in table 5.8 (last column, first row).

To preserve comparability with other research on poverty, MZA perform a series of robustness tests. In particular, MZA include the set of controls from Dollar and Kraay (2002) where income of the lowest quintile is a function of average income, country fundamentals, social indicators, financial sector variable and region effects. The elasticity of the poor's income to average income is found to be stable (approximately unity) and robust to a wide range of specifications; see Dollar and Kraay (2002). This implies that the lowest quintile's income rises approximately one-for-one with income, and lays the basis for the "Growth is good for the poor" assertion.

3. As a heuristic point, India's export share of tea has reduced from 40 percent to approximately 13 percent between 1960 and 1992 (Indian Child).

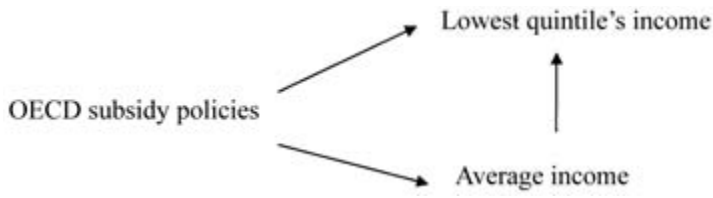

Fig. 5C.1 Possible attenuation of the regression coefficient of average income

Primarily because this finding is robust to many potential determinants of growth, it is surprising that the result attenuates (it is indistinguishable from zero) when MZA include the controls for OECDpolicies. The OECD policy variables themselves are by and large statistically significant, and they indicate that OECD support is more important than average income as a determinant of poverty. How shall we interpret this? Could OECD policies have sufficiently strong effects to wipe out the apparently robust relation between growth and poverty?

My intuition is pulled in two directions here.

On the one hand, in light of points A and B for result 1, instrumental variables estimates of table 5.8 could be biased, and the suggested pattern spurious. This is a plausible argument because the signs of the effects are contrary to what might be expected.[4]

On the other hand, even if the specific results of table 5.8 are inaccurate (because of, say, small samples), OECD policies could have strong enough effects to make growth irrelevant (or less important) for the lowest quintile's income. One reason is the sheer size of the rural population in less-developed nations, which the World Bank estimates to be 76 percent of the total population in poor nations (see MZA's table 5.1). Anecdotal evidence indicates that the rural population derives a large share of their income directly from crops; for example, in 2000 data, Mexican farmers indicated that 56 percent of their income was directly derived from corn and beans (MZA's table 5.11). In this way, a large fraction of income, for a large fraction of the population, depends directly on prices for the crops they grow. These prices affect not just the lowest quintile's income but average income as well (the share size of the rural population is well over 20 percent, as indicated above). A schematic for this scenario is shown in figure 5C.1.

What this schematic implies for regression analysis is that, where OECD policies and average income are both determinants of the lowest quintile's income and OECD subsidy policies are an important determinant of average income, the regression coefficient on the variable OECDpolicies could

4. The sums of the coefficients indicate that OECD policies lead to reductions in poverty or increases in lowest quintile's incomes, in all regions of the world except for Eastern and Central Europe.

simply denote the net effect (of the policies plus that of average income) on the lowest quintile's income. If OECD subsidy policies are negatively correlated with average income, as they should be for net exporters, the regression coefficient on average income will attenuate. This is one explanation for the finding in table 5.8.

However, MZA would also have to address net exporters and importers (result 1A) in order to precisely estimate whether OECD subsidy policies matter more than growth for poverty.

Conclusions

This paper is a good starting point in quantifying the impact of rich nations' food subsidies on poor nations' incomes. The importance of this topic is well understood in the policy literature, and MZA must be congratulated for analyzing a quite difficult and contentious policy issue. The empirical exercise raises challenges similar to those in other cross-country regression analyses, and it is further complicated by small samples. The usual interpretational issues arise, and causality is quite difficult to establish in the face of coincidental global and regional shocks.

Additional data could help resolve some of these problems. In particular, I would suggest the authors use larger samples to explore the premise that I outline in result 2: is a key determinant of the relation between lowest quintile's income and average income operating simply through policies such as the OECD subsidies?

The Mexico case study using microdata could potentially overcome many of these problems, so future work might focus on understanding the patterns of income growth and reduction using such micro-level data. This is an important area of research, so I look forward to reading more of the authors' research on the matter.

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II

Country Case Studies of Trade Reform and Poverty