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Poverty Effects of Higher Food Prices: A Global Perspective

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Abstract

The spike in international food prices between 2005 and the first half of 2008 drew much attention to the vulnerability of the poor to such shocks. This paper provides a formal assessment of the direct and indirect impacts of higher prices of agricultural goods on global poverty using a representative sample of 63–93% of the developing world's population. To assess the direct effects, the paper uses domestic food price data between January 2005 and December 2007—when the relative price of food staples rose by an average of 5.6%—to find that the number of individuals living under the extreme poverty line increased by 155 million, with almost three-quarters of this increase taking place in East Asia. To take the second-order effects into account, the paper links household survey data with a global general equilibrium model, finding that the same increase in consumer prices of agricultural goods (modeled by increasing demand for first-generation biofuels) would raise the number of individuals living under extreme poverty by 32 million, with nearly the entire increase occurring in South Asia and Sub-Saharan Africa.

1. Introduction

The rapid rise in the international price of staples or raw materials used in the production of processed food (here and after "food prices") between 2005 and 2008 raised numerous concerns about potential welfare impacts of a world with higher food prices, particularly among poor households and those with incomes just above the poverty line. Although food prices subsequently retreated from their July 2008 peak, they recently began rising again and, as of November 2010, were just 11% below the 2008 high. While these recent developments fall short of convincing evidence of a reversal in the long-term trend decline in food prices, there are several reasons why higher food prices could remain a policy concern in the future, particularly in developing countries: slower progress in development of new technologies, limited take-up of existing advanced techniques as a result of infrastructure and institutional constraints, sooner- or larger-than-expected damages from climate change, and large and growing additional demand for agricultural output from biofuels.

To date there have been few formal assessments of the likely impacts of higher food prices on global poverty, and none using a large sample of developing countries. This paper aims to bridge the existing knowledge gap by providing a set of estimates of the likely impacts of higher food prices on poverty and income distribution at the global level using a unique set of household survey data. The paper is organized as

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follows. Section 2 presents the conceptual framework. Section 3 estimates the direct (first-order) poverty effects of the recent changes in domestic food prices in a simple micro-accountability framework. Section 4 adds the second-order impacts by linking the household survey data with a global general equilibrium model in a macro–micro simulation framework. Scenarios in this section relate higher food prices to the increased production of biofuels and allow households (at the macro level) to re-optimize their consumption and labor supply choices. Section 5 concludes.

2. Conceptual Framework

The economic effects of changes in relative prices have been a well-researched subject including contributions by Deaton (1989), Ravallion (1990), and Ravallion and Van de Walle (1991) among others. According to this literature, changes in food prices can affect poverty and inequality through consumption and income channels (Figure 1). As food prices increase, the higher cost of buying a fixed consumption basket reduces consumers' welfare. However, for those whose income depends, directly or indirectly, on agricultural markets the rise in food prices represents an increase in income. For each household, the net welfare effect of an increase in food prices will depend on the combination of a loss in purchasing power (consumption effect) and a gain in monetary income (income effect).

