WPS5215

Policy Research Working Paper 5215

The Impact of Economic Shocks on Global Undernourishment

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The World Bank
Poverty Reduction and Economic Management Network
Poverty Reduction and Equity Unit
February 2010

Policy Research Working Paper 5215

Abstract

This paper estimates the impact of the 2008 food price spike and the 2009 contraction in global growth on undernourishment rates. The analysis is based on a methodology that uses a calorie-income relationship and income distribution data. The authors find that the 2008 global food price spike may have increased global undernourishment by about 6.8 percent, or 63 million people. Moreover, they show that the sharp slowdown in global growth in 2009 could have contributed to 41 million more undernourished people compared with what would have happened if the economic crisis had not occurred.

This paper—a product of the Poverty Reduction and Equity Unit, Poverty Reduction and Economic Management Network—is part of a larger effort in the department to assess the links between crises, nutrition and food security. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The author may be contacted at hzaman@worldbank.org.

The Impact of Economic Shocks on Global Undernourishment

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We are grateful for comments from Harold Alderman, John Newman, Ana Revenga, Jaime Saavedra, Meera Shekhar, Ken Simler and Emmanuel Skoufias.

1. Introduction

The sharp increase in food prices in 2008 and the impact of the 2009 global economic crisis highlights the vulnerability of the poor to external shocks. Global poverty rose anywhere from 100 million (Ivanic and Martin 2008) to close to 200 million people (Dessus et al, 2008) as a result of the food price shock which saw the World Bank food price index increasing from 180 to 334 between June 2007 and June 2008. Wheat prices doubled during the year leading up to April 2008 and rice prices increased from around $370 a ton to over $1000 a ton between January and April of 2008. The reason for the sudden increase in these prices was a confluence of factors such an export ban on rice and wheat from a few key exporters, diversion of foodgrain towards the production of biofuels, higher energy prices and the depreciation of the dollar.

While the pressure on prices has eased since its peak in mid 2008, domestic prices remain high in many countries (Wodon and Zaman, 2009). In Benin, the price of maize (which contributes 20% of caloric intake on average) has risen by 31% in the first quarter of 2009, compared with October-December 2008. During the same period, cassava prices rose by 10% in Uganda (where it represents 13% of daily calorie intake), and wheat prices rose by 13% in Sri Lanka. Hence, many of the households who fell into poverty due to the food price spike of 2008 are likely to have remained in poverty.

The global economic slowdown of late 2008 and 2009 that came at the heels of this food price shock has dealt an additional blow to countries around the world. Global GDP is expected to contract by 2.2% in 2009 and while the slowdown is greatest for OECD countries, the developing world is facing its share of pain with estimated growth falling from 5.8% to 1.2% in 2009 (World Bank 2010). At the household level, employment, real wages, earnings and remittances have all fallen, though with significant variations across regions and countries (Paci et al 2009). An additional 64 million people could be under the $1.25 a day poverty line by the end of 2010 (World Bank 2010).

Past experience on the impacts of crises on health and nutrition is sobering. The economic crisis in Cameroon in the early-1990s is estimated to have increased the prevalence of malnutrition from 16 percent to 23 percent between 1991 and 1998 (Pongou et al 2005). The 1988-1992 Peruvian economic crisis is estimated to have led to 17,000 additional infant deaths (Paxson and Schady 2005), while the 1997-98 financial crisis in Indonesia increased infant mortality risks by 3.2 percentage points (Rukumnuaykit 2003). Cutting back on essential medical expenses during crises is an important factor leading to malnutrition and other long term health impacts (Klotz et al 2008). Given the clear links that have been shown to exist between economic shocks and worsening malnutrition rates (Alderman et al. 2006, Ferreira and Schady 2008), shocks of the order that was seen in 2008 and 2009 can clearly have serious human consequences.

