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Was the Global Food Crisis Really a Crisis?

Simulations versus Self-Reporting

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ABSTRACT

Estimates by the U.N. Food and Agriculture Organization (FAO), the U.S. Department of Agriculture (USDA), and the World Bank concerning the welfare impact of the 2007/08 global food crisis conclude that between 75 million and 160 million people were thrown into hunger or poverty. However, these simulation-based approaches suffer from inherent deficiencies as well as insufficient coverage of the largest developing countries, especially China and India. This paper therefore assesses the usefulness of an alternative to simulation-based approaches, self-reported food insecurity data from the Gallup World Poll (GWP), a survey conducted before, during, and after the 2007/08 crisis. While these data are still less than ideal, we show that trends in self-reported food insecurity are statistically explained by both food inflation (positively) and economic growth (negatively). This validation motivates us to employ the GWP data as a barometer for the welfare impacts of the global food crisis. Our findings suggest that while there was tremendous variation in trends across countries, global self-reported food insecurity fell from 2005 to 2008, with the most plausible lower- and upper-bound estimates ranging from 60 million to 250 million fewer food-insecure people over that period. These results are clearly driven by rapid economic growth and very limited food price inflation in the world's most populous countries, particularly China and India. Hence, self-reported indicators of food insecurity reveal a trend opposite that of simulation-based approaches.

Keywords: global food crisis, hunger; poverty; self-reported indicators

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1. INTRODUCTION

In approximate terms, the global food crisis of 2007/08 involved a doubling of international wheat and maize prices in the space of two years and a tripling of international rice prices in the space of just a few months. Such rapid increases in the international prices of staple foods understandably raised concern about impacts on the world's poor. Surveys suggest that poor households spend at least half of their budget on food. If such a household does not earn income from producing or selling food, then a doubling of food prices would—all else equal—equate to at least a 25 percent loss of disposable income. And while that situation is most relevant to the urban poor—who by definition produce little or no food—a large body of evidence suggests that even the rural poor are often net consumers of food (World Bank 2008c). Consistent with these stylized facts, many simulation exercises of the impact of higher food prices on poverty suggest that poverty often rises in both rural and urban areas (Arndt et al. 2008; Ivanic and Martin 2008b; Robles and Torero 2010; Warr 2008; Zezza et al. 2008). The earliest such exercise was used by the World Bank to estimate that as many as 100 million were thrown into poverty (World Bank 2008a). A subsequent 73-country World Bank study estimated that global poverty rose by around 160 million people, 90 million of whom were rural (de Hoyos and Medvedev 2009). The U.N. Food and Agriculture Organization (FAO 2009) and U.S. Department of Agriculture (USDA 2009)—using a rather different methodology and the concept of calorie insufficiency rather than poverty—estimated that around 75–80 million people were thrown into hunger during the 2008 food crisis and another 97 million during the 2009 financial crisis. Another World Bank study, using an FAO-type methodology, also estimated that 63 million people were thrown into hunger by the two crises (Tiwari and Zaman 2010).

Despite an apparent consensus among international organizations that rising food prices are bad for the world's poor, that conclusion has been challenged by other academics. Some criticisms are conceptual while others focus on deficiencies in data and methods. Conceptually, Swinnen (2010) emphasized that whenever a price changes, some benefit and some lose. Whether the poor are likely to benefit or lose depends largely on their occupational status (whether they get their income from agriculture or nonagriculture) but also on the depth of their poverty (their total household budget and the proportion of that budget that they must devote to food expenditures). While the poor by definition have lower household budgets and large food expenditure shares, it is also well documented that around three-fifths of the world's poor primarily work in agriculture, with another one-fifth working in rural nonfarm sectors often dependent on agriculture (World Bank 2008c). So if rising agricultural prices also lead to rises in farm and nonfarm wages and income, then the net impacts might be positive. Aksoy and Isik-Dikmelik (2008) also demonstrated that even when the rural poor are net food consumers, they are often only marginally so. Hence one could be forgiven for believing that higher food prices involve a redistribution of income from richer urban areas to poorer rural areas. Indeed, as Rodrik noted early on in the crisis,[1] pre-crisis trade liberalization studies suggested that higher agricultural prices (food and nonfood) would *reduce* poverty in the developing world.

With regard to empirics, the World Bank, USDA, and FAO poverty and hunger estimates have also been questioned. While we provide more details of these criticisms in Section 2, there is a laundry list of potential problems. The widely cited FAO numbers—that 75 million were thrown into hunger during the crisis—are in fact based on USDA estimates because the FAO's "food availability" model has no capacity to model the impact of "food access" shocks (price changes). The USDA models access shocks based on trade channels but incorporate very little data on domestic price changes. This "global" model also excludes a number of large middle-income countries, including China, Brazil, and Mexico. More sophisticated simulations based on the approach pioneered by Deaton (1989) are better at conceptualizing and measuring the vulnerability of households to higher food prices (that is, whether they are net food producers or net food consumers), but these simulations have other weaknesses. More often

[1] Dani Rodrik, "Are High Food Prices Good or Bad for Poverty?," *Dani Rodrik's Weblog,* November 17, 2010, http://rodrik.typepad.com/dani_rodriks_weblog/2010/11/are-high-food-prices-good-or-bad-for-poverty.html.

than not the shock to the model is an assumed price increase rather than an observed one, and the shock pertains only to food prices rather than other prices that were also increasing over 2005–2008, such as fuel and nonfood commodities (Headey and Fan 2008). The models are almost invariably partial equilibrium at best, and at least one general equilibrium model (for India) indirectly suggests that rising food prices could raise unskilled wages, which benefits the poor (Polaski et al. 2008). This claim is generally supported by existing econometric studies that test the impact of price movements on agricultural wages (Lasco et al., 2008). And finally, like the USDA model, simulation-based approaches invariably exclude fast-growing China and mostly omit other large countries like India, Indonesia, and Brazil.

