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Do OECD Agricultural Policies Affect Poverty in Developing Countries?

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"The rural poor, growing maize for subsistence [see] their livelihoods destroyed by a flood of cheap US 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

Developed countries heavily subsidize their agricultural sectors. The magnitude of these subsidies is striking, compared to both the size of the agricultural sector in these countries, and incomes in poor countries. Transfers to agricultural producers from

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consumers and taxpayers as a result of policy[2] equaled $21,000 per farmer in the United States (US) and $16,000 per farmer in the European Union (EU) in 1998-2000 (OECD 2001). This is almost one hundred times greater than per capita incomes in the least developed countries[3].

These subsidies allow countries such as the United States, the EU and the UK to sell their agricultural products on world markets at prices that are below the cost of production[4]. Some argue that depressed agricultural prices disadvantage developing countries, and in particular, poor farmers who make up the majority of the population of developing countries and who depend on agricultural income for their livelihoods. Others argue that because many least developed countries, especially in Africa, are net importers of food, developed countries' subsidies, on net, benefit the poorest countries. Because of the diversity both within and among developing countries, the extent to which rich country subsidies translate into lower incomes for the rural poor in developing countries is an empirical question. Using a variety of empirical strategies, this paper seeks to understand the impact of these subsidies to agriculture on the poor in developing countries.

The debate over subsidies is one of the most contentious points in the ongoing negotiations for a new World Trade Organization agricultural trade agreement. A group of developing countries insists that the new agreement should require developed countries to dramatically reduce domestic support to agriculture. If the new agreement were to require OECD countries to reduce agricultural subsidies, would the poor benefit or be harmed?

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[2] Policy is measured by the producer support equivalent, a concept discussed in greater detail in later sections of this proposal,

[3] The most trade and production-distorting support is provided to milk, sugar, rice, beef and wheat - commodities that some developing countries may have a comparative advantage in producing (Messerlin 2002).[3]

[4] Some also argue that these subsidies increase the volatility of commodity prices since subsidy policies that are counter-cyclical with respect to domestic prices or shocks provide incentives for increased production when world prices are relatively low.

Because of the importance of this question, a large body of literature has been devoted to examining the potential impact of agricultural trade liberalization on developing countries using computable general equilibrium models (CGEs). For example, Beghin et al (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 about 20 percent. [5] While the magnitude of the estimates vary, agricultural trade liberalization is typically predicted to increase world commodity prices to the *overall* benefit of developing countries. Somewhat surprisingly, very little work has been devoted to documenting the impact of existing policies on poverty in developing countries. This paper is devoted to documenting the historical impact of these subsidies on poverty in developing countries.

We begin our analysis using a cross-country regression framework closely related to recent work by Dollar and Kraay (2003). Dollar and Kraay (2003) analyze the relationship between the per capita income of the poorest quintile and a host of explanatory variables including average income, various measures of domestic policy and other determinants of poverty. They find that the most important determinant of the income of the poorest quintile is the country's average per capita income and that little else seems to matter except the regional dummy variables. Our innovation is to include, as an explanatory variable, measures of rich-country subsidies to the agricultural products produced in the developing country in question. To our knowledge, this is the first use of this strategy to quantify the impacts of rich-country agricultural subsidy policies on poor countries. The results of this analysis can be used to assess the importance of OECD agricultural support in determining developing country poverty relative to developing countries' own policies.

An advantage of this approach is that we need to make a limited number of behavioral assumptions relative to the analysis of policy reform performed using CGE

[5] See for example, OECD 2001, ERS/USDA 2002, Trueblood and Shapouri 1999, Hoekman, Ng, and Olarreaga 2002 and Hertel et al (2003).

models, the overwhelming source of evidence on the impact of trade liberalization that is currently available[6]. A limitation of this approach is that it is subject to the usual criticisms leveled at cross-country regressions. Recognizing the limitations of this approach, we complement our work with a case study of poor Mexican corn farmers using data at the micro, individual farmer and household, level. We choose Mexico for several reasons. First, it is one of the most widely publicized cases about agricultural trade liberalization and rural poverty. Second, the case of Mexico raises a number of issues, such as the importance of domestic policy, that can help to inform our cross-country analysis. Finally, we choose Mexico because a rich, nationally representative and previously unexploited dataset is available. We follow our case study with a discussion of ways to improve upon both the cross-country analysis and the case study, and with suggestions for future work in this area.

Our data on agricultural subsidies come from the OECD and cover the years 1982 to 2000. Our measures of own country agricultural production come from the Food and Agricultural Organization. Our measures of poverty and own country policies are identical to those used by Dollar and Kraay (2002). The poverty measures come originally from Deininger and Squire and are based on household survey data. We also add to these data a measure of variations in weather obtained from the National Oceanic and Atmospheric Administration. 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, including 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.

Preliminary results from our cross-country regressions suggest that the relationship between OECD policy and developing country poverty appears to be non-

[6] Concerns about the predictive power of CGE models are at least as great as concerns about the usefulness of cross-country regression analysis. These models calibrate a model of the economy to base year data and simulate the effect of policy changes by making assumptions about functional form and parameter values. Their predictive value may be limited (Kehoe 2003, Panagariya 2004, Panagariya and Dattagupta 2001).

linear. At low levels of protection, OECD policy is weakly positively correlated with poverty in developing countries. Beyond a certain point, increased levels of protection are weakly associated with reductions in poverty. These results are consistent with the notion that OECD subsidies may have different effects on poverty depending upon whether countries are net importers or net exporters of the crops subsidized by the OECD countries. However, because our sample size is small and because measurement error is likely to be severe, we should interpret this evidence with caution. This work is probably best thought of as a first step in thinking about ways to quantify the effects of these subsidies on poverty. Future work that studies the underlying mechanisms at work may prove even more fruitful since measuring commodity prices and trade shares of commodities is likely to be less demanding than measuring poverty.

The evidence from Mexico suggests that even if our data were perfect, we may not find a relationship between OECD subsidies and poverty in developing countries in a cross-country regression framework. The income that the poorest corn farmers in Mexico derive from corn farming did appear to drop substantially between 1991 and 2000. However, the *total income* of these corn farmers remained relatively stable. The data suggest that this is because the poorest corn farmers received substantial transfers. While some of these transfers were in the form of remittances, the majority of the transfers came from the Mexican government through programs like PROGRESA and PROCAMPO.

The remainder of this the paper is organized as follows: Section 2 provides some background on support for agriculture in the OECD. Section 3 describes in more detail the data and estimation strategy used in the cross-country analysis and presents these results. Section 4 describes in more detail the data used to study the case of Mexican corn farmers and presents these results. Section 5 discusses the limitations of our analyses and makes some suggestions for future work. Section 6 concludes.

2. Background

Agricultural support policies in developed countries are designed to raise average farm income and reduce the variability of producer prices and farm income (Gardner

2003). Market price support, defined as policies that create a gap between commodity-specific producer prices and border prices in developed countries (e.g., quotas and tariffs or guaranteed minimum prices), and policies that make payments to farmers based on output of specific commodities both provide incentives for production at levels higher than would be chosen in the absence of support. For major producers of the commodity in question this effect can be large enough that equilibrium world prices are affected. The OECD (2001) estimates that price and output support increased the US wheat producer price by an average of 15 percent for the period 1986-2002, years in which the US accounted for about 10 percent of global wheat production (USDA 2003). The output response associated with this policy-induced production increase (and analogous increases in other rich countries) lowers world wheat prices by about 5 percent, according to CGE model results (Anderson et al. 2000).

EU producer prices for many commodities are well above world prices as well. In 1999-2000, the EU domestic sugar price was 250 percent of the world price, the maize price was 150 percent of the world price, as was the price of whole milk powder (ERS/USDA 2001).

Policies that reduce the variability of producer prices include price floors or "deficiency payments." For major producers, the reduced variability in producer prices created by policy will be transmitted to world markets in the form of greater price variability.[7] In the case of wheat, the OECD (2001) estimates that price and output support reduced the standard deviation of the US wheat producer price by an average of 27 percent for the period 1986-2001.

Hypothesized links between depressed and volatile world prices for commodities and poverty in developing countries result from the fact that (1) agriculture accounts for a relatively large fraction of GDP in poor countries, (2) many productive resources,

[7] Baxter and Kouparitsas (2000) show that developing country non-fuel commodity exporters have terms of trade volatility of about 12 percent per year, while the volatility of the terms of trade of developed country non-fuel commodity exporters is about 9 percent. For manufacturing exporters, developing and developed

including both labor and land are devoted to agriculture in rural areas of developing countries, and (3) rural incomes in poor countries are generally below incomes in urban areas. That is, a dollar earned in the rural sector reduces poverty more than a dollar earned in the urban sector (Timmer 2000). This is consistent with empirical evidence in the development literature that, for a given level of income per capita, a higher share of GDP originating in agriculture contributes to a more equal distribution of income (Kuznets 1955 and Cherney and Syrquin 1975).

Table 1 illustrates some stylized facts about the relative importance of agriculture in poor countries. Agriculture contributes less to GDP among OECD countries than in low and middle income countries (countries with incomes below $9,000) or the least developed countries (as defined by the United Nations). In the least developed countries, 76 percent of the population lives in rural areas, and are mostly engaged in agriculture; a larger fraction of arable land is devoted to cereal production in poor countries. However, agriculture value added accounts for only 33 percent of GDP. This suggests that rural incomes are lower than urban incomes on average in the poorest countries.

To the extent that the impacts of rich-country agricultural support policies on world prices translate into reduced agricultural profits in poor countries, rural incomes fall and poverty may increase. This claim should hold for both export commodities such as sugar, rice, cotton, and wheat (in the case of Latin America), and food crops (e.g., maize, wheat, and rice), to a lesser extent, due to offsetting effects on food prices for net food purchasers.

Depressed world prices for export commodities caused by OECD agricultural support policies could affect incomes of the poor if border price changes are transmitted to producer prices. Lower producer prices for net sellers of agricultural products would result in lower profits and rural household income. On the other hand, lower prices of these same products for net consumers of these items would result in increased real

country exporters exhibit about the same terms of trade volatility (though developing-country manufacturing net exporters is a select group).

income. These are the most direct mechanisms by which OECD agricultural subsidies could affect poverty.

The effect of depressed border prices as a result of rich-country support for domestic agricultural producers could be small relative to the effect of domestic African policies on producer prices historically. Because developing countries have traditionally discriminated against agriculture, most notably through government control of marketing and exporting, direct transmission of world prices to developing country producer prices has not historically been assured (Bates 1981, Anderson 2003). Previous evidence on market liberalization in Africa suggests that reforming domestic policies can result in producer prices reaching as much as 70 percent of border prices (Akiyama et al. 2003). FAO data suggests that in only about 10 percent of Sub-Saharan African countries did the producer price for sugar equal 70 percent of the International Sugar Agreement price in the period 1980-2000. This suggests that, in the period under consideration, most African sugar sectors were not liberalized and that producer prices may not be responsive to changes in border prices.

Even if changes in border prices are not fully transmitted to producer prices, depressed border prices for agricultural export commodities can affect agricultural profits because border prices are used by governments when prioritizing public investment decisions (Timmer 1995). Since border prices are "too low," as a result of rich-country subsidies, too little rural or agricultural public investment is made relative to the level that would be chosen in the absence of OECD subsidy policies. This holds agricultural profits and rural incomes down.

Reduced agricultural profits, whether transmitted through producer prices or inefficiently low levels of public investment, may have several secondary effects that reduce economy-wide incomes and/or increase poverty. First, rural poverty may be linked to high population growth rates (Dasgupta 1993, Timmer 1994, 2000). Second, lower agricultural profitability and rural household incomes may reduce investments in health and human capital, both of which have been hypothesized to be important for

economic development (Fogel 1994, Bloom and Sachs 1998, Barro 1998). These investments may directly contribute to increasing agricultural labor productivity, which may be a key determinant of the timing and extent to which labor can move from agriculture to the manufacturing or urban sector (Gollin, Parente, and Rogerson 2002) where productivity and incomes are higher. Third, higher agricultural profits should stimulate rural consumer-demand linkages (Binswanger and Lutz 2000) and rural non-farm economic activity. Too few linkages will be generated if agricultural profits are depressed as a result of OECD agricultural subsidies. Finally, there is some evidence that increases in domestically produced food supplies increase average caloric intake per capita, controlling for changes in income per capita, the income distribution, and food prices (Timmer 1992).

Lower world prices for food/ staple commodities caused by OECD agricultural support policies may benefit developing countries that are net food importers. Table 2 shows that for many food and staple crops, leading importing countries (excluding food aid recipients) are lower or middle income countries (with the exception of Japan). Developing country exporters that compete with the OECD usually include China, Brazil, and India, but few African countries, with the notable exception of cotton exporters. While most developing countries are food importers, their experience is diverse. As of 1999, two-thirds of least developed countries (according to the UN classification) were net importers of both food and agricultural products. However, 14 of the least developed countries were net food importers and net agricultural exporters (Valdes and McCalla 1999). As of 2000, all African countries were net importers of wheat. On the other hand, in the period1993-2000 several very poor countries are annual net exporters of maize on average, including Uganda, Zimbabwe, and Ethiopia. Table 3 shows that an even larger set of poor countries were self-sufficient in maize in this period including Pakistan, Benin, Nepal, and Mali. This diverse experience suggests that it is an empirical question whether lower commodity prices provide net benefits for the poor in developing countries.

Finally, volatile world prices for both staple and export commodities caused by OECD agricultural subsidies could affect incomes of the poor because price stability is

linked to increased efficiency in investment decisions at both the national and household levels (Ramey and Ramey 1995). Reduced volatility may be especially valuable to the poor who have limited means to ensure against income shocks (Timmer 2000).