Senauer and Sur (2001) assessed the impact of changes in global food prices on undernourishment (hunger). In this paper we build on their methodology to quantify the impact of the 2008 food price increases as well as modeling the impact of the 2009 growth slowdown on undernourishment. Like Senauer and Sur we use calorie insufficiency, based on cross-country data[1] compiled regularly by the Food and Agriculture Organization (FAO), as our measure of undernourishment. Calorie insufficiency is equated with hunger and food insecurity as it relates to the minimum food consumption required to attain required energy thresholds. We also recognize its limitations as an indicator. Calorie intake is an input-based indicator of undernourishment, while nutritional outcomes are clearly also affected by factors such as health and sanitation (Alderman 1993). Secondly a calorie-based measure ignores the other important micro-nutrients required for a healthy individual. However the advantage of this measure is that FAO is able to compile undernourishment numbers consistently for a large number of countries and the methodology which is used here to link changes in income and prices with calories, cannot be applied with other measures of malnutrition.

The rest of the paper is organized as follows. Section 2 discusses the methodology we use to assess the impact of these recent economic shocks in detail. In Section 3 we discuss the simulation results of the impact of higher food prices on undernourishment in 2008 and the

[1] The FAO methodology relies on three key statistics: (i) an estimate of per capita daily energy (calorie) supply available in the country determined from food balance sheets developed from country level agricultural production and trade data; (ii) the coefficient of variation of the distribution of calorie consumption among the country's population obtained from household surveys whenever they exist and regional averages when they don't, and (iii) the minimum per capita daily energy requirement for the country's average person that reflects the age and gender composition of the population. Based on these statistics and assuming a log-normal distribution for calorie consumption, the probability that an average person is below the minimum energy requirement is determined and interpreted as the proportion of the population that is undernourished (FAO).

impact of the economic crisis in 2009. In Section 4, we summarize the main results and conclude.

2. Methodology

The methodology used in this paper builds on Senauer and Sur (2001) and consists of three broad stages which are detailed below. The first part is the estimation of the calorie-income relationship, or the calorie Engel curve using data on per capita income and per capita calorie consumption available for a group of 83 low and middle-income countries. The second component uses country-specific income distribution data to construct a cumulative density function (cdf) of per capita income for all countries in our sample. These two steps allow us to estimate, at any given level of food price and any given level and distribution of income, the fraction of individuals unable to afford the minimum threshold caloric intake necessary to avoid undernourishment for every country in the sample. The third stage involves aggregating these country estimates to create regional baseline undernourishment numbers and simulating different food price and growth scenarios to assess the impact on undernourishment. This section describes this methodology in greater detail.

2.1 The Calorie-Income Relationship

The literature points to a wide variety of estimates for the income elasticity of calories ranging from close to 0 to close to unity. Bouis and Haddad (1992) arrive at estimates that range from 0.08 to 0.14 for the Philippines and conclude that though statistically significant, the magnitudes are too small for growth in income to lead to material improvements in nutritional status. Similarly, Behrman and Deolalikar (1987) use data from India and find the point estimate of this elasticity to be 0.37 but statistically indistinguishable from zero. Low or close to zero elasticity for the calorie-income relationship is also reported in Alderman (1993) and Strauss and Thomas (1995). Subramaniam and Deaton (1996), on the other hand, find this elasticity to be around 0.55 for the poorest households in rural Maharastra and around 0.40 for the better off households in the sample. As argued by Reutlinger and Selowsky (1976), Strauss and Thomas (1990) and Ravallion (1990) there seems to be a general agreement on the fact that there are non-linearities in the Engel curve for calories and this causes the elasticity to be higher for the poor than for the rich.

Though not directly comparable to our work which is based on cross-country data, the results of these micro studies are important references as we specify the empirical model we want to estimate. Since one of our objectives in this paper is to estimate the number of people that are undernourished due to the sharp fall in growth in 2009, these results help underscore two points. One that growth in poorer countries will yield a larger reduction in the population of undernourished compared to similar growth in a more affluent country. Second even in poor countries the distributional aspects of growth – particularly the growth experienced by the lowest deciles of the income distribution – will be just as important (if not more) as the absolute level of growth.