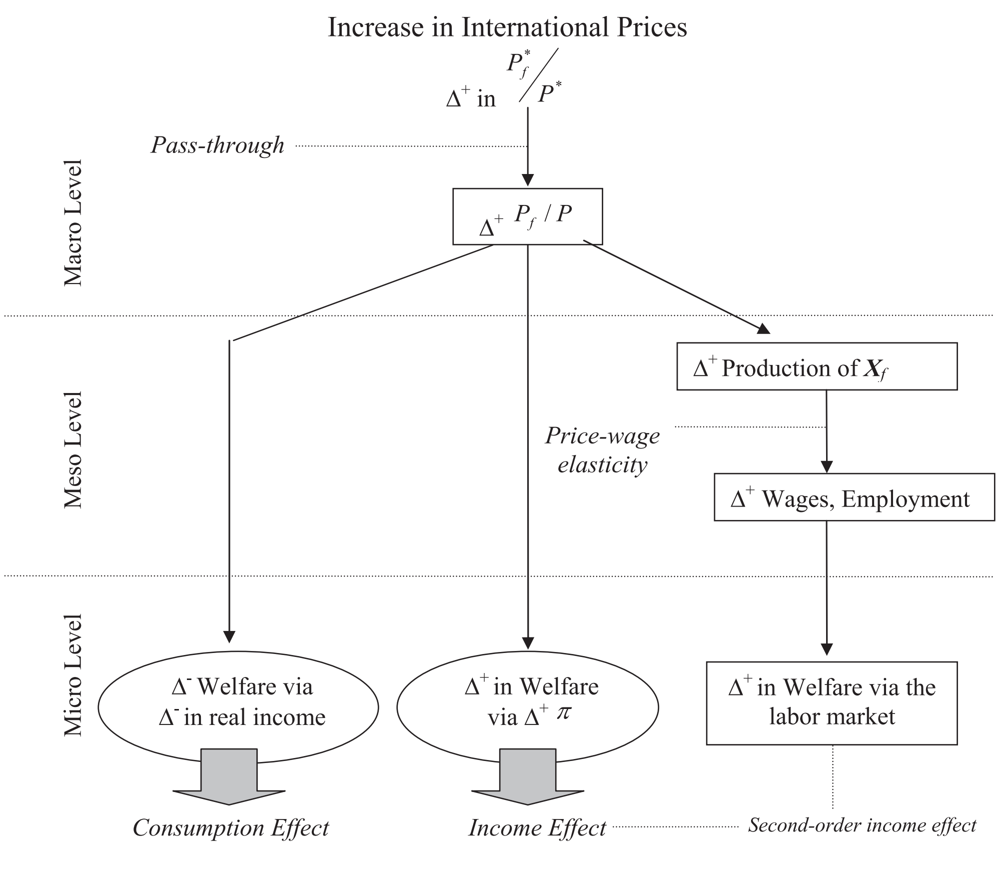

Figure 1. Relationship Between International Food Prices and Household Welfare

For households whose income has no linkages with the agricultural markets, e.g. urban dwellers, the net welfare effect of an increase in food prices will be entirely determined by the negative consumption effect. For households whose incomes are closely related to the performance of agricultural markets and for which food consumption represents a small proportion of their total budget, higher food prices would be welfare-improving. Therefore, the "first-order," or direct, welfare effects of shifts in food prices will be determined by the household's net position on food supply or demand. In the medium run, once quantities produced are adjusted to reflect the new set of prices in the economy, wages and/or employment in the agricultural sectors will increase to attract the necessary factors of production to increase output—this is what it is known as the "second-order," or indirect, income effect (Figure 1).[1]

As long as the pass-through from international to domestic food prices is different from zero, the increase in international food prices will lead to a redistribution of resources from the non-agricultural to the agricultural sector of the economy (Macro Level in Figure 1). Ultimately, the short- to medium-term poverty effects of higher international food prices will be determined by: (1) the degree of pass-through; (2) the incidence and severity of poverty among net food producers versus net food consumers; and (3) the extent to which higher food prices translate into higher income for farmers. Thus, the country-specific and global net poverty effect of higher food prices remains an empirical question.

3. Direct Poverty Effects of Higher Food Prices

International Prices, Domestic Prices, and Household Welfare

Between January 2005 and December 2007, the international food price index increased 74%.[2] The international food consumer prices index (CPI) reflects changes in the international food prices weighted by commodity-specific global trade volumes. In a world where as little as 7% of total food consumption is traded internationally, the international and domestic food CPIs are only marginally related. The relevant price changes for welfare analysis are the domestic food CPIs that have grown at a rate much slower than the international food CPI.

Figure 2 reports the change in domestic food CPI "relative" to the change in nonfood CPI observed between January 2005 and December 2007 and compares these indices

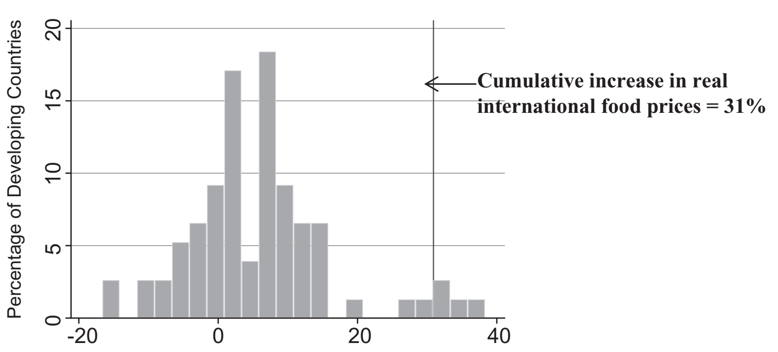

Figure 2. Distribution of Cumulative Increase in Relative Food Prices (Local Currency, January 2005–December 2007)

with the change in international food CPI relative to the manufacturing unit value (MUV) index.[3] For the great majority of the developing countries analyzed (58 out of 76) food items became more expensive in terms of nonfood items. On average, relative food prices increased 5.6%, far below the 31% increase registered by the international food CPI relative to the MUV.

Differences between the domestic and international food price indices could be explained by differences in the consumption basket with domestic food baskets containing nontraded food items. International and domestic food CPIs can also differ because of: (i) a weak price transmission in internationally traded food commodities (Baffes and Gardner, 2003), (ii) imperfect domestic markets characterized by lack of competition (Levinsohn, 1996) and poor infrastructure, and (iii) government intervention in the form of subsidies and price controls, and other market distortions. Not only can the international food CPI diverge from the average domestic food CPI but also price changes across countries show a high level of heterogeneity. Therefore "domestic" price indices should be used to infer the *ex post* welfare effects of price changes.

Define the monetary income of household h, Y_h, as the sum of incomes from profits from agricultural activities, Y_h^A, and incomes deriving from all other sources, Y_h^{NA}. These monetary income components are assumed to be a function of the vector of prices in the economy, $\mathbf{P}$, hence $Y_h = Y_h^A(\mathbf{P}) + Y_h^{NA}(\mathbf{P})$. The purchasing power of household h, Y_h^r, is defined by the ratio of its money income divided by a household-specific price index capturing the household's consumption patterns in terms of food and nonfood expenditure:

$$Y_h^r = \frac{Y_h}{P_h} = \frac{Y_h^A(\mathbf{P}) + Y_h^{NA}(\mathbf{P})}{\alpha_h P^f + (1-\alpha_h) * P^{nf}} \tag{1}$$