3. Cross Country Analysis

3.1 Empirical Strategy

3.1.1 Measuring poverty

Direct measures of poverty are an obvious choice for our dependent variable. We might then estimate an equation using the income/ consumption expenditure of the lowest quintile as a dependent variable (Dollar and Kraay 2003) or the fraction of the population below some pre-specified country-specific poverty level that rises with mean consumption (Chen and Ravallion 1997). This is a headcount measure of poverty. Another headcount measure of poverty uses a single poverty line for all countries, such as the common "dollar a day" cut-off. This definition of poverty captures changes in absolute poverty as opposed to relative poverty. None of these measures of poverty is obviously more appropriate for our purposes; we present results using the income of the lowest quintile as a dependent variable to make our work comparable to previously published results.

Potential concerns relating to the direct measures of poverty that are currently available are well known. The best data available on income/consumption expenditure distribution is very noisy and coverage for developing countries, especially in Africa, is fairly low. This is especially problematic in our case because the OECD subsidy data covers the period 1982-2002. This is somewhat shorter than the time period usually considered in cross-county regressions.

3.1.2 Measuring support for agriculture in rich countries

Since 1987 the OECD has tracked support for agriculture in member countries using the Producer Support Estimate (PSE). The USDA calculated the PSE by

commodity and country for the period 1982-1990. The PSE is the most commonly used measure of domestic support for agriculture. The PSE measures the annual monetary value, measured at the farm-gate, of gross transfers from consumers and taxpayers to agricultural producers arising from policy measures to support agriculture. This includes domestic subsidies to agriculture, barriers to market access, and export subsidies. It does not include food aid. No distinction is made among transfers according to their nature (e.g., whether payments are tied to historical production or current production), objectives (e.g., whether payments are intended to raise household incomes or crop revenues), or actual impacts on farm production or income (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 international transportation costs (called "natural protection" by the OECD), quality differences, marketing margins or internal transportation costs.

The magnitude of the PSE in monetary terms for a given country and commodity is partially determined by the scale and mix of agricultural production in that country. Thus, the PSE for a commodity is usually presented as a fraction of the value of total gross farm receipts for the commodity. This is referred to as the "percent PSE" And measures the fraction of receipts attributable to policy. Economy-wide percent PSE is the ratio of total gross transfers to agricultural producers divided by total gross farm receipts.

The percent PSE has several potential shortcomings when considering how it might be used in econometric analysis (Wise 2004). The percent PSE varies over time for reasons unrelated to policy change because of (1) exchange rate fluctuations unrelated to the agricultural sector, (2) exogenous shocks to world commodity markets, (3) weather events and other domestic shocks. To some extent, this means that the percent PSE in a given year is a noisy measure of agricultural support. This issue can be treated using instrumental variables techniques. Other measures of support that are intended to measure market distortion may also be used for econometric analysis.

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. As calculated by the OECD, the PSE is made up of several categories of transfers that have differing impacts on production, consumption, and trade. Direct measures of distortionary impacts may be more informative, for both policy analysis and econometric estimation, than the PSE.

The OECD defines the producer nominal protection coefficient (NPC) 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 any 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. If a country's PSE were to rise while the NPC were reduced, production and trade-distorting effects of agricultural subsidy policies may fall (though transfers from taxpayers and consumers to producers rises). For our purposes, it will be important to account for this possibility.

Another measure of support calculated by the OECD that may be relevant to this research 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 calculates support independent of exchange rate effects. When the NAC is equal to one, receipts are entirely derived from the market.

The measures of support for agriculture are highly correlated within countries, and generally fairly highly correlated across countries, both in aggregate and by commodity. In the current version of this paper, we measure support for agriculture in the OECD by commodity using the NPC.[8] This support measure captures what are potentially the most production and trade distorting policies, and is not influenced by so-

[8] Future revisions should investigate other measures of support for agriculture as regressors.

called natural protection or income support policies. Figure 1 reports the NPC by commodity for the OECD as a whole for the periods 1986-88 and 2000-02. Milk, sugar, and rice receive the highest levels of production-distorting support.

3.1.3 Which OECD Policies are Relevant to Which Developing Countries?

In order to estimate an equation in which country level measures of poverty are the dependent variable, we need to identify which OECD support policies are relevant to country *i* in period *t*. To do this, we match support policies to countries according to countries' historical production levels for all crops that receive support in the OECD countries. That is, for a non-OECD country *i*, we identify its production of the following products in 1970 using data from FAO: wheat, maize, rice, other grains, oilseeds, sugar, milk, beef, sheepmeat, wool, pigmeat, poultry, and eggs. These are the products for which the NPC is calculated by the OECD and USDA. We also identify production levels of vegetables, roots and tubers, fibers, coffee, cocoa, and fruits in 1970 and assume that these products receive an NPC of zero in the OECD. [9]

We create the variable $OECDPOLICY_{it}$ 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. [10] This approach should avoid the problem that current production choices are partly determined by current subsidy levels. In addition, as previously discussed, some African countries have severely discriminated against agriculture in the past: it will be important to consider their potential exports (as

[9] 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 mega-tariffs for these products. For example, WTO bound tariffs reported by the US include 19 tariffs of 100 percent or higher. Only six of these are for products for which we assume an NPC of zero and these are minor products in the nuts and tobacco commodity group.

[10] 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 it exists.

measured by their sectoral structure in 1970) rather than their actual exports or production.[11]

Appendix table A.1 summarizes the values of $OECDPOLICY_{it}$ for the country-year observations in our sample. This table shows all developing country country-year observations for which poverty data is available in Dollar and Kraay's data set for the period 1982-1999 and calculated values of $OECDPOLICY_{it}$.[12] The data set has reasonable geographic coverage; 30 percent of observations are from Sub-Saharan Africa, and 30 percent are from Latin America. Eastern Europe is relatively under-represented because historical agricultural production data for the countries of the Former Soviet Union is not available. However, as previously noted, we are left with a small sample of only 143 observations. Appendix table A.2 provides a definition of the variables used in our analysis as well as data sources.

African countries, which have a relatively large fraction of historical agricultural production in roots and tubers and coffee and cocoa tend to have low levels of $OECDPOLICY_{it}$. Small countries that import essentially all their food needs also have low values of $OECDPOLICY_{it}$. Conversely, rice producers, have high values of $OECDPOLICY_{it}$. Grain exporters, such as Brazil, tend to have values of $OECDPOLICY_{it}$ that fall in the middle of the distribution. These patterns are not correlated with income in a simple fashion.

We calculate $OECDPOLICY_{it}$ using the values of the OECD NPC as discussed in the previous section. If this variable were constructed using the OECD NAC or PSE, the patterns we identify in the data would be very similar to those found here because the support measures are correlated across commodities. Table 4 provides simple correlation

[11] An instrumental variables approach could also used to determine how subsidies and countries are matched. We can predict a developing country's leading crop in 1965 (or another appropriate year) using a multinomial model of ordered choice (Greene 1997) and a series of explanatory variables that determine in which crops a country is likely to produce. These may include climatic and geographic characteristics, as well as factor endowments. Care must be taken account for the fact that factor endowments may also be structural determinants of income inequality (Spilimbergo, Londono, and Szelely 1999).

[12] We exclude Turkey and South Korea from the data set used for econometric estimation because they are members of the OECD.

coefficients to demonstrate this; there is a strong positive correlation between the different measures of $OECDPOLICY_{it}$.

To investigate separately the effects of rich-country support policies on products that developing countries export and products that they import, future extensions might restrict attention to a country's mix of agricultural exports in 1970, as opposed to their mix of commodity production or take an average of commodity production over the period 1970-75 to develop weights. The same approach outlined above could then be applied. We discuss this and other possibilities in greater detail in section 5 of this paper.

3.1.4 Estimation

Our framework for analysis presented in equation (1) is based on Dollar and Kraay (2003) and modified to include our measures of OECD policy and weather:

$$(1)\ POVERTY_{it} = \acute{a} + \boldsymbol{X}`_{it}\hat{a}_1 + \hat{a}_2 INCOME_{it} + \tilde{a}_1 OECDPOLICIES_{it} + \tilde{a}_2 WEATHER_t + \mathring{a}_{it}.$$

In this equation, the dependent variable is a measure of poverty, and the independent variables include a set of control variables ($\boldsymbol{X_{it}}$), a measure of average income, a measure of the subsidy that may affect poverty in country i at time t, and a measure of global weather shocks that affect food production (e.g., the El Nino-Southern Oscillation). Alternative specifications may include time fixed effects or a linear time trend as another means of accounting for global weather patterns that impact agricultural output.

Since the hypothesized effect of support policies on poverty is through the channel of world prices, this is essentially a reduced form equation in which world prices for the relevant commodity are a function of (changes in) OECD support policies for that commodity, global weather shocks, and a time trend (which should capture the evolution of agricultural technology and preferences over time). The contention that this is a reasonable approach must be investigated empirically before the equation of interest is

estimated.[13] In what follows, we discuss an instrumental variables strategy to account for the fact that world prices and rich-country support levels are endogenously determined.

If the proposed regression amounts to a reduced form, another obvious approach would be to estimate a first-stage regression in which a country's terms of trade is the dependent variable and the set of explanatory variables includes relevant agricultural support measures. The coefficient on country *i*'s predicted terms of trade at time *t* could then be estimated in a variant of equation (1).[14] Work on Sub Saharan Africa by Deaton and Miller (1989) suggests that volatility in commodity prices is closely correlated with volatility of GDP. Since average income and income of the poor are closely correlated, this suggests that commodity prices might well be closely correlated with the income of the poor. Instrumental variables would still be needed to pursue this approach since support policies and terms of trade are endogenously related.

One possible virtue of the reduced form specification is that the coefficient on the variable of interest (relevant rich-country support policies) is more directly comparable to the coefficient on other control variables (e.g., domestic policies in developing countries or aid levels) in this specification. In this preliminary version of this paper, we focus on this approach.

We do not aim to break new ground with our choice of control variables in the vector $\boldsymbol{X_{it}}$. We include regional fixed effects and interact these fixed effects with our measure of OECD agricultural support policies. We test the robustness of our findings by investigating whether controlling for the structure of agricultural production affects our

[13] Global weather trends are almost certainly important determinants of world commodity prices. Brunner (2002) shows that the El Nino-Southern Oscillation accounts for about 20 percent of commodity price inflation movements in recent years. Other important determinants of commodity price movements may include global GDP growth, and price levels, as well as appropriate lags (Deaton and Laroque 2003).

[14] Sarel (1997) presents evidence that improvements in terms of trade are significantly negatively correlated with changes in income inequality in an OLS regression. He argues that since "policies can rarely affect directly terms of trade dynamics," the implications of this finding are limited. Policy changes in the OECD can directly affect the magnitude and nature of agricultural subsidies. 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.

estimation of the qualitative relationship between OECD agricultural policies and developing country poverty by including as control variables the fraction of production in tropical crops and arable land per capita.

The inclusion of control variables allows us to examine the question of whether domestic policies are more important that policies of other countries as correlates of income of the poor by including in some regressions those variables that Dollar and Kraay (2003) identify as potentially important measures of domestic growth-promoting policies. We follow their approach by entering these values as five-year averages when possible. The variables included are: exports plus imports as a share of GDP, one plus the inflation rate, the stock of secondary education, the rule of law index as of 1997-1998, government consumption as a share of GDP, and the ratio of deposit money to total bank assets. Our results should be comparable to those presented by both Dollar and Kraay and Barro (2002). Further investigations could include measures of aid as a fraction of GDP if we wish to compare the effects of aid and agricultural support policies on poverty.

To determine if there is econometric evidence of a relationship between support for agriculture in rich countries and the incomes of the poor in developing countries we begin by estimating a series of regressions that are closely related to the specification in equation (1). The equation that we estimate is:

$$(2)\quad ln(yp)_{it} = \acute{a} + \boldsymbol{X}`_{it}b_1 + b_2 ln(y)_{it} + d_1 OECDPOLICY_{it} + d_2 OECDPOLICY_{it}^2 + cWEATHER_t + e_{it},$$

where *yp* is average income in the first quintile, *y* is average income, *OECDPOLICY* is calculated as explained in section 3.2.4, and weather shocks are measured as the Southern Oscillation Index anomaly, a continuous variable measuring El Nino intensity. This specification implies a relationship between the log of per capita income in the first quintile and *OECDPOLICY* equal to $d_1 + 2d_2 OECDPOLICY$.

3.1.5 Complications: Endogeneity and Measurement Error

There is both theoretical and empirical evidence that income inequality affects income per capita growth rates and therefore the level of average income per capita. Therefore, to consistently estimate equation (1), we need to find an instrument for average per capita income. Plausible instruments for income per capita include lagged growth rates (Dollar and Kraay 2003), rainfall levels (Miguel, Satyanath, and Sergenti 2003), or the proportion of a country's area that receive five or more frost days per month (Masters and McMillan 2001). The current version of this paper instruments for income using growth rates of average income over the preceding five-year period following Dollar and Kraay.

Realized subsidy levels in any year are partially determined by exogenous shocks to supply (e.g., local weather shocks) and domestic demand. This can be treated as measurement error in the support variable when measured by the PSE or other indicators of support. Using OLS, this noise associated with the $OECDPOLICY_{it}$ will bias our estimated coefficients.

Realized subsidy levels are also determined by world price levels. As shown earlier, when world prices are low, support levels increase. The endogenous relationship between world prices and realized subsidy levels would also bias the coefficient on $OECDPOLICY_{it}$ if we estimate equation (2) using OLS.