We use data on per capita income in purchasing power parity adjusted dollars available from the World Development Indicators for all low and middle-income countries from 1995-2003. Per capita calorie consumption data was available for a subset of the countries in this sample from the FAOSTAT website for the same period. Keeping only countries that had data for both calorie consumption and per capita income we ended up with 83 countries in the cross section and an overall sample size (country-year pairs) of 742. For comparison, Senauer and Sur (2001) used data from 1992-1996 for 55 low and middle income countries and their effective sample size was 220.

The regression we estimate is the following:

$$C_{it} = \theta + \delta \log(Y_{it}) + \mu_i + \varepsilon_{it} \qquad (1)$$

where C_{it} is the per capita calorie consumption in country *i* in year *t*, Y_{it} is the per capita income for country *i* in year *t*, μ_i is the time invariant country fixed-effect and ε_{it} is the random error. We put in the country fixed effect to control for time invariant country specific characteristics such as dietary preferences that determine caloric intake and may bias the coefficients if omitted from the regression.

We use a semi-log functional form for the relationship between calories and income and estimate it using OLS. The semi-log form has a number of desirable properties. First, the relationship between calories and log income is almost linear so using OLS for the estimation is reasonable (See Annex Figure 1). Second, the semi-log form also ensures that the elasticity is declining in income.

We present the results of this regression in Table 1. We carry out the regression with and without country fixed effects. The outcomes for the two regressions are reported under specification (1) and (2) respectively. We essentially restrict attention to within country variation in the calorie demand and income when we estimate the fixed effect model so in this case it seems that not taking into account differential dietary preferences across countries would have led us to underestimate the effect of income on calorie consumption. So the estimates for ϑ and δ obtained from the second specification are our preferred estimates and we use the same values for the baseline estimates of the undernourished population.

Table 1: The Calorie-Income Relationship

VARIABLES	Calories (1)	Calories (2)
Coefficient on Per Capita GDP(δ)	267.6***	330.0***
	(22.72)	(13.96)
Constant (θ)	409.0***	201.2***
	(4.75)	(2.48)
Country Fixed Effects	No	Yes
Observations	742	742
R-squared	0.419	0.407

t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

2.2 Estimating Undernourishment

After estimating the calorie-income relationship, we require caloric requirements that define the threshold for undernourishment by region. These numbers derived from FAO estimates[2] for 2003 are presented in Annex Table 1. We also use the income distribution data available from the World Development Indicators to compute the cumulative density function of per capita income for each country. For 74 of the 83 countries in the original sample, we have data for the fraction of income/consumption accounted for by individuals in each quintile. This data can be used to calculate the cumulative density function for income so that at any given level of income we know the fraction of the country's population that is below this income level. We then estimate the fraction of population that is below these thresholds for countries in our sample to estimate the number of undernourished. The weighted average of each countries undernourished population is multiplied by each regions population to produce regional estimates.

As an example let us consider the case of Uganda. Using Annex Table 1 we assume 1810 calories per person per day is the minimum dietary norm. Now using our regression estimates of the relationship between calorie consumption and income, we find that one will require an annual income of $131 (PPP adjusted) to buy 1810 calories in Uganda and using income distribution data we find that 34 percent of the population were undernourished as they were below this threshold. In order to create regional aggregates, Uganda's 34 percent would be weighted by its 2007 population alongside the 28 other countries from Sub-Saharan Africa and the resulting number for Sub-Saharan Africa would be applied to the population of the entire region in 2007.