Another key feature of all types of simulations is that they incorporate very little real-time data from the food crisis period, be it food prices, national income trends, or household survey data. In this paper we therefore propose an alternative assessment of global trends in food insecurity based on Gallup World Poll (GWP) survey data collected before, during, and after the 2007/08 food crisis in well over 100 countries. These surveys are at least superficially well suited to assessing global food security trends for several reasons. First, the GWP has been conducted from 2005/06—before the global food crisis—to 2010 in well over 100 countries, including the most populous developing countries. Second, the vast majority of GWP surveys contain two questions that capture different dimensions of food security. One question relates to whether the household has had any problems affording food over the last 12 months, while the second asks whether the household has experienced episodes of hunger in the last 12 months. Third, Deaton (2010) has shown that the GWP indicator of food insecurity is closely correlated with gross domestic product (GDP) per capita and other welfare measures. And fourth, these surveys were conducted in the space of a month, with the month in question recorded. The significance of this last point is that we can match changes in self-reported food insecurity to monthly food inflation data and—more approximately—to annual data on economic growth. Hence we can test whether changes in self-reported food insecurity are explained by changes in mean income and food inflation, and thereby provide some validation for trends in these data.

While these characteristics suggest that the GWP data may provide a suitable means of assessing trends in global food security during the food and financial crises, there are obviously caveats. First, our research question is conceptually different from those posed in simulation analyses. The latter generally try to gauge the impact of rising food prices, all else equal. In the real world, however, all else was not equal: Oil and nonfood commodity prices were also rising, often to the benefit of developing countries, and nearly all poor countries experienced rapid economic growth over 2005–2008, especially the largest, such as China and India. Moreover, the rise in food prices was not causally independent from strong economic growth and fuel inflation. The weak U.S. dollar, the impacts of oil prices on biofuels demand, and strong economic growth in developing countries are all factors related to both economic growth and food inflation. This suggests that simulation studies typically impose unrealistic scenarios on their models.

A second caveat is that there are well-known flaws in self-reported indicators, including possible biases, as well as problems specific to the GWP. Hence, much of our paper is devoted to detailing the specific characteristics of the GWP surveys and the two measures involved (Section 3), and to exploring the plausibility of both cross-country patterns (Section 4) and within-country trends in the data (Section 5). A key finding is that while levels of self-reported food insecurity may be biased—especially when comparing richer countries with poorer countries—changes in self-reported food insecurity are very desirably explained by economic growth (positively) and inflation (negatively), especially in low-income countries.

Taking this last finding as at least a partial validation of trends in self-reported food insecurity, Section 6 goes on to estimate global and regional food insecurity trends, while Section 7 conducts some critically important sensitivity analyses. Our findings are spectacular for the degree to which they differ from simulation-based estimates. In contrast to the various USDA, FAO, and World Bank global simulation estimates, we find that global self-reported food insecurity went down from 2005/06 to 2007/08, not up. Moreover, most of our estimates suggest that it went down by a huge margin. Our upper-bound estimate puts the decrease at about 340 million people, while our lower bound puts the decrease at about 60 million. It is also quite transparent what explains this trend: very rapid economic growth and very modest inflation in China, India, and other large developing countries.

Section 8 concludes with a reiteration of the caveats of this self-reported indicator as well as some other words of caution and some lessons learned. Two important lessons are that economic growth appears to have been a major driver of trends in food insecurity and that focusing on the largest countries is obviously essential for any plausible estimate of global food insecurity. A final word of caution pertains to the fact that the impacts of the 2007/08 crisis are not necessarily a good guide to the current (2010/11) crisis. The pattern of food inflation this time around may be quite different, with inflation in China, India, and other large countries currently much higher than it was in 2008.

2. A BRIEF REVIEW OF EXISTING ESTIMATES OF THE IMPACTS OF THE FOOD AND FINANCIAL CRISES

Since self-reported indicators of welfare inevitably have flaws (see Section 3 below), the question is not whether our approach is imperfect but whether it is more or less imperfect than alternative approaches. Hence, this section provides a review of the chief criticisms of simulation-based approaches to measuring global food insecurity (hunger or poverty). The two basic approaches are the FAO/USDA and Tiwari and Zaman (2010) hunger estimates (largely based on national-level food availability data), and poverty estimates conducted by World Bank staff and their collaborators (largely based on Living Standards Measurement Study surveys).