Instrumental variables techniques can be used to account for attenuation bias and endogeneity. A valid instrument for current support policies must be correlated with support levels, but not directly correlated with world commodity price levels. Variables that predict whether products receive support, as opposed to actual levels of support, should be valid instruments as should variables that predict effective producer price floors, as opposed to realized gross receipts. We use previous findings on the political economy of agricultural protection to identify particular variables to serve as instruments.

Variation in producer protection across commodities and over time within developed countries can be modeled as the result of efficient redistribution (Gardner 1987, Jeong, Bullock, and Garcia 1999) or inefficient redistribution (Acemoglu and Robinson 2001). Both models predict that sectors or subsectors with fewer producers will receive greater levels of trade-distorting support. Gardner shows that commodities that are grown in fewer US states receive higher levels of protection, as do commodities for which output per producer is high. [15] Costs of political organization for these producers should be relatively low, and lobbying efforts should be relatively cost-effective.

Support levels are also influenced by the timing of elections and budget cycles, which are typically exogenous to world commodity prices. The timing of US Farm Bill renewal and EU budget years are fixed by law. These years are often occasion for farm policy reform. Gardner (2003) documents how the US Clinton administration and the Congress increased support for agriculture through emergency spending bills at the time of the 2000 elections, softening the impact of the relatively reformist 1996 Farm Bill. Adams (1999) argues that the voting behavior of the French electorate in presidential elections explains outcomes in Common Agricultural Policy changes in the 1980s and 1990s. We include as instrumental variables dummies for whether it is an election year in the US, France, or Japan and for whether it is the end of a budget cycle in the EU.

We develop additional instrumental variables for $OECDPOLICY_{it}$ using data on production patterns of protected crops in the the US and EU from USDA and Eurostat. We assemble data on output per farm by commodity and the geographic concentration of production in the US and EU for the period 1982-2000. To match this data to developing countries, we take a weighted average for each country-year observation exactly as we do when calculating $OECDPOLICY_{it}$. We take the weighted average of output per farm and production concentration by commodity in the US and EU, where weights are defined by the share of each product in the developing country's agricultural output in 1970.

[15] In contrast, changing geographical patterns of production of a particular commodity can create divergent interests among producers, raising the cost of lobbying. High rates of growth of output can also increase the cost of political organization, particularly if support policies are tied to production ceilings or acreage set-asides. Data to capture these effects will be included in the final version of this paper.

Output per farm by commodity is available for the two regions from census and farm survey data. For the US, agricultural census data on the number of farms producing the following crops are available at five-year intervals: beef cows, milk cows, hogs and pigs, chickens for eggs (layers, three months old or older, 20 weeks old or older 2002), chickens for meat (broilers), corn for grain or seed, wheat, oilseeds (soybeans, canola and rapeseed), rice, sugar (beets and cane) and other grains (sorghum, barley, buckwheat). These categories are matched to the categories for which the NPC is calculated. Similar data is available for the EU from Eurostat farm surveys. At two-year intervals, Eurostat provides data on the number of farms in EU member countries for the following commodities: wheat, rice, maize, other grains (rye, barley, oats), sugar beets, cattle, dairy cows, sheep, pigs, broilers, laying hens, and pulses (includes oilseeds).

We define geographic concentration of production as a Herfindahl index, the sum of squares of national acreage or number of livestock (by crop) in the ten leading states (for the US) or 5 leading countries (in the EU). For rice in the EU, we define geographic concentration as the fraction of production in Italy, the leading country, since it is produced in fewer than five countries. The geographic concentration of production data is available annually for the US from the National Agricultural Statistical Service and biannually for the EU. Additional details on data sources are presented in the appendix table A2.

3.2 Results

Summarized in table 5 are the results of estimating equation (2) using OLS. Like Dollar and Kraay, we find a coefficient on average income that is consistently insignificantly different from 1 across all specifications. The coefficient on *OECDPOLICY* is insignificant if the variable is entered linearly; when a quadratic relationship is allowed, the level term is negative and significant and the squared term is positive and significant. The magnitude of the coefficients on these two terms are fairly stable across specifications in which regional fixed effects are included (column 3), and

controls are added to capture aspects of the domestic agricultural sector (columns 5 and 6).

Our OLS regression results suggest that agricultural support policies in rich countries are negatively correlated with incomes of the poor at low levels of *OECDPOLICY,* but positively correlated with incomes of poor at higher levels of *OECDPOLICY.* Using the point estimates in the regression in column 3, for all values of income in our sample, the point estimate of the derivative of average income in the first quintile with respect to *OECDPOLICY* is negative for values of *OECDPOLICY* below the sample average of 1.6 and positive for values of *OECDPOLICY* above that level. For all values of *OECDPOLICY* in the sample, the point estimate of the second derivative of income with respect to OECD policy is positive. This result is inconsistent with the simple hypothesis that support for agriculture in the OECD has negatively affected the incomes of the poor in developing countries, controlling for average income levels. Figure 2 shows the semi-elasticity of average income in the first quantile with respect to *OECDPOLICY* implied by the coefficient estimates in the regression in column 3. Increases in agricultural support are negatively correlated with incomes of the poor at low levels, but increasing *OECDPOLICY* eventually increases incomes.

We allow the relationship between *OECDPOLICY* and income of the poor to vary across regions in the regressions in columns 4 through 6 because of concerns that the agricultural production mix is largely determined by geographic constraints. When we interact the variable *OECDPOLICY* and the regional fixed effects, the coefficients on these interaction terms suggest that *OECDPOLICY* is particularly negatively correlated with lower incomes of the poorest quintile in Sub-Saharan Africa. While the shape of the elasticity estimate is similar to that in Figure 2, the results of the regressions in columns 4 through 6 imply that in is shifted downwards in the case of Sub-Saharan Africa. This is suggestive evidence that agricultural support in the OECD may have been particularly detrimental for this region.[16] This is consistent with the finding that initial increases in

[16] Note that the coefficient on the Sub-Saharan Africa regional fixed effect is consistently positive and significant. This may reflect the fact that income inequality is relatively lower in this region compared to East Asia and the Pacific.

OECDPOLICY have larger negative implications for incomes of the poor controlling for average incomes than later increases; as discussed in section 3.2.3, the Sub-Saharan African countries in our sample have relatively low values of *OECDPOLICY.*

Though not reported here, there is also evidence that agricultural support in the OECD may have been particularly detrimental for historical food exporters. When we interact *OECDPOLICY* with net food exports per capita in 1970, and include this variable in the basic regression specification, the coefficient on this interaction term is negative and significant. Future versions of this paper should investigate whether agricultural net exporters and food net exporters differ qualitatively from net importers of food and/or agriculture.

The magnitude of the effect of *OECDPOLICY* on incomes of the poor implied by the regression coefficients in table 5 is fairly small compared to the estimated effect of an increase in average income. The estimate of the income elasticity of income of the first quintile is equal to one in these regressions. Dollar and Kraay interpret this finding as indicating that average incomes in the first quintile rise exactly proportionately with average incomes. By contrast, using the coefficient estimates in the regression in column 3, for about 70 percent of our same we predict an elasticity of income of the first quintile in the range of -0.2-0.0.

The parsimonious regressions in table 5 present coefficient estimates that are vulnerable to omitted variable bias and endogeneity concerns. To address these considerations, we investigate an IV estimation strategy in which we instrument for *OECDPOLICY* using the political economy variables discussed in section 3.2.5 and in which we instrument for log average income using growth over the preceding five years following Dollar and Kraay (2002). Table 6 presents the first stage regression with the excluded exogenous variables and the SOI anomaly measure of global weather shocks for *OECDPOLICY.*

The signs of the coefficients in this regression are largely as expected. The coefficient on the SOI anomaly is negative. When the SOI is higher than average, world commodity prices are higher (Brunner 2002) and thus measured support in the OECD is lower. Higher output per farm in the US or EU is correlated with higher support levels, as is greater geographic concentration of production in the US. There is no significant relationship between the concentration of agricultural production in the EU and support levels, contrary to the prediction that would be consistent with Gardner's (1987) findings and model. The election year variables are mostly insignificant, though support levels do appear to be higher in French election years. The negative coefficient on the EU budget year variable is expected; recent EU budget years have been occasions for CAP reform.

The F-statistics of these regressions are fairly low suggesting that we may have weak instruments. Later versions of this paper should pursue the inclusion of additional instruments.

Table 7 reports the results of the instrumental variables regressions. In the first column we instrument for log average income only. In the second column we also instrument for *OECDPOLICY.* The results in column 1 are very similar to the OLS results presented in Table 5. The coefficient on log average income is insignificantly different from one and the relationship between *OECDPOLICY* and log income per capita for the first quintile is not linear and initially negative. The equation in column 1 is exactly identified and so the validity of the instrument cannot be tested.

When we instrument for *OECDPOLICY,* the magnitude of the point estimate of the coefficients on the *OECDPOLICY* variables increases in absolute value. However, these point estimates are imprecisely estimated. This is consistent with the potential for weak instruments that we identified in the discussion of the first-stage results in table 3. A test of over-identifying restrictions does suggest that the conditions for a valid instrument are satisfied. The value of the Hansen's J statistic is 0.932 and we cannot reject the null hypothesis that the instruments are correctly excluded from the main equation at conventional levels of significance.

To determine whether to proceed using the IV or OLS specification, we perform a Hausman test. We cannot reject the hypothesis that OLS provides consistent estimates of the coefficients in column 2 of table 4 (the value of the Chi-squared test statistic with 14 degrees of freedom is 3.70 with a P-value of 0.01). Thus, we proceed to investigate the relative importance of domestic and foreign policies for the income of the poor instrumenting only for log average income. Future versions of this paper should improve on the IV estimation strategy.

Table 8 tests the robustness of the relationship identified between *OECDPOLICY* and incomes of the poor by including a series of independent variables as controls in the basic regression. We introduce the variables that Dollar and Kraay hypothesized to be potential determinants of economic growth to investigate whether these variables may be more informative about the income of the poorest quintile than *OECDPOLICY,* controlling for average income and regional fixed effects.

As shown in table 8, few of the variables that are positively correlated with economic growth seem disproportionately correlated with incomes of the poor. This is consistent with the results reported by Dollar and Kraay. As each of the control variables are included, the magnitude of the coefficient estimates on the variables that are related to *OECDPOLICY* remain largely unchanged. The coefficient estimates on the level and square term remain significant in almost all specifications. Using this approach, other countries' policies appear at least as important as domestic policies as covariates of income of the poor.

These findings and the non-monotonic elasticity estimate suggest that the next step in the cross-country regression exercise should be to investigate the relationship between *OECDPOLICY* and the terms of trade and food trade shares of developing countries. Both the data discussed in section 2 and the suggestive evidence that Africa may be disproportionately harmed by OECD agricultural support policy suggest that further understanding of this mechanism is needed. To do this, we must identify a

successful econometric strategy to treat the endogeneity between *OECDPOLICY* and country's terms of trade and export shares.

4. The Case of Mexican Corn Farmers

In 1994, Mexico signed the North American Free Trade Agreement (NAFTA) which, among other things, liberalized the trade of corn, a key strategic and highly protected crop for Mexico. Economic analysis at the time (Levy and van Wijnbergen, (AER, 1995) and de Janvry, Sadoulet and Gordillo, (World Development ,1995)) predicted that corn trade liberalization would be beneficial for small-scale subsistence farmers, who were mostly net consumers of corn. However, post-NAFTA, corn trade liberalization has been widely criticized in the popular its' supposedly detrimental effects on poor farmers and rural poverty in Mexico. It has also been blamed for increased migration to the U.S. ("Why Mexico's Small Corn Farmers Go Hungry "(NY Times, March 3, 2003), "Trade liberalization seen to fail Mexican farmers, environment" (FT Asia, Nov.9,2000),"NAFTA de-regulation of corn markets has hurt Mexican farmers"(Mercantil.com , Nov.25,2000)). As recently as January, 2003 tens of thousands of Mexican farmers descended on Mexico City to protest the free importation of corn from the US, the latest in a series of protests by Mexican farmers since NAFTA was signed. What, in the end, was the impact of corn trade liberalization on farmers in Mexico? In this section of the paper, we study how different types of rural dwellers and in particular, poor corn farmers, reacted to the changes brought on by the liberalizations that took place during the 1990s.

Somewhat surprisingly, very little work has been done to assess the ex post impact of NAFTA on these poor corn farmers. An exception to this is a paper written by Alejandro Nadal for Oxfam Great Britain and the World Wildlife Fund International called "The Environmental and Social Impacts of Economic Liberalization on Corn Production in Mexico" (2000). Nadal finds that, in the face of falling corn prices, small corn farmers maintained and even increased their production levels of corn. He claims that the drop in corn prices reduced incomes of the poor corn farmers both directly and indirectly through a reduction in off farm employment opportunities.

Though Nadal's work is an important first step and provides a rich discussion of the policy environment and related issues, it suffers from two serious shortcomings. First, Nadal bases his generalizations on a sample of 38 corn farmers. Second, these farmers were interviewed in 1998 and no attempt was made to collect data concerning income and employment prior to 1998. In fact, in a section of the paper that describes the structure of the corn sector in Mexico, Nadal uses data from a 1991 census on the grounds that no accurate information is available about the structure of the corn sector before and after the price reductions brought about by NAFTA.

Fortunately, detailed micro data on corn farmers is collected by INEGI (the National Statistical Agency of Mexico) and covers years both pre and post NAFTA. Our approach to the case study consists of using this micro data to track welfare measures of corn farmers (both small and large) over time. In what follows below, we first provide some background on this issue and establish what happened to Mexican corn imports and the producer price of corn in Mexico over the period 1990 to 2002. This is followed by a discussion of the policy environment in Mexico during this same period. We then describe the datasets that are available for assessing the impact of the price changes on the welfare of Mexican corn farmers. This is followed by a set of figures that track changes in real income and sources of income for the various classes of corn farmers over the period 1991 to 2000.