where P^f and P^{nf} are food and nonfood price indices and α_h is the proportion of household's h budget spent on food. Equation (1) captures the dual effect of a price increase depicted in Figure 1, i.e. the possible higher monetary income on the one hand, and the loss in purchasing power on the other. The changes in real incomes brought about by a change in "relative" prices of food vs nonfood, $\frac{d(P^f/P^{nf})}{dt} = \dot{p}$, can be approximated by the following linear expression:

$$\dot{Y}_h^r = Y_h^A \dot{p} - \alpha_h Y_h \dot{p}. \tag{2}$$

Equation (2) states that, in the short term and for sufficiently small $\dot{p}$, profits from farming activities, Y_h^A, will increase in the same proportion as the changes in relative prices and the loss in purchasing power will be proportional to the amount of the total household budget spent on food, $\alpha_h Y_h$. Therefore, in the short term, the proportional change in real income with respect to the base period can be written as follows:

$$\frac{\dot{Y}_h^r}{Y_h} = (\varepsilon_h - \alpha_h)\,\dot{p} \tag{3}$$

where ε_h is the share of total household income that is derived from profits from farming activities. Hence, in the short term, higher food prices will benefit net producers of agricultural goods ($\varepsilon_h > \alpha_h$) and hurt net consumers of agricultural products ($\varepsilon_h < \alpha_h$). Equations (2) and (3) assume that production and consumption patterns remain constant after the change in prices (Deaton, 1989) and, while useful for capturing near-term or direct impacts, should be complemented with an analysis allowing for substitution possibilities. This will be explored in section 4.

Urban Households

As it is clear from equation (3), the share of the total household budget that is spent on food, α_h, is an important element determining the deterioration in purchasing power originating from an increase in food prices. For some countries, this information is readily available from household surveys, however, in several cases one has to estimate or impute this value.[4] This and the following sections make use of the Global Income Distribution Dynamics (GIDD) dataset that has been recently developed by the World Bank. The GIDD dataset consists of 73 detailed household surveys for low and middle-income countries, 21 of which include information on food expenditure by household.[5] Together, this dataset covers 63% of the population in the developing world, with the major missing country being China. The welfare measures are expressed in 2005 purchasing power parity (PPP) prices for consistency with the US$1.25 and US$2.5 a day poverty lines recently developed in Chen and Ravallion (2008).[6]

For urban dwellers, where, most likely, the quantities of food produced are close to zero, the welfare effects of higher food prices will be largely determined by the loss in purchasing power. Therefore we assume that Y_h^A in equation (2) is zero for all households in this stratum, hence: $\dot{Y}_h^r = -\alpha_h Y_h \dot{p}$. The results of the simulation focusing on the loss in purchasing power in urban areas can be seen as an instructive way of summarizing: (i) domestic changes in food prices, (ii) the initial incidence and severity of poverty, (iii) the proportion of the total budget spent on food.[7]

The top panel of Table 1 shows that the urban poverty headcount increased by 2.86 percentage points, equivalent to an additional 68.8 million individuals below the poverty line, owing to a *ceteris paribus* change in *relative* food prices observed between January 2005 and December 2007 (Figure 2).[8] Additionally, the average gap between the poor's income and the poverty line grew by 0.89 percentage points. To better understand the relationship between food prices and urban poverty Table 1 presents the elements that determine the increase in urban poverty: (1) the relative change in domestic food prices faced by urban households; (2) the proportion of the total budget that poor urban households allocate to food; and (3) the initial incidence and intensity of poverty among urban dwellers. To preserve space, the table shows regional weighted average poverty effects, while country-specific impacts can be requested from the authors.

As discussed earlier, the magnitude of the food price increase faced by households is, in all regions, significantly lower than the changes registered by the international food price index. The weighted average increase in "relative" food CPI for urban areas in the developing world is 4.10% with food prices increasing at slower rates in Latin America and the Caribbean and in Eastern Europe and Central Asia and quite the opposite in East Asia and the Pacific and the Middle East and North Africa. East Asia experiences the largest increase in poverty owing to the high importance of food items in poor urban households and a large increase in food prices. Middle East and North Africa also experienced a relatively large increase in urban poverty caused by a sharp increase in the relative prices of food in this region (12.54%). It should be emphasized that these results represent an upper bound of the real poverty impact and therefore should be taken with caution. In the medium- to long-run, urban households would change their consumption patterns towards less expensive food baskets; additionally, some of the general equilibrium effects of higher incomes in the agricultural sector will eventually benefit urban areas.