Beginning with the former approach, the FAO uses minimum energy requirements as a "hunger line" and then estimates the proportion of people falling below that line based on estimates of the total number of available calories in the country and a lognormal distribution of calories estimated from income data from household surveys. It would be fair to say that all three components of this method suffer from serious measurement problems, a fact that FAO statisticians and others are clearly aware of (FAO 2002; Svedberg 2000). Specifically, sensitivity analyses have shown that while the FAO method is not very sensitive to the lognormal distributional parameters, it is highly sensitive to the hunger line chosen and the estimate of mean calorie consumption (FAO 2002). With regard to the hunger line, minimum energy requirements vary with physical activity levels, which are entirely unobserved. In a nontrivial example, the one billion plus people of India, Deaton and Dreze (2008) persuasively argued that this fast-growing economy's declining calorie consumption may be partly explained by declining calorie requirements associated with less physical labor.

With regard to measurement of food availability the problem is perhaps even worse. The FAO measures of calorie availability are derived from estimates of food production, net imports, wastage, and storage, but none of these components are measured accurately in developing countries. Again in the Indian context, Headey, Chiu, and Kadiyala (2010) showed that while national survey sources indicate declining calorie consumption, the FAO data suggest increasing calorie availability. In African countries measurement errors are probably even worse. Smith, Alderman, and Aduayom (2006) rigorously compared FAO-based estimates of hunger to household survey–based estimates in 12 African countries. The mean percentage point difference between the two prevalence series was an extraordinary 32 points. The source of this divergence could be errors in both the FAO balance sheets and the household surveys, but in poorer countries there are good reasons to think that the FAO balance sheets contain the greater error because they estimate consumption by very indirect means and rely heavily on data inputs from capacity-constrained national statistical agencies. Moreover, the balance sheets estimate only the availability for consumption, not the actual consumption.[2] One prominent critique has gone so far as to conclude that "the FAO method is not reliable enough to provide policy-relevant estimates of the prevalence of malnutrition, even at the broad regional level" (Svedberg 2000, 300).

But if there are such substantial errors in levels, there is even less reason to think that short-run shocks—like international price surges—could be adequately captured by the FAO methodology.[3] For example, unlike detailed country studies, the FAO data did not show any increase in hunger during the 1997/98 Asian financial crisis because its estimates were driven by food availability rather than access (FAO 2002). Without a food access component to the model, how then was the FAO able to estimate the hunger impacts of rising food prices in 2007 and 2008? In fact, the FAO model was incapable of producing any credible estimates, so the FAO simply borrowed USDA (2008, 2009) estimates of the

[2] That said, the Smith, Alderman, and Aduayom (2006) estimates have also been questioned. In a recent paper, Ecker and Qaim (2010) uncovered a much lower estimate of food insecurity in Malawi, suggesting that Smith, Alderman, and Aduayom's estimates could be influenced by measurement error.

[3] The 2002 FAO symposium on the measurement of hunger and food security (FAO 2002) provided a long list of concerns about these data.

percent change in "global" hunger in 2007 and 2008/09, and applied these changes to its own pre-crisis dataset. Strictly speaking, then, there are no FAO estimates of the impacts of the food and financial crises.

How, then, did USDA estimate the impacts of these crises? The USDA (2008) hunger indicator is conceptually similar to the FAO model,[4] but it uses a more sophisticated structural model to derive hunger estimates. Specifically, USDA uses calorie–income elasticities based on cross-country data on per capita calorie availability (as per the FAO) and per capita income, along with income distribution data from the World Bank. It then incorporates these elasticities into a partial equilibrium global trade and production model that includes elements like a food demand function. However, the model is still weak on the food access dimension, with no incorporation of domestic food inflation, for example. Moreover, as the authors of the report note, if countries draw down on stocks or receive more food aid, then the model may underestimate food availability (USDA 2008). Also critical is the fact that the USDA model pertains only to 70 low-income countries and thus excludes some huge middle-income countries, including China, Brazil, and Mexico. This would appear to explain why FAO applied the proportional change in the "global" USDA hunger figures rather than the country-level changes.

As for the financial crisis impacts, USDA based these on International Monetary Fund (IMF) projections from February 2009 on lost growth in export earnings and capital inflows for 2009. A "lost exports" scenario puts the increase in hunger at 63 million people, while the "lost exports plus lost capital flow" model puts it at 97 million. Such a large number is mainly driven by the fact that early IMF estimates projected that Asian countries would suffer most from lost export earnings and capital inflows because their baseline growth in these indicators was so strong. So Asia accounts for about half of the 97 million additional hungry people, for example. This surge in Asian hunger comes despite the fact that the region has continued to have spectacular economic growth rates during the financial crisis. It also seems implausible that slower trade growth would hurt food availability so severely in Asia. Among the larger East Asian countries, only the Philippines is a consistently large grain importer (Bangladesh is occasionally so); the rest of Asia is largely self-sufficient in staple grains, especially rice. Indeed, updated USDA (2011) estimates of food consumption for 2007/08 and 2008/09 show that, relative to 2005/06, food consumption was at the same level or higher in all Asian regions, with only a very slight -0.7 percent decline in rice consumption in East Asia (Table 2.1).