4.1 U.S. Corn Subsidies, NAFTA and Mexican Corn Farmers

Corn is one of the products heavily subsidized by the United States. Prior to NAFTA, Mexico imposed high tariff barriers on imported corn. As a result of NAFTA, these tariffs were removed. Though causality is difficult to establish, the evidence suggests that NAFTA may have been responsible for increased US corn exports to Mexico and a drop in prices paid to Mexican corn producers. Figure 3 shows that the amounts of both yellow and white corn exported to Mexico increased substantially after the signing of NAFTA. 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. The data in Figure 3 makes it clear that the U.S. exports both types of corn to Mexico.

Figure 4 shows that the average price paid to producers of corn in Mexico dropped significantly between the period 1991 and 2000. Part of the drop in Mexican producer prices has to do with the drop in the world price of corn. Figure 4 clearly shows that prior to NAFTA, Mexican corn farmers were heavily subsidized. Once NAFTA came into effect, the producer price of corn in Mexico closely follows the international reference price of corn.

Many argue that the flood of U.S. corn into Mexico and the drop in producer prices has been responsible for destroying the livelihoods of poor Mexican corn farmers. Further, they argue that because of the subsidies U.S. corn farmers receive, U.S. corn is being sold below the cost of production.

4.2 The Policy Environment in Mexico

A recent evaluation of the effect of NAFTA on Mexico's agricultural sector (Yunez-Naude, 2002) stresses the importance of also taking into account the domestic policy reforms that took place around the time NAFTA came into effect. According to Yunez-Naude, NAFTA was part of a wider set of policy reforms and would have been financially unsustainable had these other reforms not been implemented. He also argues that NAFTA was used by the Mexican government to assure the consolidation and permanance of domestic reforms. We agree that it is important to consider the domestic policy context. In what follows, we briefly describe the reforms in the agricultural sector. Our account draws largely on the work of Yunez-Naude. Table 9 reproduces a table from his study which presents the main agricultural policy reforms between 1985 and 1999.

The reforms in the agricultural sector that most directly affected corn farmers are the removal of price supports and the implemenation 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.

According to Yunez-Naude (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 maize was supported through government procurement by CONASUPO (the National Basic Foods Company). The 1991 nominal rate of protection to corn was 77% and the producer subsidy equivalent (PSE) amounted to $92 per tonne for white maize and $71 per tonne for yellow maize, compared to $28 in the U.S. 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 so as to sell maize at the high support price and then buy their consumption needs at the low subsidized prices.[17]

CONASUPO was officially dismantled in 1998. However, its' role in the maize market was substantially diminished in 1995 largely 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 maize farmers. However, because of the drop in maize 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 and maize producer prices are currently not supported.[18]

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 and considered to have no connection with production decisions and technology employed. Its' main purpose was to help farmers facing stiff competition

[17] De Janvry, Alain, Elisabeth Sadoulet and Gustavo de Anda (1995).

from U.S. and Canadian farmers to make a transition to more competitive crops. It is intended to last until 2008 when full trade liberalization under NAFTA is expected to be attained.

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 increased 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 that 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.

4.3 Data

Our data on corn farmers comes 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 it provides 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 dataset 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 dataset is not a panel, as each subject is only interviewed once

[18] 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 "resonable" profit.

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 includes main (primary) source of income, and does 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 which do not follow households over time. The survey provides a broad measure of household income, including income from wages, income from business and production (including agricultural production, but not broken out by crops) profits and income from transfers (including remittances domestically and from abroad, and subsidies from PROCAMPO and other government programs). The survey also has a detailed consumption module which recounts household expenditure on food, including corn and corn products, education, health, housing, clothing, etc.

Table 10 presents summary statistics from ENE for the entire sample period. These data highlight several important facts. In general, corn farmers are poorer (as measured by real income) than other farmers and than the rest of the population. Corn farmers also have less schooling and higher labor participation rates than the rest of the population. Also using data from ENE, Table 11 shows trends over time in the numbers of corn farmers. Between 1991 and 2000, the percent of the rural population who report that their main source of income is maiz and beans drops from approx 35% to 16%. The percent of farmers who report that their main source of income comes from corn and beans drops from 63% to 56%. The percent of the farmers reporting that their main crop for subsistence is corn drops from 82% to 74%. Also notable is the substantial drop in the percent of respondents reporting that their main occupation is farming. In 1991, 48% of the rural population reports that their main source of income comes from agricultural

activities and 14% of the rural population reports being a farmer[19];in 2000, 35% of the rural population reports their main source of income comes from agricultural activities and farmers represent only 9% of the rural population.

4.4 How Have Poor Mexican Corn Farmers Fared?

Using data from ENE, Figure 5 shows trends over time in the main source of income for the poorest rural dwellers. Inspection of Figure 5 reveals two important facts. Maiz and beans are clearly the most important main source of income to the rural poor. In 1995 close to 60% of the rural poor report that cultivation of maiz and beans provides the main source of income. This was true before NAFTA and seems to be true after NAFTA though in 2000 only 40% of the rural poor report that their main source of income is maiz and beans.

Also using data from ENE, Figure 6 shows trends in corn farmers income by amount of land that corn farmers own. The poorest corn farmers own less than 1 hectare of land and the richest corn farmers own more than 15 hectares of land. These data show that the real monthly income of both the small and very small corn farmers has dropped significantly between 1991 and 2000. By contrast, medium and large scale corn farmers suffered a drop in real monthly income over the period 1991 to 1995 but post-95, their real income seems to have rebounded. However, a shortcoming of the data in Figure 6 is that it only tracks corn farmers income from corn farming. It is possible that once transfers are accounted for, real income remains constant or even increases.

To study the full income of corn farmers, we use data from the household survey (ENIGH). Figure 7 presents these results. In fact, the income of the low income corn farmers seems to have remained relatively constant over the period 1992 to 2000. This would be consistent with a story in which the most able members of corn farming families migrated and now send remittances back to the poorest corn farmers. It is also consistent with a story in which the government implemented income support programs to cushion the shock for the poorest corn farmers. To understand why the poorest corn

[19] This is defined as someone who is involved in agricultural activities and is a producer either renting or owning

farmers income has remained constant even though their real income from corn farming dropped significantly, we turn to Figure 8 which breaks down the sources of income for the poorest corn farmers.

Figure 8 confirms the trends in Figure 6. The profit share of income - or income from corn farming – was close to 90% in 1992 and in 2000 represents only 40% of total income. By contrast, the share of income from transfers has increased remarkably from around 20% in 1992 to more than 50% in 2000. Importantly, the lion's share of the transfers in 1998 and 2000 are not coming from remittances. They appear to be coming from government programs like PROGRESA and PROCAMPO.

4.5 Outstanding Issues

One issue raised by these data is that of selection bias, since we are only observing repeated cross sections of corn farmers over time. It is clear from Table 11 that the absolute number of poor corn farmers 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 which likely correlates well with present income) leaving corn farming. Because none of the surveys mentioned above follows the same individuals over time, it is difficult to verify this, although the hypothesis can be tested. 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 impact. 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.

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land (as opposed to a laborer working in farming).

5. Discussion

There is clearly much more scope for work on this important and under-researched topic. This work should proceed along at least three dimensions. First, there are important ways in which the cross-country analysis could be refined. Second, more country-specific case studies using household level data would help shed light on this issue. Third, one could study changes in the patterns of production and trade of those products most heavily subsidized by the OECD countries to determine whether there is any relationship between the subsidies, output and trade. In what follows, we discuss each of these three strategies in turn.

5.1 Refining the Cross-Country Analysis

There are a number of important steps one could take to make the cross-country analysis more thorough and more convincing. These include: (1) separating countries that are net importers from countries that are net exporters by product, (2) redefining the weights, (3) including measures of developing country's policies vis a vis agriculture and (4) defining the mechanisms via which we think OECD subsidies will affect poverty.

It is clear that there is a substantial amount of heterogeneity among developing countries. It is also true that countries that are net importers (exporters) of products subsidized by the OECD benefit from (are harmed by) the lower prices caused by the subsidies. This is true for all products and not just cereals. One could account for this in the empirical analysis by including OECD policy variables by crop and allowing the coefficient on this variable to vary according to whether a country was a net importer or exporter of this product in 1970 or over some period of time say 1970 to 1975.

The OECD policy variable currently in the regressions is a weighted average of OECD nominal protection coefficients where the weights are defined by the share of production of the relevant commodity in total agricultural production in 1970. It is not clear that an unweighted average would not be better. The weights themselves are at least in part determined by domestic policy vis a vis agriculture and that crop in particular. By

using these weights, we may be confounding domestic policy vis a vis agriculture with OECD policy vis a vis agriculture.

An important omitted variable is domestic policy vis a vis agriculture. Developing countries have tended to heavily tax agriculture both directly and indirectly (see Krueger, Schiff and Valdes, 19). The indirect taxation of agriculture could be controlled for in the regression framework by including a measure of the black market exchange rate premium as an explanatory variable. The direct taxation of agriculture could be controlled for by including nominal protection coefficients for the most important crops produced in each country.

Finally, to better understand whether OECD policy is having an impact on poverty, it will be important to pin down the mechanisms through which OECD policy might have an impact on poverty. For example, Deaton and Miller ( ) find that commodity price fluctuations have a significant impact on GDP in Sub Saharan Africa. It is likely that OECD policy has an impact on commodity price fluctuations. By modelling commodity prices as a function of OECD policy, we would be able to quantify the significance of this impact.

5.2 Analyzing the Issue Using Micro Data

There is no question that a deeper understanding of these issues will be gained by studying the issue at a micro level on a country by country basis. In a recent review of the evidence on trade liberalization and poverty, Winters et al (JEL, March 2004) argue convincingly that "to assess the poverty impact of price changes, it is necessary to focus on the responses of individual producers, especially small farmers." Further, they argue that this is most easily done using household level data with detail on farmers and that very little work of this type has been done.[20] Therefore, we see this as a promising avenue for future research.

5.3 Analyzing the Issue Using Production and Trade Data

[20] See Winters et al pp 89-92 for a detailed discussion of the existing literature.

The Food and Agricultural Organization of the United Nations (FAO) collects Agricultural trade and production data by country by year. This data goes back to 1960 for many countries. Two recent papers have used this data to predict the impacts of a reduction in OECD subsidies on countries in Sub-Saharan Africa. Soledad Bos (2003) uses a partial equilibrium approach, but also concludes that OECD subsidy reduction would lead to welfare losses in African countries. Using a partial equilibrium framework, Soledad Bos (2003) calculates changes in consumer and producer surplus that would occur in the maize markets of five African countries if OECD countries were to reduce domestic support to agriculture by 100% or 50%. She finds negative net welfare changes in each of the countries she studies: Uganda, Kenya, Zimbabwe, Botswana and Mozambique. Peacemaker Arrand (2004) expands the analysis to all African countries for which data is available, and studies both maize and wheat markets. She also finds that the removal of wealthy countries' subsidies would lead to welfare losses for most African countries, although the net effects are a small percentage of GDP in each country.

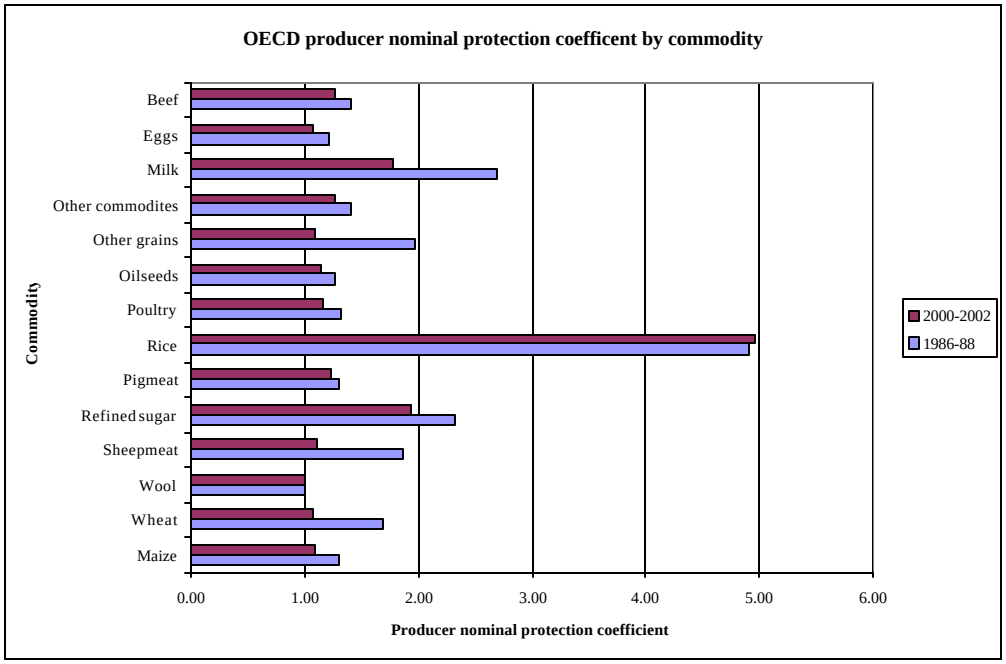
These results are not surprising given that most African countries are net importers of both wheat and maize. However, these same data could be used to study whether there have been substantial changes in the market structure of the various crops subsidized by the OECD over time. While it would be difficult to infer causality from OECD subsidies to market share, the exercise would still be informative. For example, one thing that both Soledad Bos and Peacemaker Arrand miss is whether African countries were net importers of maize and wheat in the 1960s and 1970s. Similarly, Valdes and McCalla point out the large number of countries that are net importers of both food and agricultural products for the period 1996-1998. It would be useful to know whether this has always been the case or whether the picture has changed substantially over the past three decades.