Table 1. Poverty Effects of the Changes in Relative Food Prices (January 2005–December 2007)

			Initial (ca 2005)		Change		
Region	*Shock to food prices (%)*	*Food share among the poor (% of total income)*	*Poverty headcount ratio*	*Poverty gap*	*Poverty headcount ratio (percentage points)*	*Poverty gap (percentage points)*	*Number of poor (million)*
Urban households only							
East Asia and the Pacific	13.81	67.46	13.28	2.69	6.34	1.86	51.1
Eastern Europe and Central Asia	–0.49	56.87	1.31	0.22	0.04	0.01	0.1
Latin America and the Caribbean	1.64	40.36	3.73	1.39	0.12	0.02	0.5
Middle East and North Africa	12.54	57.03	2.71	0.48	2.49	0.72	4.4
South Asia	4.84	61.86	32.27	8.07	1.89	0.66	8.2
Sub-Saharan Africa	4.91	52.75	34.09	12.97	1.65	0.75	4.6
Developing world	4.1	58.76	15.17	4.29	2.86	0.89	68.8
Urban and rural households							
East Asia and the Pacific	12.98	70.65	24.77	5.59	5.98	1.97	113.5
Eastern Europe and Central Asia	–0.39	60.42	1.94	0.34	0.04	0.01	0.2
Latin America and the Caribbean	3.09	44.1	7.97	3.23	0.19	0.07	1.1
Middle East and North Africa	19.79	61.7	9.61	2.14	2.41	0.8	7.4
South Asia	4.96	64.9	40.6	9.81	1.84	0.65	27.7
Sub-Saharan Africa	8.14	64.35	48.32	19.69	0.74	0.36	5.8
Developing World	5.6	64.51	28.72	8.18	2.38	0.75	155.6

Notes: The regional changes in food prices are weighted averages of the cumulative increase in domestic food CPIs relative to nonfood CPI observed between January 2005 and December 2007. The poverty line is set at US$1.25 (2005, PPP) per day. The share of food consumption to total consumption among the poor is computed as described in De Hoyos and Lessem (2008). To get the increase in number of poor the regional change in headcount was applied to all countries in the region. East Asia does not include China and the Middle East includes only Jordan, Morocco and Yemen.

Rural Households

The adverse poverty effects of higher food prices could be compensated by an increase in farmers' income. Since the incidence of poverty among agricultural producers is higher than among non-agricultural households, a net poverty reduction as a result of a rise in food prices is not an implausible outcome (Aksoy and Isik-Dikmelik, 2008).

The GIDD dataset classifies households as "rural" and "urban" according to the national statistical definition for each country. Thus, rural households include large land owners, self-sufficient farmers, agricultural wage earners, and households with income sources other than agriculture. Additionally, the GIDD dataset identifies income or consumption "only at the household level." This poses a serious challenge since we do not have information on the level and distribution of the share of total household income that comes from agricultural activities ε_h. Both α_h and ε_h vary across households but, as opposed to α_h there is no economic theory that we can use to estimate a relationship between ε_h and other observable characteristics like household per capita income.

In order to estimate ε_h we rely on the information from the Rural Income Generating Activities (RIGA) project.[9] According to the observed data and controlling for income differences, the share of self-employed income in rural areas is highest in Sub-Saharan Africa and much lower in Latin America and South Asia. Using data for 19 countries in five of the six World Bank developing regions, we estimate a simple relationship between ε_h and per capita household income (or consumption) y_h and regional fixed effects:

$$\begin{aligned} \varepsilon_h &= 0.76 - 0.5y_h + 0.0002y_h^2 - 0.38EAPh_h - 0.30ECA_h - 0.44LAC_h - 0.49SAS_h \\ N &= 630{,}692;\ R^2 = 0.5. \end{aligned} \tag{4}$$

The results of this specification are used to impute the share of self-employed agricultural income in all rural households (out-of-sample) taking into account their per capita household income (or consumption) and regional location.

Figure 3 shows the difference between the observed (scatter points) and imputed (continuous line) agricultural self-employed income share for each percentile of per capita consumption in rural areas. The share labeled "all countries" shows that the average share in the poorest households for rural areas is close to 80% while this falls to 15% for rural households in upper percentiles. Figure 3 also tests the predictive power of the model for out-of-sample observations by comparing the observed shares, ε_h, vs the fitted values, $\widehat{\varepsilon_h}$, for two rather different countries: Nigeria and Panama. The country-specific fitted values in Figure 3 are based on two separate regressions that excluded Nigeria and Panama, respectively (in order to test the ability of the model to predict the agricultural earning shares for countries out of the sample). The imputed and observed shares are very close, with the average absolute difference between observed and imputed shares in Panama and Nigeria being around 7 percentage points.

In the short-run, incomes of self-employed farmers will increase in proportion to the increase in prices of their produce. The lack of household-level information on rural income sources implies that, as a result of higher food prices, all rural households experience an increase in nominal income equal to $\alpha_h Y_h \dot{p}$. Therefore, as long as $\varepsilon_h < \alpha_h$, household h will experience a reduction in real income as a result of higher food prices. For the same increase in price, given the higher value of $\widehat{\varepsilon_h}$ estimated by specification (4), rural households in Sub-Saharan Africa experience a higher increase in nominal income compared with rural households in Latin America.