A variation of the USDA and FAO approaches was developed in a World Bank research paper by Tiwari and Zaman (2010). These authors estimated a cross-country Engel curve in order to quantify the amount of income required to purchase the calorie requirement, estimated cumulative density functions for income, and then assumed an own-price calorie elasticity of -0.5. They then shocked the model with a food price shock and an economic growth shock. The food price shock was an assumed food price increase (for example, 25 percent) rather than an observed one, which influenced calorie availability through the own-price elasticity. The financial crisis shock was the difference between pre–financial crisis forecast growth rates and post–financial crisis forecast growth rates, although we again note that it has subsequently turned out that developing countries were mostly not hard hit by the financial crisis, especially China and India (IMF 2010). So once again, the model and the shocks to the model were very simplistic. Moreover, the food price effect almost entirely hinged on the assumed own-price calorie elasticity of -0.5, a figure applied to the global dataset but based on estimates from only three developing countries.

We think a fair assessment of these hunger models is that they are far too crude to reliably predict the impact of access shocks, such as a rise in international food prices.[5] The results for all three models

[4] The FAO and USDA approaches to hunger measurement do have differences. FAO uses a minimum requirement of 1800 calories while USDA uses 2100 calories. FAO uses the estimate of per capita calorie consumption of a country as its mean, while consumption–income variance is estimated based on household survey data; it assumes the consumption–income relationship to be lognormal. And while FAO uses the number of calories as a unit of measurement, USDA's Economic Research Service (ERS) converts the calories to kilograms of grain equivalent. See www.ers.usda.gov/Briefing/GlobalFoodSecurity/questions.htm for more details.

[5] Of the three hunger models, the USDA model is certainly the most sophisticated. It is also important to note two other

also seem to contradict USDA data on consumption trends, reported in Table 2.1. These data show that cereal availability for food consumption did not decline substantially in any Asian region. Moreover, while consumption of wheat appears to have declined in Sub-Saharan Africa in 2007/08, maize and rice consumption actually increased by around 5 percent in each case. Overall, then, Table 2.1 does not suggest that there was a major food availability shock in any populous region. This does not rule out the importance of access shock, of course, but this is not really a channel that these models are exploring.

Table 2.1—Availability of major cereals in 2007/08 and 2008/09 relative to 2005/06 (% change)

Region	Maize		Wheat		Rice		Any major declines?
	2007/08	2008/09	2007/08	2008/09	2007/08	2008/09	
Caribbean	1.1%	0.9%	7.7%	1.4%	10.0%	3.6%	no
Central America	13.4%	13.4%	-3.0%	-3.3%	3.3%	5.2%	wheat only
South America	4.8%	9.6%	2.3%	2.7%	0.6%	4.6%	no
East Asia	16.3%	18.5%	-0.1%	-0.5%	-0.7%	3.6%	no
South Asia	-4.7%	10.8%	9.6%	4.8%	6.6%	8.0%	maize only
Southeast Asia	12.5%	20.8%	3.6%	4.5%	5.1%	4.5%	no
Sub-Saharan Africa	5.0%	16.3%	-11.0%	3.8%	5.2%	10.5%	wheat only
North Africa	15.0%	30.0%	6.0%	9.7%	1.7%	15.6%	no
Middle East	9.2%	9.2%	1.4%	3.4%	-1.1%	2.7%	no
Former USSR	5.7%	11.7%	-0.4%	0.1%	-2.4%	-6.7%	rice only
Other Europe	-4.1%	-4.1%	-4.6%	-5.5%	16.2%	6.8%	maize & wheat
European Union	-10.3%	0.7%	-0.7%	3.0%	20.1%	10.3%	maize only
North America*	40.0%	56.4%	1.9%	1.1%	4.5%	5.5%	no

Source: USDA (2011).

Notes: Data generally run from July in year *t* to June in year *t* + 1. Note that all data are aggregate. *In the case of maize and wheat we have used nonfeed consumption data, which includes industrial uses such as biofuels. This explains the sharp increase in North American maize consumption.

Are simulation techniques based on the Living Standards Measurement Study (LSMS) any better? A number of studies followed Deaton (1989) in estimating changes in household disposable income as a function of whether a household is a net consumer or net producer of food. Ivanic and Martin (2008a, b) conducted such an analysis for 9 developing countries, and Zezza and colleagues (2008) for 11 countries, while Dessus, Herrera, and de Hoyos (2008) and de Hoyos and Medvedev (2009) conducted an analysis for 73 developing countries. While the two 73-country studies are certainly quite comprehensive, the former covered only urban areas, while the latter's coverage of rural areas was based on an imputation of rural nonfarm income shares—which is essential to measuring net food consumption versus production—from just 19 of the 73 countries. Moreover, the 73-country dataset still excluded China (25 percent of the developing world's population), so coverage was still not truly global.

Are there other problems with LSMS-based simulations? In truth, many of the studies cited above were rigorous and sophisticated analyses, so the criticisms below often apply more to the nature of the simulations rather than the quality of the work per se. Bearing that in mind, Headey and Fan (2008, 2010) reviewed a number of these models and pointed to some important limitations. First, they expressed some skepticism that higher food prices seemed so often to raise rural poverty in these simulations. For example, it is well documented that many rural households engage in both farm and nonfarm activities (Winters et al. 2008), suggesting that rural people could conceivably be able to quickly switch their labor efforts as the terms of trade for agriculture change.[6] Moreover, many rural nonfarm activities relate

features of the USDA model. First, in our view its estimates should be considered upper bound because countries can respond to higher international food prices by altering their trade policies (for example, reducing tariffs) or by releasing stocks. Hence many countries may not import international food inflation as the model suggests. Second, USDA conducted its model relatively early on when the full impacts of the financial crisis in developing countries were estimated by the IMF to be quite dire. Re-estimating the USDA model with more recent data could well show more muted impacts on hunger.