6. Conclusion

Whether or not agricultural subsidies have had an impact on poverty in

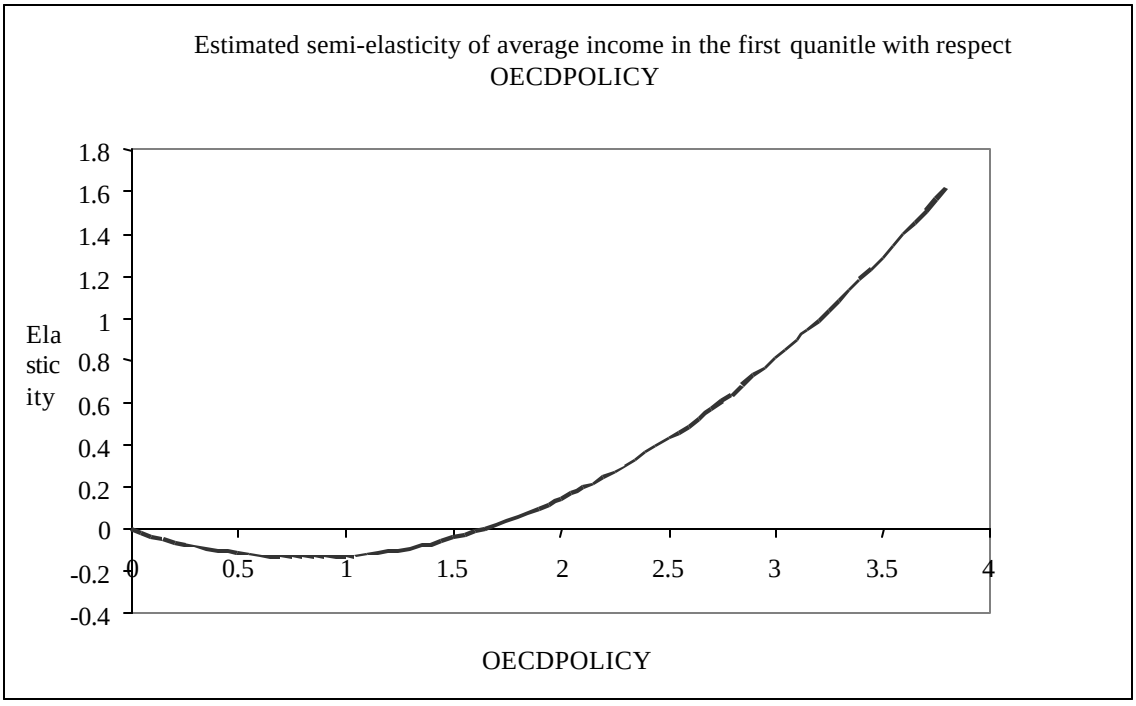
developing countries is an empirical question. We hope that our study makes clear the fact that the answer to this question is likely to vary across countries and across commodities. In some instance, subsidies are likely to have increased the real income of the poor and in other instances, subsidies are likely to have decreased the real income of the poor.

Figure 1 Producer nominal protection coefficients by commodity



Source: OECD PSE/CSE database.

Figure 2: Estimated semi-elasticity of incomes of the poor and OECD agricultural support policy



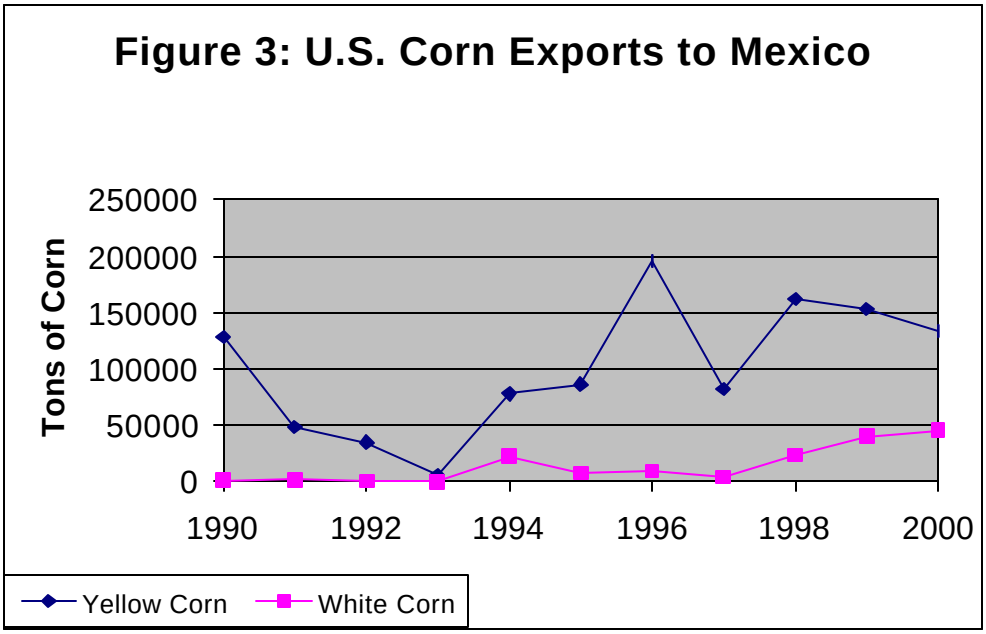


Figure 3: U.S. Corn Exports to Mexico
Tons of Corn
250000
200000
150000
100000
50000
0
1990
1992
1994
1996
1998
2000
Yellow Corn
White Corn

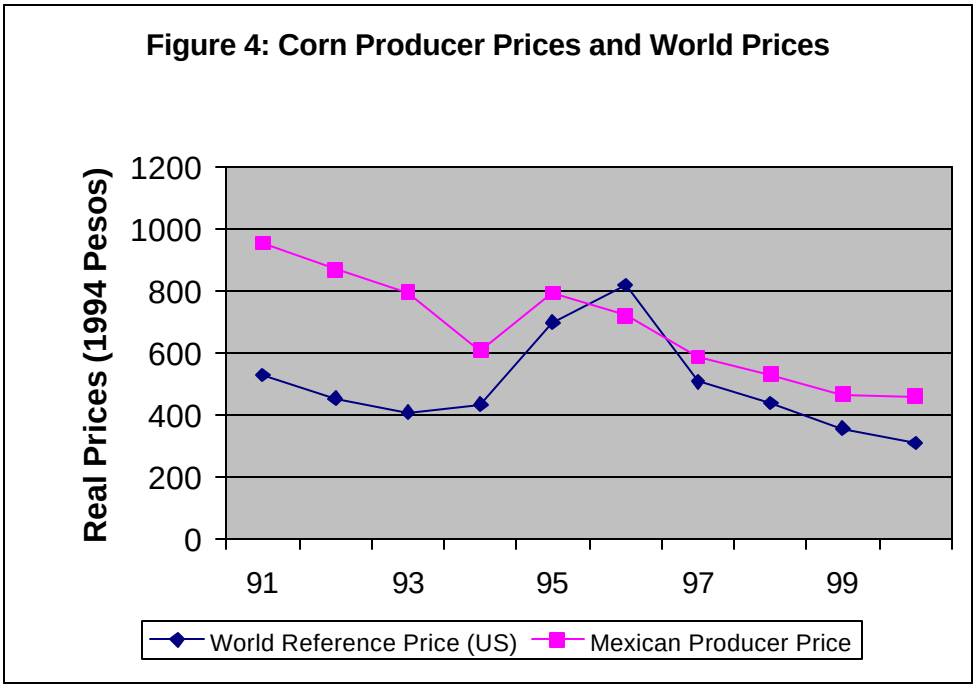


Figure 4: Corn Producer Prices and World Prices
Real Prices (1994 Pesos)
1200
1000
800
600
400
200
0
91
93
95
97
99
World Reference Price (US)
Mexican Producer Price

Figure 5

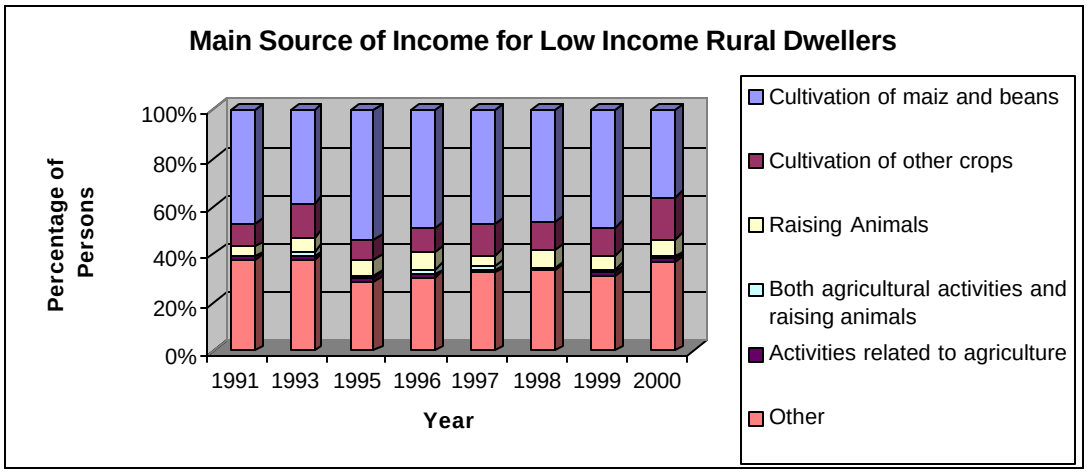
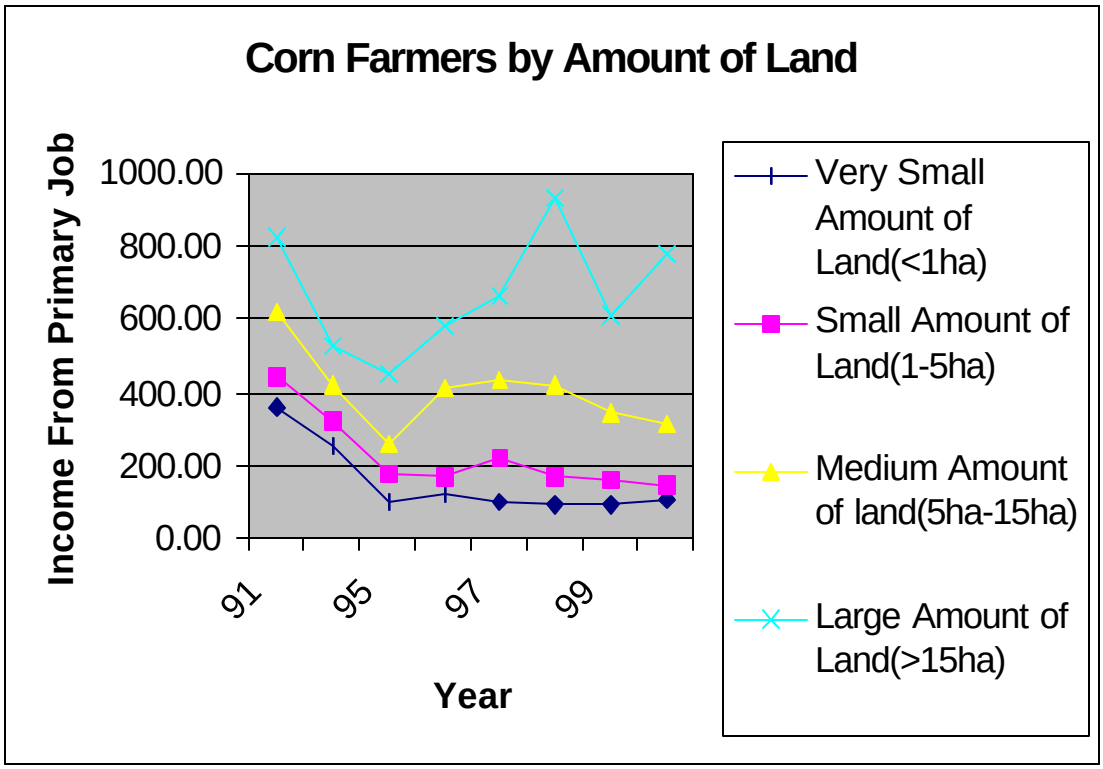
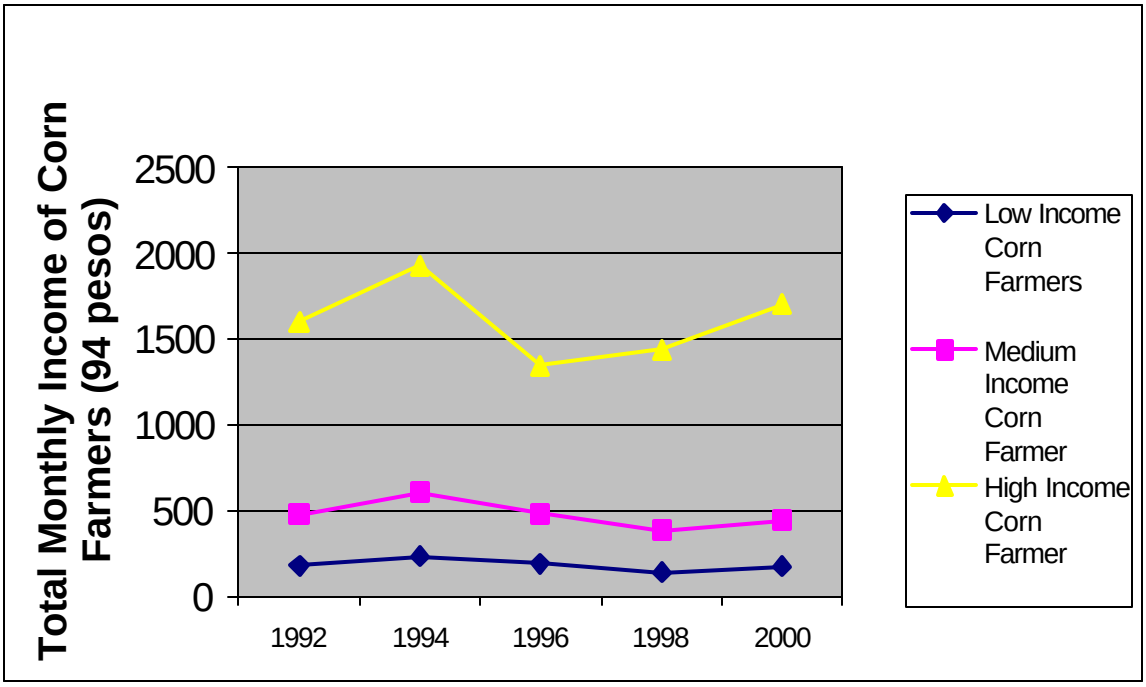