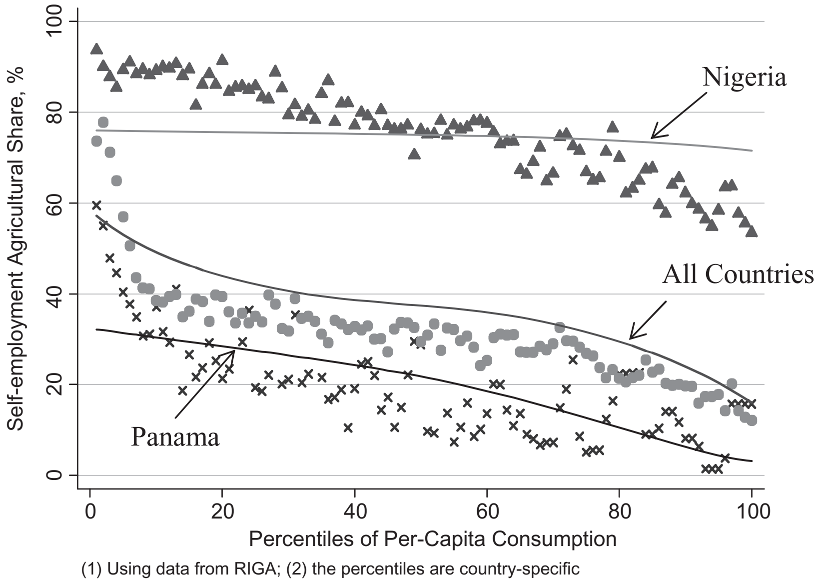

Figure 3. Observed and Imputed Share of Agricultural Self-employed Income

Total Poverty Effects

Overall, the number of poor increased by 155 million as a result of the cumulative increase in relative food prices between January 2005 and December 2007 (Table 1).[10] This contrasts with the 105 million reported in Ivanic and Martin (2008) for the following reasons: (i) the present paper uses data for 73 developing countries as opposed to nine, (ii) the estimates of Ivanic and Martin (2008) were based on nominal price changes for seven commodities whereas we take the cumulative change in food CPI relative to nonfood CPI as the price shock, (iii) the income/consumption household aggregates are expressed in 2005 PPP and the newly developed US$1.25 and US$2.50 poverty lines are used to measure the initial poverty indices (see Chen and Ravallion, 2008), and (iv) Ivanic and Martin (2008) total poverty estimates are valid for low-income countries covering a total population of 2.3 billion whereas our estimates are for all the developing world covering a population of 5.4 billion. Given all these differences, the discrepancy of 50 million between the number of new poor presented in this study and the number of new poor estimated in Ivanic and Martin (2008) is indeed a small one.

4. Incorporating Indirect Poverty Effects of Higher Food Prices

Extensions to Methodology and Data

The previous section explored the direct, first-order poverty implication of a 5.6% increase in the global prices of agricultural goods (food prices). The methodological approach assumed fixed quantities of demand and supply, and did not take into account second-order general equilibrium effects. In order to broaden the analysis and include these types of effects, this section links a recursive-dynamic global computable general equilibrium (CGE) model with a global micro-simulation model.

In order to simulate a food price shock of the same magnitude in a model with flexible prices and quantities, we assume an exogenous increase in demand coming from the rising production of biofuels.[11] Several studies have claimed that increased production of biofuels was a major contributing factor to the food price increase of 2005–2008 (Mitchell, 2008; World Bank, 2009, ch. 2). The model contrasts a baseline scenario with no additional demand for biofuels with an alternative scenario where increased biofuel production raises global food prices by 5.6%.[12]

The CGE model used in this paper is the World Bank's Environmental Impacts and Sustainability Applied General Equilibrium model (ENVISAGE).[13] Production is modeled with a series of nested constant elasticity of substitution (CES) functions that allow for different degrees of substitutability across intermediate inputs, energy, skilled and unskilled labor, different capital vintages, land, and natural resources. The mobility of land and old capital vintages across uses is limited while new capital vintages and skilled labor are freely mobile across sectors. Unskilled workers are freely mobile within farm and nonfarm activities, but the movement from farm to nonfarm employment is limited with a Harris–Todaro migration function. Consumer demand is modeled with a nesting of Cobb–Douglas and constant differences-in-elasticity (CDE) utility functions. International trade is specified with nested CES and constant elasticity of transformation (CET) functions that allow for limited substitution between domestically produced goods and imports or exports (the Armington assumption). The macro closure has government expenditures as a share of gross domestic product (GDP) fixed at base year levels, while a demographically driven savings function determines the allocation of private expenditures between consumer demand and domestic investment. The manufactured export price index of high-income countries is the numéraire. The model uses the GTAP database with a 2004 base year, which has been aggregated to 26 country/regions and 22 sectors.[14]

The distributional analysis is carried out with the World Bank's GIDD model, which generalizes the existing CGE-microsimulation methodologies at the global level and is described in detail in Bussolo et al. (2010). Starting from the observed global distribution, the CGE model provides a set of link variables for the micro-simulation: (a) change in the allocation of workers across sectors in the economy, (b) change in returns to labor by skill and occupation, (c) change in the relative price of food and nonfood consumption baskets, and (d) differentiation in per capita income/consumption growth rates across countries. The final distribution is obtained by applying the changes in these link variables to the household surveys. The survey data is a combination of the 73 household surveys described earlier in section 2 and more aggregate data on income groups (usually vintiles) for 25 high income and 22 developing countries. The final sample covers 93% of the world's population.[15]

Simulation Results

When rising demand for biofuels is introduced into the model, agricultural producers accelerate the output of biofuel crops by shifting resources away from other agricultural activities. The increases in production vary substantially by region and type of grain (Table 2), with the largest gains realized in countries with relatively more abundant land, higher initial demand (e.g. the legislative mandates adopted in the USA and the EU), and the existing penetration of biofuel technologies (e.g. Brazil is more competitive in sugar-base ethanol than other producers). At the same time, the supply expansion is limited by the amount of additional land that may be brought under cultivation as well as the additional labor that may be attracted to the agricultural