[6] The study by de Hoyos and Medvedev (2009) also relied on estimates of the size of the rural nonfarm economy in the majority of its 73-country sample.

directly to the processing, transporting, or sale of food, and there is a large literature showing strong effects of farm-based economic growth on rural nonfarm incomes (Haggblade, Hazell, and Reardon 2007). This suggests that first-round effects on farm incomes, even if accrued to the nonpoor, could have beneficial spillover effects on farm and nonfarm wages, which could well accrue to the poor.[7] In a computable general equilibrium model for India, for example, Polaski et al. (2008) showed that higher rice prices reduced overall poverty because they raised unskilled wages in both rural and urban areas. However, the majority of partial equilibrium simulation approaches do not incorporate these more indirect causal pathways.[8]

Second, most of the LSMS-based simulation exercises incorporate price shocks that are an assumed proportion of international price increases rather the actual price increases observed in domestic markets (the study by de Hoyos and Medvedev [2009] is an important exception since it used domestic food inflation relative to nonfood inflation). However, Headey and Fan (2008)—and others—documented large variation in domestic food inflation across countries. Transmission of international prices was quite high in Africa and parts of Latin America, but much lower in several of the most populous Asian countries, such as China, India, and Indonesia (Dawe 2008).[9] Moreover, these large Asian countries were under-studied in this literature, and the only detailed analyses of large developing countries—Polaski and colleagues (2008) for India and Ivanic and Martin (2008a, b) for Vietnam—suggested that higher food prices would actually benefit the poor. There are no detailed studies of China, but considering that rural incomes are much lower than urban incomes in China, it seems perfectly plausible that a rise in food prices would reduce poverty in the world's most populous country.

Finally, virtually all of these simulation exercises asked a very specific question of their models: "What would happen to poverty if food prices went up, and only food prices went up?" However, this *ceteris paribus* assumption definitely does not apply to the period 2005–2008. On the negative side, fuel prices were also increasing rapidly, which constituted a secondary source of inflation that may have hurt the poor quite considerably (Arndt et al. 2008; Passa Orio and Wodon 2008). But on the plus side, the period before and during the crisis comprised several years of rapid economic growth in the vast majority of developing countries. Moreover, rapid economic growth was often cited as an underlying cause of the food crisis, so economic growth and food inflation have not been mutually exclusive phenomena in recent years. This economic growth was also very widespread. It included net exporters of nonfood commodities, such as oil, minerals, and cash crops, but also included the most populous developing countries. The economies of China, India, Brazil, Nigeria, and Ethiopia—to name just a few—were all growing at 6–10 percent per year in the "crisis" years as well as those preceding them. Moreover, the early IMF forecasts of the impact of the financial crisis on developing countries turn out to have overestimated the slowdown in economic growth among developing countries in 2009 and 2010. So it is certainly plausible that this strong economic growth in the developing countries—especially the most populous—was both rapid enough and pro-poor enough to overturn any adverse impact of rising food prices. On this basis it should not be surprising if Gallup World Poll data from 2005 to 2008 show results that are different from those of the LSMS-based simulations, because the GWP presumably captured the effects of income growth as well as actual domestic price changes. Even so, this claim needs to be formally established, as do other strengths and weaknesses of the GWP data.

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[7] Ivanic and Martin (2008a, b) partly allowed for some wage effects through a partial equilibrium adjustment.

[8] Headey and Fan (2010) also suggested that household surveys may overestimate net food consumption given recall biases. For example, sometimes production and consumption questions cover different recall periods. This creates the potential for a bias rather than just random error. For example, longer recall periods of production could lead to underreporting of food production, while a shorter recall period for consumption could fail to pick up food received in kind. Recent work by Beegle and De Weerdt (2010) found that the method of estimating food consumption has significant impacts on estimates, suggesting that estimation of net food consumers versus producers could indeed be biased by differences in the consumption and production modules of household surveys.

[9] This observation is consistent with more specific studies on price transmission. For example, Minot (2010) showed that price transmission was high in 12 African economies, and Robles and Torero (2010) found significant transmission in several Latin-American countries. However, Dawe (2008) found much lower rates of transmission in Asian countries, which typically protect their markets for international prices.

3. AN OVERVIEW OF THE GALLUP WORLD POLL SURVEYS AND THEIR SPECIFIC INDICATORS OF FOOD SECURITY

In this section we aim to provide an overview of the Gallup World Poll and of the specific food security indicators that it collects. Since GWP is conducted by a private organization and its collaborators, our analysis of the reliability and accuracy of the data is limited to external observations, and we rely on Gallup materials for many of the factual details that follow.[10]

Since 2005/06 the Gallup World Poll has interviewed households in about 150 countries, although not always on an annual basis. Surveys are translated from English, French, or Spanish into the required local languages. Most questions are constructed to have yes or no answers so as to minimize translation errors. In developing countries all but one of the GWP surveys are face-to-face (China 2009 being the exception) and most take around one hour.