Figure 6: Real Monthly Income from Main Source of Income by Occupation 1991-2000



Source: ENE

Figure 7: Total Real Income of Corn Farmers by Income Quantiles 1991-2000



Source: ENIGH

Figure 8

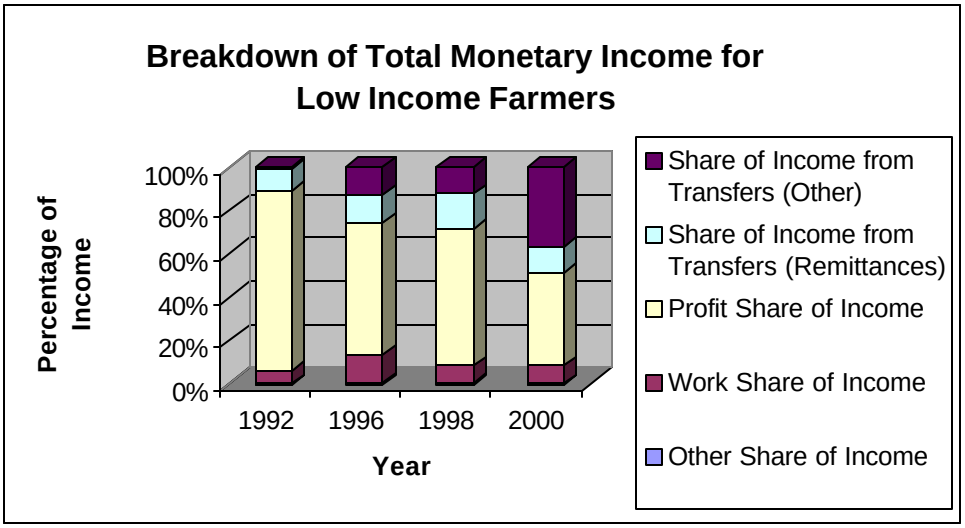


Table 1: Agriculture's importance in economies by income classification

Countries	Agriculture value added (% of GDP)	Rural population share (%)	Arable land under cereal production (%)
High income OECD	2	21	38
Low & middle income	12	58	53
Least developed countries	33	76	60

Source: World Development Indicators. Notes: Low and middle income classification uses World Bank definition (income below about $9,000); least developed countries uses United Nations (UN) classification (44 poorest members of the UN).

Table 2 Leading net importers and exporters of OECD-supported commodities, 2000 ('000s of Metric Tonnes)

Rice				**Maize**				**Refined Sugar**				**Wheat**			
Net importers	**QM**	**Net exporters**	**QX**	**Net importers**	**QM**	**Net exporters**	**QX**	**Net importers**	**QM**	**Net exporters**	**QX**	**Net importers**	**QM**	**Net exporters**	**QX**
Indonesia	1,500	Australia	552	Japan	16,340	Moldova	50	Iran	720	Belarus	230	Brazil	7,201	China	428
Philippines	1,410	Burma	670	Korea	8,743	Thailand	166	Algeria	700	Korea	348	Iran	6,284	Hungary	963
Nigeria	1,250	Egypt	694	Mexico	5,911	Ukraine	371	Nigeria	685	Colombia	349	Egypt	6,050	India	1,128
Iraq	959	Uruguay	736	Egypt	5,268	Paraguay	458	Indonesia	542	Poland	363	Algeria	5,600	Turkey	1,135
Saudi Arabia	942	China	1,580	Taiwan	4,924	Hungary	717	Israel	490	China	367	Japan	5,431	Kazakhst	3,654
Iran	765	India	1,685	Canada	2,624	S.Africa	886	Sri Lanka	449	U.A.E.	521	Indonesia	4,020	Argentin	11,265
Senegal	735	U.S.	2,245	E. U.	2,591	Brazil	5,938	India	413	Turkey	613	Morocco	3,534	E.U.	12,066
Bangladesh	672	Pakistan	2,429	Malaysia	2,365	China	7,187	Syria	375	Thailand	1,802	Iraq	3,300	Australia	15,856
E. U.	641	Vietnam	3,488	Colombia	1,857	Argentina	9,653	Uzbekistan	313	Brazil	3,900	Philippin	3,050	Canada	17,117
Brazil	632	Thailand	7,521	Algeria	1,600	U.S.	49,140	Bangladesh	310	E.U.	6,019	Korea	2,999	U.S.	26,459
Cotton				**Oilseeds**				**Dry Whole Mild Powder**							
Net importers	**QM**	**Net exporters**	**QX**	**Net importers**	**QM**	**Net exporters**	**QX**	**Net importers**	**QM**	**Net exporters**	**QX**	**Net importers**	**QM**		
Indonesia	574	Burkina	113	E.U.	17,392	Ukraine	2	Algeria	110						
Mexico	389	Mali	125	China	13,037	Hungary	5	Brazil	108	Colombia	0				
Russia	359	Cote d'Ivoire	131	Japan	4,767	Uruguay	14	Venezuela	65	Poland	0				
Turkey	353	Benin	136	Mexico	4,381	Ecuador	30	Philippines	52	Canada	4				
Thailand	342	Turkmenist	147	Taiwan	2,330	Zimbabwe	39	China	41	Ukraine	4				
India	321	Syria	229	Korea	1,404	Canada	316	Taiwan	38	U. S.	12				
Korea	306	Greece	306	Thailand	1,290	Paraguay	2,550	Mexico	34	Argentina	103				
Italy	289	Uzbekistan	739	Indonesia	1,127	Argentina	6,995	Egypt	30	Australia	164				
Japan	248	Australia	850	Israel	617	Brazil	14,570	Thailand	26	N.Zlnd	407				
Taiwan	226	U.S.	1,464	Malaysia	592	U.S.	27,006	Peru	22	E.U.	568				

Source: USDA/FATUS. Countries in bold are rich-country OECD members. Data excludes food aid.

Table 3: Net maize exporters include poor countries

Developing country net maize exporters 1993-2000	Net exports (1,000 MT)
Benin	0
Pakistan	0
Afghanistan	0
Burkina Faso	0
Central African Republic	0
Chad	0
Gambia	0
Guinea	0
Guinea-Bissau	0
Mali	0
Nepal	0
Sierra Leone	0
Sweden	0
Cambodia	0
Uganda	2
Madagascar	4
Ethiopia	4
Zimbabwe	5
Burma	42
Paraguay	227
Brazil	784
South Africa	1,086
China	6,264
Argentina	9,511

Source: USDA/FATUS. Excludes transition economies.

Table 4: Pair-wise correlation of $OECDPOLICY_{it}$ calculated with alternative measures of support

Support measures	*MPS*	*PSE/ unit of output*	*PSE/ total receipts*	*NPC*	*NAC*
MPS	1.0000				
PSE/ unit of output	0.8861*	1.0000			
	(0.0000)				
PSE/ total receipts	0.0891*	0.1425*	1.0000		
	(0.0000)	(0.0000)			
NPC	0.0384	0.0707*	0.9495*	1.0000	
	(0.0760)	(0.0000)	(0.0000)		
NAC	0.1214*	0.1821*	0.9495*	0.9813*	1.0000
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	

Weighted averages across commodities by country-year observation of various measures of OECD support for agriculture. There are 143 observations. Standard errors reported in parentheses. * significant at the 5 percent level.

Table 5: Do rich country agricultural policies affect the incomes of the poor?

Dependent variable: Log income per capita of first quintile						
	(1)	(2)	(3)	(4)	(5)	(6)
	OLS	OLS	OLS	OLS	OLS	OLS
OECDPOLICY	0.073	-0.036	-0.325	-0.373	-0.254	-0.390
	[0.046]	[0.058]	[0.130]**	[0.210]*	[0.226]	[0.185]**
OECDPOLICY squared			0.099	0.120	0.104	0.124
			[0.033]***	[0.053]**	[0.054]*	[0.048]**
Log average income per capita	1.049	0.950	0.948	0.960	0.936	0.959
	[0.046]***	[0.051]***	[0.052]***	[0.061]***	[0.074]***	[0.060]***
SOI anomaly	-0.016	-0.021	-0.012	-0.002	-0.005	-0.004
	[0.035]	[0.030]	[0.030]	[0.030]	[0.030]	[0.031]
ECE*OECDPOLICY				0.596	0.504	0.533
				[0.313]*	[0.304]	[0.387]
MENA*OECDPOLICY				0.155	0.049	0.100
				[0.187]	[0.189]	[0.259]
LAC*OECDPOLICY				0.203	0.140	0.160
				[0.134]	[0.139]	[0.191]
SSA*OECDPOLICY				-0.197	-0.259	-0.194
				[0.098]**	[0.115]**	[0.103]*
SA*OECDPOLICY				-0.080	-0.166	-0.124
				[0.172]	[0.179]	[0.246]
Arable land per capita					-0.045	
					[0.039]	
Non-program crops share, 1970						-0.131
						[0.320]
<u>REGIONAL FIXED EFFECTS</u>						
East and Central Europe		0.419	0.486	-0.029	0.205	0.042
		[0.077]***	[0.084]***	[0.321]	[0.364]	[0.404]
Middle East North Africa		-0.031	0.029	-0.095	0.116	-0.029
		[0.085]	[0.086]	[0.209]	[0.271]	[0.299]
Latin America Caribbean		-0.394	-0.315	-0.573	-0.413	-0.515
		[0.067]***	[0.070]***	[0.209]***	[0.247]*	[0.278]*
Sub-Saharan Africa		0.257	0.269	0.703	0.835	0.681
		[0.069]***	[0.071]***	[0.231]***	[0.264]***	[0.250]***
South Asia		-0.509	-0.468	-0.347	-0.167	-0.287
		[0.127]***	[0.128]***	[0.268]	[0.300]	[0.343]
Constant	-1.797					
	[0.377]***					
Observations	143	143	143	143	141	143
R-squared	0.79	0.88	0.88	0.89	0.89	0.89
F-stat	188.30	164.55	122.59	122.42	124.94	108.28

Excluded dummy variable in regressions with regional fixed effects is East Asia and Pacific. Huber robust standard errors in parentheses. Significantly different from zero at 90% (*), 95% (**) 99% (***) confidence. SOI is Southern Oscillation Index. Income measured in $1985, PPP. MENA is Middle East and North Africa, ECE is Eastern and Central Europe. LAC is Latin America and Caribbean, SSA is Sub-Saharan Africa, SA is South Asia. Program crops are defined as those for which a NPC estimate is calculated by the OECD.

Table 6: Determinants of agricultural support in the OECD

Dependent variable: $OECDPOLICY_{it}$					
	(1)	(2)	(3)	(4)	(5)
	OLS	OLS	OLS	OLS	OLS
EU Budget year? (0/1)	0.135	0.217	0.134	-0.089	
	[0.214]	[0.193]	[0.195]	[0.163]	
Japanese election year? (0/1)	-0.203	-0.189	-0.144	-0.200	
	[0.164]	[0.133]	[0.133]	[0.107]*	
US election year? (0/1)	-0.048	-0.070	-0.014	0.043	
	[0.158]	[0.156]	[0.144]	[0.116]	
France election year? (0/1)	0.459	0.362	0.409	0.338	
	[0.207]**	[0.186]*	[0.187]**	[0.131]**	
Output per farm, US		1.457	0.967	0.219	0.081
		[0.279]***	[0.304]***	[0.276]	[0.382]
Output per farm, EU			11.793	6.574	6.670
			[3.221]***	[3.280]**	[3.463]*
Concentration of production in US				9.859	11.750
				[1.069]***	[2.440]***
Concentration of production in EC					-0.691
					[0.842]
SOI anomaly	-0.056	-0.062	-0.091	-0.092	-0.030
	[0.067]	[0.059]	[0.061]	[0.045]**	[0.039]
Constant	1.305	0.716	0.277	-0.337	-0.301
	[0.092]***	[0.159]***	[0.179]	[0.162]**	[0.155]*
Observations	143	143	143	143	143
R-squared	0.04	0.17	0.23	0.55	0.53
F-stat	1.11	5.30	8.31	21.31	31.69

Output per farm and concentration of production variables are weighted averages across commodities like the dependent variable where weights are country-specific and defined as fraction of agricultural production in each commodity class in 1970. Huber robust standard errors in parentheses. Significantly different from zero at 90% (*), 95% (**) 99% (***) confidence. SOI is Southern Oscillation Index.