Table 2. Biofuels Impact on Output Prices, Output Volumes, Consumer Prices, and Household Real Income (% Change Relative to Nonbiofuels Scenario)

	Output price					*Output volumes*					*Consumer price index*				*Household real income*	
	Corn	*Oil seeds*	*Wheat*	*Sugar cane and beet*	*Agriculture*	*Corn*	*Oil seeds*	*Wheat*	*Sugar cane and beet*	*Agriculture*	*Agriculture*	*Processed food*	*Agriculture and food*	*All goods and services*	*Percent change*	*$2004 million*
High income countries	6.3	7.4	2.3	1.3	2.2	52.2	56.2	9.5	0.6	8.6	1.9	0.5	0.7	0.1	–0.1	–18,967
East Asia and Pacific	10.8	11.4	2.9	4.3	4.0	39.1	26.0	5.4	–1.6	1.1	3.5	1.9	2.7	0.7	–1.0	–13,757
South Asia	29.2	30.5	14.0	16.5	16.2	42.2	45.3	6.0	–2.7	3.9	16.1	4.1	10.6	4.4	–3.0	–22,538
Europe and Central Asia	8.0	8.6	4.5	4.2	4.7	47.3	48.7	7.3	–1.3	4.1	4.2	1.4	2.5	0.6	–0.5	–4,028
Middle East and North Africa	4.4	5.4	3.7	4.1	3.7	33.9	38.7	2.6	–0.9	2.2	3.7	1.4	2.3	0.4	–0.4	–3,543
Sub Saharan Africa	11.3	13.5	6.3	6.0	9.2	41.4	52.4	–13.0	–2.1	3.6	9.0	1.9	4.9	1.8	–1.4	–6,455
Latin America and the Caribbean	12.4	15.6	8.4	8.7	9.2	32.0	85.1	–7.3	17.2	9.2	7.2	3.1	4.1	0.0	–0.6	–10,227
Developing countries	11.9	19.4	7.8	11.0	7.5	38.8	56.3	4.1	3.1	3.8	7.6	2.4	4.7	1.0	–1.0	–60,548
World total	9.6	15.2	5.6	8.9	5.5	45.2	56.3	6.8	2.5	6.0	5.6	1.0	2.2	0.2	–0.3	–79,516

sector, which is limited by the large and persistent wage gaps between rural and urban incomes in the developing world.[16] Therefore, outputs of other agricultural goods—such as rice, other crops, and livestock—decline relative to baseline as farmers find it more profitable to focus on biofuels. Given that many biofuel crops use land intensively, the returns to land rise substantially, ranging from above 40% in Brazil to just under 4% in Japan. The returns to unskilled labor rise substantially less: for developing countries as a whole, unskilled wages increase by 11% while land prices go up by 16%.

The increase in factor incomes is offset by a rise in consumer prices. The consumer price of agricultural goods increases by 5.6% relative to the baseline, while the price of agriculture and processed food rises by 2.2%. The incidence of the price increases is heavily biased towards the poorer regions of the world. This is because the two poorest regions—South Asia and Sub-Saharan Africa—do not produce large amounts of biofuels but consume large amounts of grains. This vulnerability, combined with limited producer gains, causes South Asia and Sub-Saharan Africa to experience the largest welfare losses (in percentage terms) in the biofuels scenario (Table 2).

As a result of these price shocks, the extreme and moderate poverty headcounts in developing countries increase by 0.6 and 0.9 percentage points, respectively (Table 3).[17] This increase is determined almost entirely by South Asia and Sub-Saharan Africa. In the former, an additional 32.5 million people slip into extreme poverty as a result of higher food prices brought about by increased production of biofuels. In the latter, extreme poverty rises by 1.8 million. The number of poor, however, is reduced significantly in Latin America, where higher farm incomes contribute to an exit of 2.3 million people out of extreme poverty. Overall, extreme poverty rises by 32 million people; while a large number, this is only one-fifth of the increase in poverty shown in the previous section.

At the higher (moderate) poverty line, more than 47 million people slip into poverty as a result of higher prices of agriculture and food commodities. The regional incidence of moderate poverty changes is very different from changes in extreme poverty, with the differences determined by sources of income and density around each poverty line. In the case of East Asia, extreme poverty hardly changes because the 2.5 million persons increase in urban poverty is nearly offset by a compensating reduction in rural poverty. Moderate poverty in East Asia, however, rises by 29 million people (more than 60% of the total poverty increase) because there are many more urban households in the vicinity of the higher poverty line. In South Asia, where both farm and nonfarm households experience welfare losses owing to higher food prices, the density of the population around the moderate poverty line is substantially less than the density around the extreme poverty line. As a result, fewer additional households slip into moderate poverty than into extreme poverty. This is particularly true of households who earn their primary income from farming.