Surveys follow a complex design with probability-based samples intended to be nationally representative of the entire resident civilian noninstitutionalized population, aged 15 and older. In the first stage of sampling, primary sampling units (PSUs), consisting of clusters of households, are stratified by population size, geography, or both, with clustering achieved through one or more stages of sampling. Where population information is available, sample selection is based on probabilities proportional to population size; otherwise simple random sampling is used. Gallup typically surveys 1,000 individuals in each country except in larger countries such as India (roughly 6,000), China (4,000), and Russia (3,000).

In the second stage, random route procedures are used to select sampled households within a PSU. Unless an outright refusal occurs, interviewers make up to three attempts to survey the sampled household at different times of the day and on different days (if possible). If an interview cannot be obtained at the initial sampled household, a simple substitution method is used. Third-stage respondents are randomly selected within the selected households. Interviewers list all eligible household members and their ages or birth dates. The respondent is selected by means of the Kish grid, and the person who answers the door is not informed of the selection criteria until after the respondent has been identified. In a few Middle Eastern and Asian countries where cultural restrictions dictate gender matching, respondents are randomly selected using the Kish grid from among all eligible adults.

In addition to the sampling, the post-survey treatment of data is also an important consideration in assessing the GWP. Gallup's directors of survey research in each region of the world review the data for consistency and stability by interviewer and region. If the regional director suspects a problem, he or she can ask for new data to be collected. After review by the regional directors, Gallup scientists perform additional validity reviews. The data are centrally aggregated and cleaned, ensuring correct variable codes and labels are applied. The data are then reviewed in detail for logical consistency and trends over time. Once the data are cleaned, weighted, and vetted, the final step is to calculate approximate study design effect and margin of error. Data weighting is used to ensure a nationally representative sample for each country and is intended to be used for calculations within a country. First, base sampling weights are constructed to account for oversamples and household size. If an oversample has been conducted, the data are weighted to correct the disproportionate sample. Weighting by household size (number of residents aged 15 and older) is used to adjust for the probability of selection, since residents in large households will have a disproportionately lower probability of being selected for the sample. However, weighting by household size was introduced only in 2008. Second, post-stratification weights are constructed. Population statistics are used to weight the data by gender, age, and where reliable data are available, education or socioeconomic status. Finally, approximate study design effect and margin of error are calculated to reflect the influence of data weighting (see Gallup 2010b for more details as well as Appendix C for a list of estimated margins of error by survey).

Margins of error are generally in the 3–4 percent range at the 95 percent confidence level, with a mean error margin of 3.3 percent. This means that if the survey was conducted 100 times using the exact

[10] Much of what follows is drawn directly from the Gallup *Worldwide Research Methodology* (Gallup 2010a).

same procedures, the "true value" around a reported percentage of 50 would fall within the range of 46.7 percent to 53.3 percent in 95 out of 100 cases. Note, however, that because these surveys are a clustered sample design, the margin of error varies by question, so it is possible that the margin of error is greater for certain questions, including the two analyzed herein (more on this below). We also note that the margin of error in China and India tends to be lower than the average (1.6 to 2.6 percentage points). This is because the law of large numbers ensures that general measurement errors are relatively low (see below).

Another point of note is that in the vast majority of cases Gallup does not report any sampling errors, but in a handful of cases it finds that certain sections of the population are oversampled (see Appendix C). For example, urban areas were oversampled in Pakistan, Russia, and Ukraine in at least one year, and in the August–September 2009 survey in China the provinces of Beijing, Shanghai, and Guangzhou were oversampled, possibly because of a switch to telephone surveying. In other contexts it appears that Gallup oversampled more educated groups (Senegal, Zambia), and in some developing countries certain parts of the country were not sampled at all because of ongoing political instability or other accessibility problems. This includes northeastern India, eastern Democratic Republic of the Congo (DRC), northern Uganda, northwest Pakistan, eastern Chad, and northern Sri Lanka. In all cases except eastern Chad, these areas represent less than 10 percent of the country's population, and more often less than 5 percent.

While these general characteristics of the GWP surveys are pertinent, we now turn to the specific questions of interest. The exact phrasing of the two questions on food security is as follows:

1. "Have there been times in the past 12 months when you did not have enough money to buy the food that you or your family needed?" A simple yes or no answer is recorded. For shorthand we refer to this as the "food insecurity" indicator, rather than a more cumbersome term such as "food unaffordability."
2. "Have there been times in the past 12 months when you or your family have gone hungry?" Again, a simple yes or no answer is recorded. For shorthand we refer to this as the "hunger" indicator.

It is worth dwelling on some characteristics of the exact phrasing of these questions for a moment, and on some potential question-specific problems. First, both questions very much pertain to concepts of food access rather than availability or production. Hence, conceptually at least, they are well suited to picking up the effects of a food price shock or another shock to disposable income such as economic growth.