Table 7: Instrumental variables regressions

Dependent variable: Log income per capita of first quintile		
	(1)	(2)
	IV- income only	IV- income and OECDPOLICY
Log average income per capita	0.939	0.724
	[0.141]***	[0.330]**
SOI anomaly	-0.002	-0.013
	[0.028]	[0.059]
OECDPOLICY	-0.393	-1.249
	[0.229]*	[1.416]
OECDPOLICY squared	0.123	0.340
	[0.052]**	[0.413]
ECE*OECDPOLICY	0.606	-1.728
	[0.299]**	[6.286]
MENA*OECDPOLICY	0.160	-0.152
	[0.180]	[2.379]
LAC*OECDPOLICY	0.215	-0.165
	[0.148]	[1.150]
SSA*OECDPOLICY	-0.187	-0.439
	[0.114]*	[0.842]
SA*OECDPOLICY	-0.062	0.608
	[0.190]	[0.841]
East and Central Europe	-0.041	2.077
	[0.309]	[5.676]
Middle East North Africa	-0.111	0.117
	[0.223]	[2.451]
Latin America Caribbean	-0.590	0.055
	[0.221]***	[1.653]
Sub-Saharan Africa	0.670	1.209
	[0.295]**	[1.862]
South Asia	-0.396	-1.427
	[0.386]	[1.309]
Observations	143	143
F-stat	95.21	25.57
Hansen J Stat (test of OIR)	--	0.932
Hansen J P-value	--	0.33

Columns 1 and 2 log average income instrumented using 5-year lagged growth. Column 2 instruments for OECDPOLICY with political economy variables. Excluded dummy variable in regressions with regional fixed effects is East Asia and Pacific. Huber robust standard errors in parentheses. Significantly different from zero at 90% (*), 95% (**) 99% (***) confidence. SOI is Southern Oscillation Index. Income measured in $1985, PPP. MENA is Middle East and North Africa, ECE is Eastern and Central Europe. LAC is Latin America and Caribbean, SSA is Sub-Saharan Africa, SA is South Asia.

Table 8: My policies or yours?

Dependent variable: Log income per capita of first quintile- instrumenting for income only							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	IV	IV	IV	IV	IV	IV	IV
Log average income per capita	0.998	0.849	0.883	0.988	0.799	1.048	0.319
	[0.205]**	[0.131]***	[0.164]***	[0.218]***	[0.253]***	[0.193]***	[0.449]
SOI anomaly	-0.004	0.005	-0.008	-0.011	-0.002	-0.014	0.013
	[0.032]	[0.030]	[0.030]	[0.030]	[0.027]	[0.031]	[0.043]
OECDPOLICY	-0.651	-0.431	-0.435	-0.443	-0.459	-0.159	-0.799
	[0.354]*	[0.234]*	[0.245]*	[0.385]	[0.251]*	[0.292]	[0.449]*
OECDPOLICY squared	0.208	0.119	0.129	0.137	0.142	0.070	0.296
	[0.100]**	[0.054]**	[0.054]**	[0.078]*	[0.058]**	[0.096]	[0.173]*
ECE*OECDPOLICY	0.801	0.480	0.546	0.626	0.618	0.490	1.445
	[0.396]**	[0.293]	[0.333]	[0.371]*	[0.285]**	[0.406]	[0.801]*
MENA*OECDPOLICY	0.193	0.089	0.181	0.213	0.216	0.042	0.447
	[0.197]	[0.193]	[0.182]	[0.289]	[0.180]	[0.279]	[0.402]
LAC*OECDPOLICY	0.234	0.259	0.297	0.235	0.297	0.220	0.506
	[0.172]	[0.149]*	[0.168]*	[0.219]	[0.163]*	[0.172]	[0.191]*
SSA*OECDPOLICY	-0.335	-0.155	-0.163	-0.209	-0.164	-0.188	-0.547
	[0.183]*	[0.106]	[0.124]	[0.106]**	[0.127]	[0.197]	[0.363]
SA*OECDPOLICY	0.014	-0.000	-0.031	-0.052	-0.090	-0.282	-0.069
	[0.236]	[0.195]	[0.192]	[0.251]	[0.191]	[0.219]	[0.254]
Exports+Import/ GDP	-0.310						-0.604
	[0.310]						[0.319]*
Gov't consumption / GDP		-1.095					-1.449
		[0.828]					[0.959]
1+inflation rate			-0.160				-0.179
			[0.109]				[0.070]*
Stock of secondary educ.						0.036	0.399
						[0.098]	[0.200]*
Rule of Law Index 1997-98					0.118		0.215
					[0.142]		[0.129]*
Deposit money/total bank assets				0.021			0.503
				[0.283]			[0.420]
F-statistic							
Observations	132	143	143	135	140	114	107

Log average income instrumented using 5-year lagged growth. All regressions included regional fixed effects where excluded dummy variable is East Asia and Pacific. Huber robust standard errors in parentheses. Significantly differen from zero at 90% (*), 95% (**) 99% (***) confidence. SOI is Southern Oscillation Index. Income measured in $1985, PPP. MENA is Middle East and North Africa, ECE is Eastern and Central Europe. LAC is Latin America and Caribbean, SSA is Sub-Saharan Africa, SA is South Asia. All control variables measured as five-year averages except Rule of Law Index.

Table 9: Main Agricultural Policy Reforms in Mexico: 1985-1999

Policy	Description	Years
Mexico joins GATT	• By 1990/91, most licenses to import agricultural products were abolished. In 1991-1994 most agricultural commodities were subject to tariffs fluctuating between 0% and 20%	1986/94
Institutional Reforms and the Government's New Role	• All State seed and fertiliters' companies were privatized. • State storage companies were privatized. • Elimination of all state companies involved in the commercialization of sugar, tobacco and coffee. • New institutions, such as ACERCA (1991) were created to give support and services to producers.	From 1988/89
Reform of the Agrarian Law	• Land redistribution ends • Guarantees freedom of choice and management to the ejido and its members • Recognizes the individual rights of each ejido • Members of each ejido can, if they wish: buy, sell, rent or use their lands as a warrant: when before they could only usufruct it. • The above makes commercial associations for ejidos possible	1992
North American Free Trade Agreement (NAFTA)	• Defines which are the obligatory conditions for market access and for export subsidies • Each country has the right to choose its own internal subsidies, phytosanitary measures, rules of origin and regulations for packing and tagging products. Each nation is responsible for making these rules as clear as possible, and must give exporters the opportunity to express themselves when regulations are changed. When rules change, reasons have to be scientifically demonstrated • Consistency with the WTO and with the Uruguay Round • Import and export licenses are abolished and substituted by tarrification • In 15 years, all tariffs will be eliminated by NAFTA members.	1994
PROCAMPO (Program of Direct Support for the Countryside)	• Direct payments to the producers of basic crops that compensates producers for the loss of input subsidies, price supports and import protection • Grants annual direct payments per hectare to those producers who continure to produce, based on historical acreage for nine crops • Works as a "security net" for rural income • Supports rural capitalization since it works as a guarantee for production • The program helps around 3.3 million producers, covering 14 million hectares	1994-2009
Elimination of producer price supports, abolition of CONASUPO (the National Company for Popular Subsistence) and creation of ASERCA for marketing supports to producers	• In 1991, guaranteed prices for wheat, sorghum, soy beans, rice, barley, safflower, sesame seed and sunflower were eliminated, and in 1999 support prices for beans and maize producers were abolished. • Prices of most grains began to be determined according to its international reference price • Supports for the marketing of wheat and sorghum • Since 1995, subsidies to grain producers to buy options at international markets in order to help mitigate risk	1991-1999
Alliance for the Countryside (Alianza para el Campo)	A set of programs designed to support farmers with productive potential in an open economy Its major goals are: to raise producer's income, to improve agriculture's balance of trade, to make food production grow twice as fast as the population, and to ensure the country's food security Federalized. Each state is responsible for the application of Alliance's programs. Major programs: PROCAMPO, PRODUCE (realated to infrastructure and extension-type assistance and plague and disease control supports)	1995 onwards
Source: This table was directly reproduced from "Lessons from NAFTA: The Case of Mexico's Agricultural Sector" where it appeared as Table 1 by Antonio Yunez-Naude (2002).		

Table 10: Summary Statistics by Category

	All	Involved in Agriculture		Farmer		Corn Farmer		Small Corn Farmer (<5ha)	Medium Corn Farmer (5-15ha)	Large Corn Farmer (>15ha)
		Yes	No	Yes	No	Yes	No			
# Observations	**453503**	**116947**	**336556**	**45708**	**407795**	**26681**	**19027**	**1146**	**4515**	**20934**
Real Income (1994 Peso)	**639**	**484**	**742**	**504**	**677**	**341**	**665**	**282**	**482**	**873**
	1986	(2500)	(1546)	(3342)	(1386)	(2966)	(3638)	(3322)	(559)	(1261)
Years of Schooling	**5.16**	**4.10**	**5.58**	**3.10**	**5.42**	**2.69**	**3.67**	**2.62**	**2.80**	**3.53**
	(3.56)	(3.22)	(3.60)	(2.99)	(3.54)	(2.73)	(3.23)	(2.68)	(2.81)	(3.17)
Labor Participation	**0.50**	**0.80**	**0.39**	**0.99**	**0.44**	**0.99**	**0.99**	**0.99**	**0.98**	**0.99**
	(0.50)	(0.40)	(0.49)	(0.10)	(0.50)	(0.11)	(0.10)	(0.11)	(0.12)	(0.09)
Involved in Agriculture	**0.28**	**1.00**	**0.00**	**1.00**	**0.19**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
	(0.45)	0.00	(0.00)	(0.00)	(0.39)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Farmer	**0.11**	**0.39**	**0.00**	**1.00**	**0.00**					
	(0.31)	(0.49)	(0.00)	(0.00)	(0.00)					
Corn Farmer	**0.06**	**0.23**	**0.00**	**0.58**						
	(0.25)	(0.42)	(0.00)	(0.49)						
Total Land (in ha)	**1.63**	**5.82**	**0.00**	**14.76**	**0.00**	**11.88**	**18.72**	**2.19**	**8.43**	**218.49**
	(96.94)	(183.00)	(0.02)	(291.04)	(0.02)	(271.57)	(315.90)	(1.33)	(2.42)	(1339.08)

Table 11: Trends Across Time

	1991	1993	1995	1996	1997	1998	1999	2000
Farmer	14.84%	14.93%	12.44%	10.38%	8.64%	10.36%	9.17%	8.68%
Corn Farmer	62.89%	44.74%	62.71%	58.03%	59.15%	60.60%	59.69%	56.01%
Corn Farmer1 (Broader Definition)	12.59%	12.74%	10.10%	8.96%	8.66%	8.80%	8.84%	7.24%
Farmers who are Corn Farmer1	91.43%	89.21%	88.71%	88.19%	84.54%	86.22%	84.43%	81.97%
Main Crop for all Farmers								
	1991	1993	1995	1996	1997	1998	1999	2000
Maiz	82.23%	82.66%	80.98%	77.16%	72.86%	78.63%	76.76%	74.45%
Beans	3.23%	2.05%	2.37%	2.43%	3.37%	2.14%	2.77%	2.34%
Wheat	0.23%	0.07%	0.16%	0.14%	0.29%	0.10%	0.13%	0.05%
Rice				0.02%	0.09%	0.02%	0.65%	0.52%
Vegetables	0.44%	0.51%	0.19%	0.60%	0.24%	0.42%	0.18%	0.24%
Fruits	0.12%	0.50%	0.35%	0.23%	0.38%	0.54%	0.47%	0.48%
Other	0.50%	0.24%	0.20%	0.54%	0.55%	0.55%		
Produce to Sell only	13.25%	13.98%	15.74%	18.89%	22.22%	17.61%	19.04%	21.93%

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 whose main source of income is corn. Corn Farmer1 is defined as someone who takes part in agricultural activities and whose main crop for subsistence is corn or whose main crop for selling is corn or whose main source of income is corn; this is a broader definition than that of Corn Farmer, which restricts to those whose main source of income is corn.