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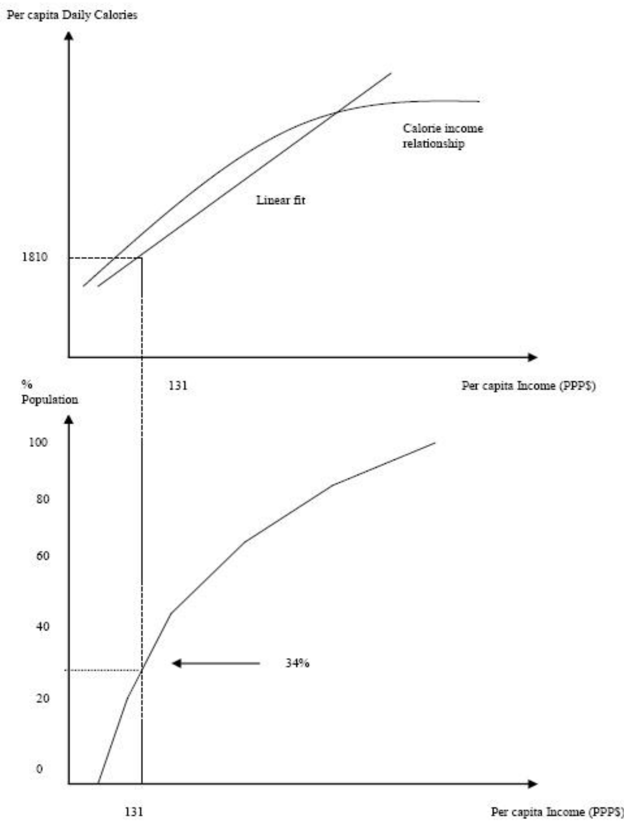
[2] There is significant variation in the dietary requirement across regions because they reflect the age distribution and stature of the population that reside in particular regions.

Figure 1: A Summary of the Methodology Using Uganda as an Example



Using this method, the baseline estimate of the number of people undernourished globally was found to be 993 million for 2007 compared with the actual figure of 923 million estimated by the FAO (see Table 2). Since our goal is to use this model and its baseline to estimate the proportionate increase in undernourishment due to changes in growth and food prices, the exact numbers of our 'constructed baseline' are not critical, as the proportionate increase is applied to the actual FAO baseline.

Table 2: Available Estimates for Undernourishment, Various Years

(in millions)	**Senaur and Sur (2001)**	**FAO 1990-92**	**FAO 2003-05**	**FAO 2007**	**Baseline 2007**	**% Undernourished (2007 Baseline)**
Sub Saharan Africa	285	162	212	236	228	29%
Asia and Pacific	636	589	542	583	639	15%
Latin America	77	53	45	51	44	8%
Middle East/North Africa	39	19	33	37	12	4%
Total	1110	842	848	923	993	17%

Source: Senauer and Sur (2001) are baseline estimates for 1996. Baseline 2007 numbers are authors' calculations using the methodology described in the paper. Asia and Pacific numbers are aggregated for presentation alongside FAO estimates.

2.3 Estimating the Impact of Economic Shocks

Using this set of baseline results, we can consider how these numbers will evolve due to shocks such as those resulting from higher food prices and a growth contraction.

The first thing that food price changes affect in our model is the Engel curve for calories. As can be seen from Figure 1, higher prices means one will need to spend more for the same amount of calories which in turn implies, ceteris paribus, that a higher fraction of the population is going to fall below the affordability mark[3]. So the Engel curve shifts "down" when prices go up for calories. The amount by which the Engel curve shifts depends on the elasticity of calories to prices and this elasticity in turn depends on the extent to which alternate caloric sources are available and affordable at any given level of income as well as the degree of substitutability between these sources. Unfortunately compared to the amount of work on the estimation of income elasticity of calories holding prices fixed, there is less evidence on the estimation of price elasticity of calorie demand holding income fixed is relatively scarce. Waterfield (1985) has an excellent review of the work in this area. He shows that Timmer and Alderman (1979) using data from 54000 households in Indonesia find that the average price elasticity of calories from all foods is -0.514; Gray (1982) finds it to be -0.477 for rice in Brazil and Pitt (1983) finds the calorie price elasticity in Bangladesh from rice to be -0.529 for the 25th percentile and -0.484 for the 90th percentile. Using this review Senauer and Sur (2001) argue that elasticity of total calorie consumption to the price of the primary staple food for the poorest households is in the range of -0.5. Having reviewed this evidence we also use this estimate though we also present results of the impact of higher food prices using elasticity values between -0.4 and -0.6 in Annex Table 2.