The previous discussion alluded several times to the critical importance of the farm/nonfarm distinction to the poverty outcomes. Compared with the baseline, in which the urban wage premium of unskilled workers in developing countries fell by 8% between 2004 and 2010, the same wage premium is reduced by 24% in the biofuels scenario. These income gains, however, are offset by the increase in the cost of consumption basket of farmers, who spend a larger portion of their income on food than the richer urban consumers. As a result, the extreme poverty headcount in agriculture remains virtually unchanged between scenarios, while the headcount for non-agriculture households rises by 1.3 percentage points. Therefore, nearly all of the

Table 3. Biofuels Impact on Poverty

	Poverty headcount			*Number of poor, millions*		
	Ca 2005	*Baseline, 2010*	*Biofuels, 2010*	*Ca 2005*	*Baseline, 2010*	*Biofuels, 2010*
US$1.25 (PPP) per day poverty line						
East Asia and Pacific	17.0	7.4	7.4	307	137	137
Eastern Europe and Central Asia	5.4	3.1	3.0	21	12	12
Latin America and Caribbean	8.1	5.9	5.5	40	31	28
Middle East and North Africa	2.9	1.1	1.1	6	3	2
South Asia	39.3	26.5	28.6	567	401	433
Sub-Saharan Africa	49.7	37.3	37.5	268	215	217
Developing countries	24.8	15.8	16.4	1208	798	830
US$2.50 (PPP) per day poverty line						
East Asia and Pacific	51.7	36.2	37.7	936	669	698
Eastern Europe and Central Asia	24.2	16.0	16.1	93	61	62
Latin America and Caribbean	21.4	16.8	15.8	105	87	81
Middle East and North Africa	29.7	18.5	18.8	61	41	41
South Asia	85.8	80.0	81.1	1237	1211	1230
Sub-Saharan Africa	80.5	71.9	72.3	434	415	418
Developing countries	58.8	49.1	49.9	2867	2483	2531

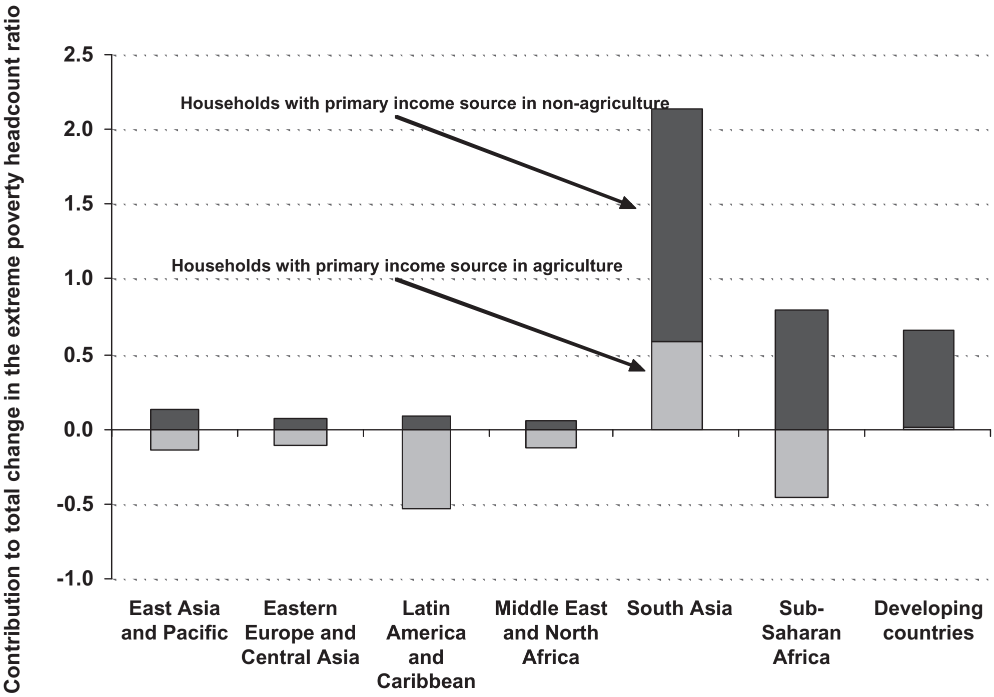

Figure 4. Decomposition of Poverty Impact of Biofuels

poverty increase at the global level is accounted for by the rise in poverty for households outside agriculture, although this statement does not hold at the regional level (Figure 4).

5. Conclusions

The spike in food prices between 2005 and the first half of 2008 highlighted the vulnerabilities of poor consumers to higher prices of agricultural goods and has generated calls for massive policy action. This paper provides a formal assessment of the first- and second-order implications of higher prices for global poverty using a representative sample of 63–93% of the population of the developing world. Using data on changes in the domestic food CPI over the period covering January 2005 and December 2007—when food prices increased by an average of 5.6% in real terms—the paper finds that the implied increase in the extreme poverty headcount at the global level is 1.7 percentage points. This estimate takes into account both the increase in the cost of each household's food consumption basket and the rise in the incomes of agricultural producers. The global number hides a significant amount of regional variation, with poverty in Eastern Europe and Central Asia and Latin America remaining roughly unchanged, while the headcount ratios in East Asia and the Middle East and North Africa increase by more than almost 6 and 2.4 percentage points, respectively.