Table A.1

	Country	Region	Year	OECDPOLICY	Log income of poor	Log average income
1	China,hkong	East Asia and Pacific	1991	0.00	8.45	9.66
2	China,hkong	East Asia and Pacific	1986	0.00	8.36	9.35
3	Papua N Guin	East Asia and Pacific	1996	0.07	5.96	7.49
4	St Lucia	Latin America	1995	0.08	6.94	8.29
5	Rwanda	Sub-Saharan Africa	1983	0.12	5.98	6.73
6	Burundi	Sub-Saharan Africa	1992	0.15	5.40	6.34
7	Cent Afr Rep	Sub-Saharan Africa	1992	0.19	4.20	6.24
8	Ghana	Sub-Saharan Africa	1997	0.23	6.05	6.94
9	Ghana	Sub-Saharan Africa	1992	0.29	5.91	6.86
10	Cote dIvoire	Sub-Saharan Africa	1985	0.31	6.05	7.34
11	Nigeria	Sub-Saharan Africa	1997	0.32	5.29	6.86
12	Cameroon	Sub-Saharan Africa	1983	0.34	5.48	7.20
13	Ghana	Sub-Saharan Africa	1987	0.34	5.61	6.69
14	Uganda	Sub-Saharan Africa	1989	0.35	5.43	6.31
15	Jordan	Middle East North Africa	1997	0.40	7.03	8.02
16	Nigeria	Sub-Saharan Africa	1985	0.44	5.74	6.97
17	Nigeria	Sub-Saharan Africa	1991	0.47	5.29	6.95
18	Cote dIvoire	Sub-Saharan Africa	1993	0.48	5.91	6.97
19	Poland	Europe and Central Asia	1996	0.54	7.47	8.46
20	Jordan	Middle East North Africa	1991	0.57	6.73	7.89
21	Tanzania	Sub-Saharan Africa	1991	0.64	4.14	6.32
22	Jordan	Middle East North Africa	1986	0.64	7.20	8.24
23	Algeria	Middle East North Africa	1995	0.65	6.73	7.81
24	Seychelles	Sub-Saharan Africa	1984	0.72	6.31	7.94
25	Singapore	East Asia and Pacific	1983	0.72	7.80	9.03
26	Singapore	East Asia and Pacific	1993	0.76	8.36	9.55
27	Poland	Europe and Central Asia	1991	0.78	7.60	8.22
28	Singapore	East Asia and Pacific	1988	0.81	8.28	9.24
29	Tunisia	Middle East North Africa	1985	0.81	6.47	7.92
30	Algeria	Middle East North Africa	1988	0.82	6.82	7.93
31	Hungary	Europe and Central Asia	1982	0.84	7.98	8.55
32	Mozambique	Sub-Saharan Africa	1996	0.85	5.58	6.73
33	Namibia	Sub-Saharan Africa	1993	0.86	5.15	7.88
34	Guinea	Sub-Saharan Africa	1991	0.87	4.68	6.64
35	Tunisia	Middle East North Africa	1990	0.89	6.72	7.98
36	Honduras	Latin America	1996	0.89	5.47	7.24
37	Costa Rica	Latin America	1982	0.92	6.69	8.03
38	Paraguay	Latin America	1991	0.92	6.46	7.67
39	Zambia	Sub-Saharan Africa	1996	0.92	4.86	6.46
40	Bolivia	Latin America	1990	0.96	6.11	7.41
41	Poland	Europe and Central Asia	1986	0.96	7.77	8.37
42	Romania	Europe and Central Asia	1989	0.97	6.93	7.62
43	Panama	Latin America	1989	0.99	6.08	7.93
44	Hungary	Europe and Central Asia	1993	0.99	7.80	8.44
45	Romania	Europe and Central Asia	1994	0.99	6.69	7.41
46	Morocco	Middle East North Africa	1984	1.01	6.41	7.55
47	Panama	Latin America	1995	1.04	5.99	8.16

48 Malawi	Sub-Saharan Africa	1993	1.05	3.81	6.27
49 Bahamas	Latin America	1991	1.06	8.01	9.40
50 Ethiopia Pdr	Sub-Saharan Africa	1995	1.06	4.74	5.80
51 Costa Rica	Latin America	1989	1.09	6.79	8.15
52 Ecuador	Latin America	1994	1.10	6.61	7.97
53 Korea Rep	East Asia and Pacific	1982	1.10	7.23	8.13
54 Honduras	Latin America	1991	1.12	5.70	7.22
55 Costa Rica	Latin America	1996	1.14	6.62	8.22
56 Djibouti	Sub-Saharan Africa	1996	1.15	5.35	6.59
57 Zambia	Sub-Saharan Africa	1991	1.17	5.24	6.55
58 Morocco	Middle East North Africa	1990	1.17	6.53	7.67
59 Hungary	Europe and Central Asia	1987	1.19	8.00	8.64
60 Bahamas	Latin America	1986	1.19	7.87	9.43
61 China	East Asia and Pacific	1985	1.19	6.43	7.14
62 Peru	Latin America	1994	1.22	6.35	7.80
63 Ecuador	Latin America	1988	1.22	6.40	7.95
64 Chile	Latin America	1992	1.23	7.15	8.49
65 Yemen	Middle East North Africa	1998	1.24	6.64	7.39
66 Lesotho	Sub-Saharan Africa	1993	1.26	4.76	6.87
67 Honduras	Latin America	1986	1.27	5.27	7.23
68 Colombia	Latin America	1995	1.29	6.39	8.23
69 El Salvador	Latin America	1995	1.30	5.99	7.66
70 El Salvador	Latin America	1989	1.30	5.42	7.51
71 Guineabissau	Sub-Saharan Africa	1991	1.30	4.02	6.39
72 Iran	Middle East North Africa	1984	1.31	6.86	8.30
73 Mexico	Latin America	1995	1.33	6.97	8.69
74 Mexico	Latin America	1989	1.35	7.09	8.62
75 Mongolia	East Asia and Pacific	1995	1.35	6.24	7.27
76 Kenya	Sub-Saharan Africa	1992	1.36	4.99	6.82
77 Uruguay	Latin America	1989	1.36	7.15	8.45
78 Burkina Faso	Sub-Saharan Africa	1994	1.38	4.87	6.20
79 Dominican Rp	Latin America	1989	1.42	6.23	7.80
80 Malaysia	East Asia and Pacific	1984	1.42	7.07	8.39
81 Yemen	Middle East North Africa	1992	1.43	6.16	7.38
82 Chile	Latin America	1987	1.44	6.49	8.24
83 Colombia	Latin America	1988	1.47	6.66	8.08
84 Botswana	Sub-Saharan Africa	1985	1.48	5.99	7.76
85 Zimbabwe	Sub-Saharan Africa	1990	1.49	5.41	7.07
86 Brazil	Latin America	1993	1.51	6.07	8.30
87 Venezuela	Latin America	1993	1.51	7.57	8.85
88 Senegal	Sub-Saharan Africa	1991	1.51	5.22	7.02
89 Dominican Rp	Latin America	1996	1.51	6.29	7.83
90 India	South Asia	1983	1.51	6.03	6.89
91 Lesotho	Sub-Saharan Africa	1986	1.52	4.83	6.83
92 South Africa	Sub-Saharan Africa	1993	1.54	6.17	8.02
93 Puerto Rico	Latin America	1989	1.54	7.47	9.07
94 Niger	Sub-Saharan Africa	1992	1.55	5.07	6.07
95 Egypt	Middle East North Africa	1991	1.57	6.70	7.56
96 China	East Asia and Pacific	1990	1.59	6.29	7.19
97 Mali	Sub-Saharan Africa	1989	1.60	5.25	6.32
98 Philippines	East Asia and Pacific	1985	1.63	6.19	7.34

99 Philippines	East Asia and Pacific	1997	1.64	6.18	7.53
100 Pakistan	South Asia	1996	1.64	6.55	7.32
101 Sri Lanka	South Asia	1985	1.65	6.72	7.62
102 Peru	Latin America	1986	1.68	6.75	7.95
103 China	East Asia and Pacific	1995	1.72	6.33	7.62
104 Jamaica	Latin America	1988	1.73	6.46	7.80
105 Brazil	Latin America	1986	1.74	6.81	8.36
106 Mexico	Latin America	1984	1.74	7.28	8.62
107 Pakistan	South Asia	1985	1.74	6.27	7.14
108 Mali	Sub-Saharan Africa	1994	1.77	4.68	6.19
109 Mauritania	Sub-Saharan Africa	1988	1.77	4.88	6.67
110 Guatemala	Latin America	1987	1.80	6.00	7.65
111 Venezuela	Latin America	1987	1.80	7.55	8.78
112 Jamaica	Latin America	1993	1.81	6.71	7.81
113 Pakistan	South Asia	1990	1.84	6.31	7.24
114 Nicaragua	Latin America	1993	1.86	5.47	7.07
115 Trinidad Tob	Latin America	1988	1.89	7.59	9.00
116 Malaysia	East Asia and Pacific	1989	1.91	7.20	8.45
117 Nepal	South Asia	1984	1.93	6.05	6.84
118 Mauritania	Sub-Saharan Africa	1993	1.95	5.36	6.76
119 Philippines	East Asia and Pacific	1991	1.99	6.21	7.44
120 Bangladesh	South Asia	1983	2.00	6.10	6.97
121 Dominican Rp	Latin America	1984	2.01	6.56	7.68
122 India	South Asia	1988	2.03	6.27	7.09
123 Sierra Leone	Sub-Saharan Africa	1989	2.06	3.74	6.82
124 Thailand	East Asia and Pacific	1998	2.11	7.23	8.40
125 Gambia	Sub-Saharan Africa	1992	2.13	5.11	6.66
126 Mauritius	Sub-Saharan Africa	1991	2.17	7.57	8.69
127 Madagascar	Sub-Saharan Africa	1993	2.19	5.14	6.40
128 Guyana	Latin America	1993	2.20	5.99	7.18
129 Indonesia	East Asia and Pacific	1999	2.28	6.92	7.74
130 Malaysia	East Asia and Pacific	1995	2.29	7.35	8.84
131 India	South Asia	1993	2.29	6.36	7.19
132 Sri Lanka	South Asia	1990	2.37	6.82	7.65
133 Mauritius	Sub-Saharan Africa	1986	2.42	7.15	8.40
134 Indonesia	East Asia and Pacific	1987	2.44	6.50	7.44
135 Indonesia	East Asia and Pacific	1993	2.44	6.85	7.70
136 Thailand	East Asia and Pacific	1992	2.67	6.86	8.28
137 Cambodia	East Asia and Pacific	1997	2.67	5.64	6.73
138 Sri Lanka	South Asia	1995	2.68	6.90	7.84
139 Nepal	South Asia	1995	2.88	6.08	7.07
140 Bangladesh	South Asia	1988	2.88	6.40	7.17
141 Viet Nam	East Asia and Pacific	1992	2.89	5.60	6.56
142 Thailand	East Asia and Pacific	1986	2.89	6.51	7.83
143 Bangladesh	South Asia	1995	3.20	6.56	7.41
144 Laos	East Asia and Pacific	1992	3.77	6.52	7.27

Table A2: Description of variables and data sources

Variable name	Source	Description
Log income per capita of first quintile	Dollar and Kraay (2002) data set available: http://econ.worldbank.org/view.php?type=18&id=22018	Constant $1985 US Dollar
Log average income per capita	Dollar and Kraay (2002) data set	Constant $1985 US Dollar, real GDP per capita
SOI anomaly	National Oceanic and Atmospheric Administration. Available: ftp://ftp.ncep.noaa.gov/pub/cpc/wd52dg/data/indices/soi	Southern Oscillation Index anomaly
OECDPOLICY	SourceOECD Agriculture support estimates, available: http://oecdpublications.gfi-nb.com/cgi-bin/OECDBookShop.storefront/EN/product/512002093C3 USDA Economic Research Service Trade Issues data, available: 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, sheepmeat, wool, pigmeat, poultry, eggs, coffee, cocoa, roots and tubers, fruits, vegetables (including melons). Data available from OECD for period 1987-2000, and USDA/ERS for period 1982-87.
	FAOSTAT Agricultural production of primary crops, available: 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.
Arable land per capita	Dollar and Kraay (2002) data set	Total arable land in hectares per adult population
Non-program crops share, 1970	FAOSTAT Agricultural production of primary crops:	Fraction of agricultural production in 1970 in categories: roots and tubers, coffee, cocoa, fruits and vegetables (including melons)
EU Budget year? (0/1)	European Union, available: http://europa.eu.int/comm/budget/index_en.htm	Every seven years beginning 1985
Japanese election year? (0/1)	Electionworld database available: http://www.electionworld.org/	Lower house of parliament election years: every four years beginning 1983
US election year? (0/1)	Electionworld database /	Presidential election years: every four years beginning 1980
France election year? (0/1)	Electionworld database	Presidential election years: every seven years beginning 1981
Output per farm, US	US Census of Agriculture 1992, 2002 National Agricultural Statistical Service Agricultural Statistics database available: http://www.nass.usda.gov:81/ipedb/	Output per farm by commodity for each of the major commodity classes listed above. Data available at five-year intervals and linearly interpolated. Data included in regression as weighted average across commodities where weights are production shares for major commodity classes listed above in 1970.
Output per farm, EU	Eurostat, Farm structure Historical results Surveys from1966/67 to 1997 and 1999-2002 Spain Agricultural Census (1999)	Output per farm by commodity for each of the major commodity classes listed above. Data available biannually and linearly interpolated. Data included in regression as

	Italy Agricultural Census (2000)	weighted average across commodities where weights are production shares for major commodity classes listed above in 1970.
Concentration of production in US	US Census of Agriculture 1992, 2002 National Agricultural Statistical Service Agricultural Statistics database available: http://www.nass.usda.gov:81/ipedb/	Sum of squared shares of national production for each crop and numbers of livestock for each of the ten leading states in each commodity. Data included in regression as weighted average across commodities where weights are production shares for major commodity classes listed above in 1970.
Concentration of production in EC	Eurostat, Farm structure Historical results Surveys from1966/67 to 1997 and 1999-2002	Data available biannually and linearly interpolated. Sum of squared shares of EU area planted for each crop and numbers of livestock for each of the five leading EU member countries in each commodity in classes listed above. All industrial crops used instead of oilseeds. Except rice, where share of production in Italy is used. Data included in regression as weighted average across commodities where weights are production shares for major commodity classes listed above in 1970.
Exports+Import/ GDP	Dollar and Kraay (2002) data set	Exports and imports in constant 1985 US Dollars at market exchange rate. GDP is in $1985 PPP
Gov't consumption / GDP	Dollar and Kraay (2002) data set	Measured in local currency
ln(1+inflation rate)	Dollar and Kraay (2002) data set	Log of rate of inflation plus one
Stock of secondary educ.	Dollar and Kraay (2002) data set	Stock of years of secondary education
Rule of Law Index 1997-98	Dollar and Kraay (2002) data set	Greater values indicate better Rule of Law
Deposit money/total bank assets	Dollar and Kraay (2002) data set	Commercial bank assests as fraction of total bank assets

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