The manner in which the price elasticity of calorie demand (ε) enters our model is as follows. For every price shock we consider (5%, 25%,….,*p*), the new Engel curve is estimated by lowering the (calorie) purchasing power of real income by $p.\varepsilon$ from the previously estimated

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[3] In reality of course, calories are derived from a variety of sources some of which are cheap and some are more expensive. This will generate significant variation in relative prices within food categories inducing a lot of substitution between classes. However, we abstract from that and consider the composite price of food as being isomorphic to the price of calories. To the extent that there are substitutions that mitigate the impact of price increases such as these, our estimates can be considered an upper bound of the impact on undernutrition.

calorie-income line. For example, from the discussion in section 2.2 we know that the incidence of undernourishment in Uganda was 34 percent. In the scenario in which price increases by 25 percent, for example, the (calorie) purchasing power of every level of income decreases by 12.5 (-0.5*25) percent[4]. Under this new calorie-income relationship, the real income required to maintain the previous levels of calorie consumption will be higher. As a result, in this particular example, the share of the population in Uganda that cannot afford the minimum daily calorie intake of 1810 rises to 37 percent.

Unlike the price changes that cause the estimated calorie-income curve (in Figure 1) to shift, changes to growth rates of per capita income affect the cumulative distribution of income. A distribution neutral growth of per capita GDP would 'flatten' the cumulative distribution function (the lower figure in Figure 1) or rotate it to the right. For example, consider the case of Uganda again. If income grew in the year after the estimated baseline, then the 131 USD (PPP adjusted) that was required to purchase the daily caloric intake of 1810, is now going to be beyond the reach of fewer than 34 percent of Ugandans. Thus every growth scenario beyond the baseline has a direct implication on the cumulative distribution function and identifies a certain fraction of the population as undernourished. In order to estimate the impact of the economic slowdown we use growth rates predicted for 2009 before the financial crisis and compare it to latest estimates to assess the effect of the global economic slowdown on undernourishment.

Continuing with our example of Uganda, the pre-crisis growth rates projected for Sub-Saharan Africa in 2009 was 6.3 percent. Had this growth rate actually materialized in Uganda, our estimates indicate that the incidence of undernourishment would have declined to 31.4 percent of Uganda's 2009 population or roughly 10.1 million. Using the revised growth rate for Sub-Saharan Africa of 1.1 percent as the post-crisis growth rate for 2009, we get an estimate of 32.5 percent as the rate of undernourishment. This represents about 10.4 million Ugandans. We

[4] We note here that this method of adjusting the Engel curve leads to an association between the calorie-income elasticity and prices as the slope of the new Engel curve would be different. Skoufias (2003), however, has shown that calorie-income elasticity is fairly invariant to price changes. One way to shift the Engel curve ensuring that elasticity doesn't change in response to prices would be to scale up or down the intercept so that we get parallel shifts. We tried the entire set of simulations using this method as well but found that the results don't change materially.

interpret the difference in these numbers – 356,000 people – as the potential impact of the slowdown in economic growth on undernutrition.

Typically researchers have adopted two primary approaches in the analysis of the impact of economic growth on health and nutrition outcomes. One approach is to estimate the income elasticity of demand for calories using household survey data. The primary idea behind these studies is the fact that calorie consumption is an important input in the health production function. Some examples of this approach are Behrman, Foster and Rosenzweig (1997) and Bouis and Haddad (1992). The second approach is to estimate cross-country regressions of some measure of nutrition on per capita income. Our approach is derived from this second approach: we use calorie consumption as our preferred measure of nutritional status and estimate the impact of growth on undernourishment using a parametric relationship between calorie consumption and per-capita income in a cross country setting.

There are some clear limitations to this methodology. First, the cross-country regression nature of the estimation of the calorie-income relationship necessitates the use of per capita GDP which is often not the best measure of individual welfare within each country and given the concavity of the calorie-income curve, may lead to an overestimation of the incidence of undernourishment (Gabbert and Weikard 2005). Second the price elasticity of calorie demand which we use is not country-specific but an approximation based on the literature review discussed earlier. Third, in the case of the food price shock, we have to make simplifying assumptions about the extent to which global price changes were passed onto local consumers, and as such show two scenarios with a full pass-through and a partial pass-through of global prices. These shortcomings notwithstanding these methods remain useful as a way of obtaining an approximate measure of the impact of these shocks on undernourishment.