Second, both questions ask about both the individual and the family as a whole. This seems important given the well-documented possibility of biases in the intrahousehold distribution of food, particularly against females (Haddad, Hoddinott, and Alderman 1996). It suggests, for example, that a mother who is sacrificing her own food intake for her children and husband still ought to answer yes to question 2. Moreover, the GWP sampling design seems to take account of possible gender biases in answers to this question, although a perusal of gender-disaggregated food insecurity prevalence rates suggests relatively small differences in answers between men and women.[11]

A third aspect of these two questions is the 12-month recall period. Since the month of the survey is recorded, we can match the survey responses to monthly inflation data, such as average inflation over the last 12 months, or even the maximum inflation rate over the previous 12 months (see Section 5 below). However, one might also be skeptical about whether most respondents could accurately recall a 12-month period.

Fourth, while it is possible that *hunger* has an almost universal definition, *food* certainly does not. For a well-off and well-educated family accustomed to a high-quality diet, *food* may mean a food bundle

[11] Even in wealthy countries it is well documented that husbands and wives provide different responses to these kinds of affordability questions. For example, a husband who is only responsible for the mortgage might claim that the family is not struggling with the mortgage or food, while a wife who is responsible for food purchases might claim that they are not struggling with the mortgage because of sacrifices on food items.

of sufficiently high quality (meat, eggs, dairy, and so on). For a very poor family, however, *food* may just mean enough cereals or other staple foods. Hence it is possible that the food insecurity measure is biased upward by education or income, or downward by overly low standards of food intake. This issue is taken up in the next section, where we explore whether cross-country patterns in the levels of these variables make sense.[12]

Fifth, the question about food affordability may be influenced by the ordering of questions within the survey, although Gallup does not provide systematic details on the ordering of questions. However, for China we do know that in the first GWP survey in 2006 the question of food affordability was placed immediately after a quite detailed income question.[13] This may have made respondents more likely to negatively assess their own food insecurity in that round (due to priming). Although this is only a conjecture, we will see below that food insecurity fell very sharply in China from 2006 to 2008, perhaps suggesting that food insecurity was indeed overestimated in 2006. Since China is the largest country in the world, concerns over self-reported food insecurity trends in China move us to consider a range of sensitivity analyses in Section 7.

Sixth, in our data there is no disaggregation of rural and urban respondents. Moreover, there is no distinction in the GWP survey between net food producers and net food consumers, which is a weakness relative to the LSMS-type surveys reviewed in the previous section. For example, one concern might be that a smallholder who buys only 20 percent of his household food from the market may likely answer yes to the food access question if prices are high, even though the impact on his total disposable income is very small.

Finally, any self-reported indicator can suffer from other problems. In authoritarian regimes there is the possibility that respondents are afraid to answer politically sensitive questions in an honest fashion. Similarly, media coverage of food price inflation could bias answers to this question. In some cultures there may also be cultural norms against admitting poverty, while in other countries people may over-report food insecurity if poverty is a qualifier for social safety nets. A more specific issue relevant to the food access question is how farmers interpret the question.

For these reasons economists have traditionally been wary of self-reported indicators of welfare (Bertrand and Mullainathan 2001), although that trend has reversed in recent decades. Comparisons of self-reported poverty and more objectively defined indicators of poverty have uncovered very close relationships between the two (Pradhan and Ravallion 2000). And there is now, of course, an immense economic literature using indicators of self-reported well-being and health (Benitez-Silva et al. 2004; Headey, Muffels, and Wagner 2010), including indicators from the Gallup World Poll (Kahneman and Deaton 2010). Even so, there is no existing literature that explores the validity of these specific GWP measures, so the next two sections explore both cross-country patterns and time series trends in these two indicators. In our conclusion we also stress the need to do more extensive testing of these measures, including measuring test–retest reliability, and more exploration of how different people define food and food insecurity (for example, farmers and nonfarmers, rural and urban people, educated and uneducated people).

[12] Phrasing has been found to be an important source of measurement error in these types of questions (Bertrand and Mullainathan 2001).

[13] We thank Angus Deaton for this information. Deaton also noted that he found the order of questions to be an issue in other questions in the GWP.

4. DO CROSS-COUNTRY PATTERNS OF THE SELF-REPORTED INDICATORS MAKE SENSE?

The goal of this section is to gauge whether the cross-country pattern of the two GWP indicators is in line with prior expectations. To that end we look at some basic descriptive statistics, including those concerning region, as well as some comparisons with indicators of poverty and food insecurity from other sources. We refrain from using the term "validation" to describe these comparisons because alternative indicators are also flawed, as discussed above and elsewhere (Deaton 2010). Moreover, it should also be pointed out that errors in levels do not necessarily translate to errors in differences, which are examined in the next section.

To see if cross-country patterns in the two GWP indicators broadly make sense, Table 4.1 reports basic descriptive statistics while Table 4.2 reports regional means. From Table 4.1 we observe that the mean prevalence of households reporting problems with affording food is almost 32 percent, but mean levels of self-reported hunger are just 17 percent. Clearly this suggests that these two questions pertain to different concepts, as might be expected. Also of note is that both measures reach as high as 80 percent, and that the standard deviation is unsurprisingly quite large for both measures (20 points). Consistent with expectations, Table 4.2 shows that food insecurity and hunger are easily the highest in Sub-Saharan Africa, which is by far the poorest region in the world. However, food insecurity in South Asia is surprisingly low (31.2 percent) compared with East Asia and Latin America (34–36 percent). This pattern is particularly surprising given that anthropometric indicators of malnutrition are much higher in South Asia than in East Asia or Latin America, although malnutrition is certainly influenced by factors other than food security (such as healthcare, education, and gender inequality). Part of the divergence from expectation also relates to outliers and the small size of subsamples. For example, self-reported food insecurity in Cambodia is unusually high (67 percent), but in Nepal it is extremely low (9 percent). Population-weighted means also result in levels that are about equal in South and East Asia (33–34 percent).