Although agricultural prices declined in the second half of 2008 and in 2009, they have recently started rising again and are now (as of November 2010) just 11% below the 2008 peak. This could mean that the long-term downward trend in the prices of agricultural commodities may be coming to an end, and thus the food crisis may be just a "preview" of a world with higher food prices. By linking the household survey data with a general equilibrium model, the paper finds that a 5.6% increase in consumer prices of agricultural goods owing to rising demand for first-generation biofuels could raise extreme global poverty by 0.6 percentage points and moderate poverty by 0.9 percentage points. Poverty increases at the regional level vary substantially, with nearly all of the increase in extreme poverty occurring in South Asia and Sub-Saharan Africa. Although farmers benefit from higher output prices, they also dedicate a larger share of their expenditure to food than the richer urban dwellers, which results in the agricultural poverty headcount remaining unchanged while the non-agriculture poverty headcounts increases by 1.3 percentage points.

The results in this paper suggest that the poverty consequences of higher food prices are substantial, but that the implied total poverty elasticity of high prices (taking indirect effects into account) is much lower than the first-order, or direct, elasticity. Still, millions of consumers could fall into extreme poverty owing to higher food prices, and millions more already under the poverty line are likely to experience a further deterioration in their living standards. The results presented in the paper are dependent on a number of assumptions and estimated relationships—including food consumption shares in a number of countries, the share of self-employed income of agricultural households, structural features of the general equilibrium model, and the link between variables of the micro-simulation—and therefore should not be interpreted as "the effect" of higher food prices on poverty. The results nonetheless provide an important contribution to the discourse by identifying the relevant transmission channels, establishing the orders of magnitude, and exposing the regional and country variation concealed in the aggregate numbers.

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Notes

1. Arguably, there is also a “second-order effect” taking place in the consumption side, that is, given the new set of prices, the consumer can chose a different consumption basket. This effect is ignored in the present analysis based on the high degree of correlation among prices of different food items and the little scope that the poor have for food consumption substitution.
2. Using figures from the World Bank (DECPG).
3. The domestic food CPIs are collected by the International Labor Organization (ILO) (http://laborsta.ilo.org/) directly from the national statistical offices (or central banks). The international food CPI and the MUV indices are constructed by the research department at the World Bank (http://go.worldbank.org/MD63QUPAF1).
4. In 21 of the 73 countries, household-level information on total food expenditure was available. Using the information for these 21 relatively large countries, a developing countries’ Engel curve was estimated, which was then used to impute α_h for the other countries. The methodological details of this procedure, which echoes Cranfield et al. (2002), are explained in De Hoyos and Lessem (2008).
5. A list of the countries and a description the dataset is available at http://www.worldbank.org/gidd
6. Most of the household surveys in the GIDD are for years between 2000 and 2005. When the GIDD dataset did not include the newest household survey available from the World Bank’s PovCal, the GIDD’s survey mean income (or consumption) was modified so that the extreme poverty headcount matched the latest information available from PovCal.
7. For a more detailed discussion on the urban poverty effects of higher food prices, see Desuss et al. (2008).
8. Using the change in the “poverty deficit” (financial resources required to eliminate poverty under perfect targeting) as the cost measurement, Dessus et al. (2008) showed that, on average, 90% of the additional cost of alleviating urban poverty can be attributable to the reduction of real income of households classified as poor before the price increase.
9. For a complete description of the RIGA project including publication of the first results, see Carletto et al. (2007) and visit: http://www.fao.org/es/ESA/riga/index_en.htm
10. The country-specific changes in the poverty headcount ratio are available from the working paper version of this study: http://ideas.repec.org/p/wbk/wbrwps/4887.html
11. We only consider first-generation biofuels: corn, sugar cane, and wheat for ethanol, and oil seeds for biodiesel.
12. In the baseline scenario, biofuels demand as a share of total demand for each crop remains at the base year levels, while in the biofuels scenario demand broadly follows its historical path and production mandates.
13. The detailed description is available in Van der Mensbrugghe (2008).
14. The regions include the USA, Canada, Japan, Western Europe, rest of high income, China, Indonesia, rest of developed East Asia, India, rest of South Asia, Russia, rest of Eastern Europe and Central Asia, Sub-Saharan Africa, Middle East and North Africa (MENA) energy exporters,

rest of MENA, Brazil, Mexico, Colombia, Peru, Venezuela, Argentina, Chile, Bolivia and Ecuador, Paraguay and Uruguay, Central America, and Caribbean. The sectors include paddy rice, wheat, other cereals, oil seeds, sugar cane and beet, other crops, livestock, forestry, coal, crude oil, natural gas, other mining, processed food, refined oil, chemicals, energy-intensive manufacturing, other manufacturing, electricity, gas distribution, construction, transport, and other services.

15. See the GIDD's webpage for a complete country coverage: www.worldbank.org/prospects/gidd

16. In other words, although higher prices of agriculture contribute to a faster closing of rural–urban wage gaps in developing countries (relative to the baseline scenario) and reduce the incentive to migrate at the margin, an average agricultural worker still finds it advantageous to move to an urban area where earnings tend to be much higher. This labor market rigidity limits the supply response in developing countries.

17. This paper uses the new World Bank poverty line of US$1.25 (2005 PPP) per day, and, in accordance with earlier practice, defines the moderate poverty line as twice the extreme poverty line (US$2.50 per day, 2005 PPP). The extreme poverty statistics in this paper are fully consistent with Chen and Ravallion (2008) at the country level, but do not line up exactly to the global and regional poverty estimates published in World Development Indicators or in Chen and Ravallion (2008) owing to differences in country coverage.