3.0 Results

We present the results of the two economic shocks discussed earlier (i) estimates of the impact of higher food prices in 2008 on undernourishment levels and (ii) estimates of the impact of a slowdown in growth due to the global economic crisis in 2009 on undernourishment levels.

3.1 Impact of the 2008 Global Food Price Increase on Undernourishment

The World Bank index of food prices increased by 35 percent in 2008 compared to its annual average in 2007 and by roughly 50 percent in July 2008 compared to its level in July 2007. We consider a scenario in which prices increase by a 'trend level' of 5 percent from 2007 levels and scenarios with increases of 25 percent, 35 percent and 50 percent. Recognizing that the full extent of price movements in international commodity markets does not pass through into domestic consumer prices we also consider the case in which 20 percent of the change in international prices is not passed through. The results are presented in Table 3.

Table 3: Impact of food price increases on undernourishment

		2008 - Full Passthrough				2008 - Partial Passthrough	
% Increase from 2007		**5%**	**25%**	**35%**	**50%**	**35%**	**50%**
Sub-Saharan Africa		1%	4%	5%	7%	4%	6%
Asia and Pacific		-4%	6%	11%	19%	8%	14%
Latin America and Caribbean		0%	10%	16%	24%	12%	18%
Middle East and North Africa		-1%	13%	20%	31%	15%	24%
Total		-2%	6%	10%	16%	7%	12%
	Baseline	**2008 - Full Passthrough**				**2008 - Partial Passthrough**	
(incidence in millions)	**FAO 2007**	**5%**	**25%**	**35%**	**50%**	**35%**	**50%**
Sub-Saharan Africa	236	239.3	245.5	248.6	253.4	246.4	250.2
Asia and Pacific	583	561.5	619.7	649.6	695.5	628.6	664.8
Latin America and Caribbean	51	50.8	56.2	59.0	63.2	57.0	60.4
Middle East and North Africa	37	36.6	41.8	44.4	48.5	42.5	45.8
Total	923	902.2	974.9	1012.2	1069.4	986.5	1031.1

Notes: Partial pass through of price assumes that the price shock faced by domestic consumers is 80% of the price shock in the international markets. The % increase numbers correspond to increase over 2007 model baseline. The incidence numbers in the lower panel correspond to the estimate percentage increase under the various scenarios applied to the FAO baseline for 2007.

Under the 5 percent food price increase scenario, the number of total undernourished would have decreased to 902 million in 2008. This reduction would largely be due to economic growth with the rise in average incomes more than making up for the increase in food prices. A more extreme scenario considers the change in the food price index between June 2007 and June 2008 – 50% - and shows that this would imply a 16 percent increase in undernourishment in 2008 if global prices were fully passed through. The more moderate, and realistic scenario, involves taking the average price increase for 2008 (35%) and the partial (80%) pass through of global prices. This scenario implies that the undernourishment count for 2008 rose by 63 million people to a total of 986 million or a 6.8 percent increase from the previous year. There are other ways of interpreting this absolute increase. For instance the true impact of the price increase was perhaps larger, as without the price shock, undernourishment could have declined below the 2007 baseline in 2008. Consider the 5 percent price increase as the counterfactual, for instance. The impact of the 2008 price increase would then have to be compared, not with the baseline figures for 2007 but the undernourishment under this counterfactual which is 902.2 million. Computed this way, one could argue the impact was as large as 9.1 percent. Moreover, Annex Table 2 shows that the choice of the price-calorie elasticity also has a bearing on our estimates. For instance if we use a lower price elasticity of calorie demand of -0.4, our estimate for the impact of the food price increase is 42 million people compared to 2007. Looking at absolute numbers in various regions, the biggest increases are likely to have been in Asia and Sub-Saharan Africa, while in proportional terms, the hardest hit regions were Latin America and Caribbean and Middle East and North Africa.

3.2 Impact of the Global Economic Slowdown on Undernourishment

We use our model to obtain some estimates of the effect of the global economic slowdown on undernourishment. In Table 4, we show the regional growth forecasts for 2009 made by the World Bank before and after the true scale of the global economic crisis had become apparent. In June 2008 when the Global Development Finance 2008 was published, financial markets were already starting to show signs of stress but the sheer size of the upheaval that was to follow was largely unanticipated. The spike in food and energy prices seemed more pressing issues at the time. Therefore the GDF concluded at the time that "developing countries' growth is easing but is still robust" (GDF, 2008). We use the growth predictions made in the 2008 GDF for 2009 as a baseline measure of economic growth that would have been realized had financial markets not imploded in the last quarter of 2008. We also have revised estimates of 2009 growth from the January 2010 Global Economic Prospects publication. We use a measure of the difference between these revised estimates and the growth predicted in 2008 to assess the impact of this growth shock on undernourishment.

The Newly Independent States in Europe and Central Asia and Latin America and Caribbean regions bore the biggest brunt of this growth shock. Whereas they were previously on course to grow at 5.4 percent and 4.3 percent respectively, the latest 2009 growth forecasts show them to be on track to shrink by 4.7 and 2.6 percent respectively. In Table 4, we present some estimates of undernourishment under the original and revised growth scenarios and with different price scenarios. The first price scenario reflects the 17% decline in the World Bank food price index between 2008 and 2009. The second scenario assumes no change in prices between 2007 and 2008. Our objective is to estimate the extent that the economic crisis led to additional numbers of undernourished relative to the absence of the crisis and hence a comparison of these two scenarios provides an indicative range.

Table 4: Impact of the economic shock on undernourishment under various scenarios

			2009 /a Growth Shock & Price Decline		**2009 /b Growth Shock & No Price Change**	
	Pre-crisis growth forecast for 2009	**Latest growth estimates for 2009**	Change in Undernourished (in mil)	% Change	Change in Undernourished (in mil)	% Change
Sub Saharan Africa	6.3	1.1	2.5	1.1%	5.3	2.4%
East Asia	8.5	6.8	2.3	2.0%	3.6	3.1%
China	9.2	8.4	1.3	1.3%	1.5	1.5%
South Asia	7.2	5.7	16.8	4.3%	22.1	5.7%
Latin America	4.3	-2.6	6.1	15.1%	6.4	15.8%
Middle East/North Africa	5.3	2.9	1.0	7.6%	1.5	11.1%
Newly Independent States	5.4	-4.7	11.3	18.3%	12.7	20.7%
Total	..	..	41.3	4.4%	53.1	5.6%

Note: 2009/a Refers to the scenarios in which the actual food price fall between 2008-09 is taken into account. 2009/b Refers to scenarios in which prices are assumed to have remained unchanged from their 2008 levels.

In a scenario where food prices in 2009 remain unchanged, we estimate that there would be 53.1 million people, or 5.6 percent, more undernourished people than if the economic crisis had not occurred. However, we know that food prices actually declined in 2009. The World Bank's average food price index for 2009 was 17 percent lower than 2008. If we consider this scenario for prices, we estimate that there are 41.3 million people, or 4.4 percent, more undernourished people than if the economic crisis had not occurred.[5] We prefer this latter estimate as it takes into account the actual change in food prices as part of our analysis of the impact of the slowdown in growth.

[5] We note that we assume that the two simulated growth scenarios are distribution neutral. This is an important assumption, particularly if one believes that the growth shock experienced due to the financial crisis had heterogeneous impacts on different income groups in different countries.

4 Conclusion

In this paper we built on the Senauer and Sur (2001) methodology to assess the consequences of higher food prices in 2008 and the 2009 growth contraction on the incidence of undernourishment. We show a range of estimates for the impact of the food crisis based on different assumptions about the extent prices rose and the pass-through of global to domestic prices. Our preferred, or most realistic, estimate suggests that the incidence of undernourishment could have increased by around 63 million people in 2008 due to the significant global food price spike. This is a 6.8 percent increase over the 923 million people estimated by FAO to be undernourished in 2007.

We also used our model to determine the impact of the 2009 slowdown in global growth on undernourishment. We estimate that the growth shortfall may have lead to a 4.4 percent, or 41 million, more undernourished people in 2009 than would have been the case had the economic crisis not taken place.

These results are indicative and are meant to highlight the fact that food security and nutrition ought to remain at the forefront of the development agenda especially following recent global shocks and in light of the fact that close to a billion people remain hungry. The specific policy implications are beyond the scope of this paper and most are country-specific. Broadly they relate to initiatives to promote growth, reduce food price volatility, insulate the poor from shocks and improve the effectiveness of nutritional programs.

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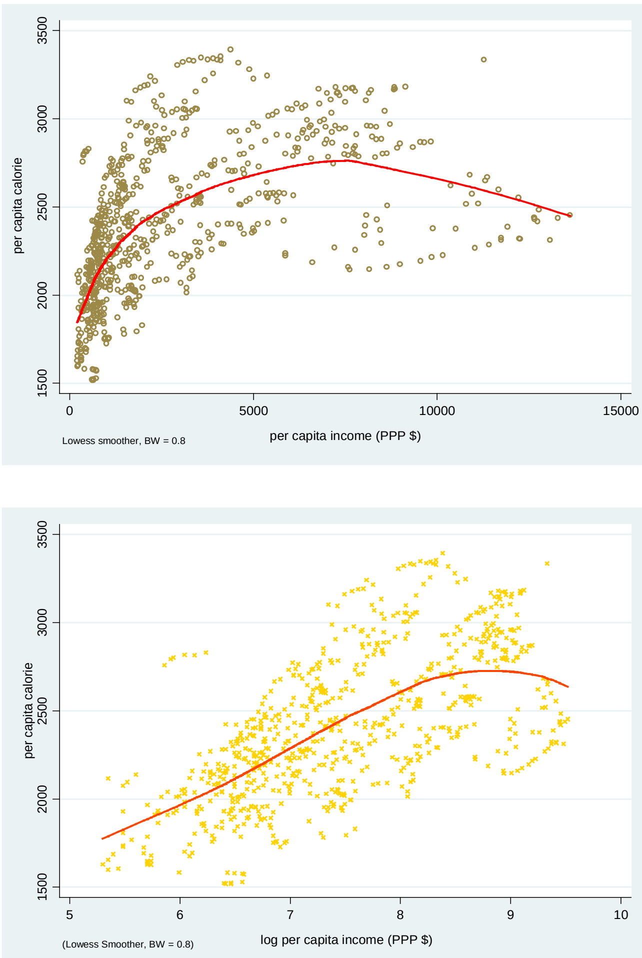
Annex

Figure 1: The Calorie-Income Relationship (in levels and in semi-log form)



Annex Table 1: Minimum Dietary Energy Requirements by Region

	2007
Sub Saharan Africa	1810
East Asia	1880
China	1900
South Asia	1790
Latin America	1900
Middle East/North Africa	1880
Newly Independent States	1920

Source: 2007 figures are based on FAO estimates for 2003-05.

Annex Table 2: Estimates of the impact of higher food prices varying the price elasticity of calories

		Price Elasticity of Calories				
		-0.4	**-0.45**	**-0.5**	**-0.55**	**-0.6**
% Increase from 2007						
Sub-Saharan Africa		4%	4%	4%	5%	5%
Asia and Pacific		5%	6%	8%	9%	11%
Latin America and Caribbean		9%	10%	12%	13%	15%
Middle East and North Africa		11%	13%	15%	17%	19%
Total		4%	6%	7%	8%	9%
Undernourishment Incidence *(in millions)*	Baseline (FAO 2007)					
Sub-Saharan Africa	236	244.6	245.5	246.4	247.2	248.1
Asia and Pacific	583	611.3	619.5	628.6	636	644.4
Latin America and Caribbean	51	55.4	56.2	57	57.7	58.5
Middle East and North Africa	37	41	41.7	42.5	43.2	43.9
Total	923	964.5	974.7	986	995.3	1005.7