Table 4.1—Basic descriptive statistics for the two GWP measures, various years 2005–2010

	Food insecurity	Hunger
Unweighted mean	31.7	17.0
Median	27.0	9.0
Maximum	81.0	80.0
Minimum	1.0	1.0
Std. dev.	20.2	18.8
Observations	433	340

Source: Data are from the Gallup World Poll (Gallup 2011).

Table 4.2—Regional unweighted means for the two GWP measures, circa 2005

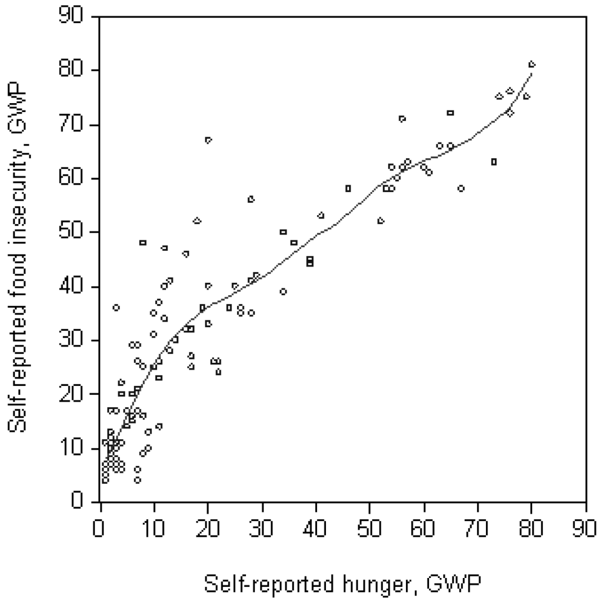
	Food insecurity		Hunger	
	Mean	**# Obs**	**Mean**	**# Obs**
Sub-Saharan Africa*	58.3	27	54.2	29
South Asia*	31.2	5	18.3	6
East Asia*	34.0	7	14.4	7
Middle East & North Africa*	26.5	2	18.0	3
Central America & Caribbean*	34.7	9	23.1	12
South America*	36.0	10	20.6	10
Transition[a] countries	29.1	23	8.1	23
OECD[b]	8.3	22	2.8	23
Low income[c]	48.6	49	37.4	55
Middle income[c]	29.6	28	14.1	31
Upper income[c]	11.0	34	3.4	34

Source: Data are from the Gallup World Poll (Gallup 2011).

Notes: *Indicates that only developing countries are included. For example, Japan and South Korea are excluded from East Asia, and Saudi Arabia and the United Arab Emirates are excluded from the Middle East and North Africa. [a]. *Transition* refers to former Communist countries. [b]. Members of Organisation for Economic Co-operation and Development. [c]. *Low income* is defined as a 2005 GDP per capita of less than US$5,000 purchasing power parity (PPP), *middle income* as US$5,000–13,000, and *upper income* as greater than US$13,000.

Figure 4.1 reports a scatter plot of the two measures. The correlation is a high 0.90, although as Figure 4.1 suggests, the relationship is slightly nonlinear, with self-reported food insecurity rising rapidly at low levels of hunger (less than 20 percent) and then more gradually thereafter. One explanation might be the hypothesis discussed in the previous section regarding the differing definitions of *food* for the poor and nonpoor. If *food* means a reasonably high-quality diet for the upper- and middle-income countries but basic staples for the lower-income countries, then one would expect hunger levels to be much lower than food insecurity levels for richer countries, and the two measures to be about the same for the developing countries. This is precisely what Figure 4.1 indicates. Moreover, in Table 4.2 we see that food insecurity and hunger levels in Africa are about the same (58.3 percent and 54.2 percent respectively). This suggests that in levels at least, the food insecurity indicator is probably biased upward in the upper- and middle-income countries.

Figure 4.1—The relationship between the two GWP indicators



Source: Data are from the Gallup World Poll (Gallup 2011).

To explore other possible measurement problems, we now turn to comparing the GWP measures with other conceptually similar indicators, such as FAO hunger prevalence, World Bank poverty estimates, and anthropometric indicators of undernutrition. We stress again that this not a validation exercise, however. In the introduction we made reference to significant criticisms of the FAO and USDA measures of hunger. However, the standard World Bank poverty estimates have also been widely criticized,[14] and anthropometric indicators are heavily influenced by nonfood factors such as health, education, family planning, and cultural norms (World Bank 2006). Bearing that in mind, Table 4.3 systematically tests whether the GWP self-reported indicators are significantly correlated with a range of other measures. All the variables are measured as close to 2005/06 (pre–food crisis) as possible, but in general the years do not coincide exactly, so this may weaken the correlations somewhat. Another problem is the paucity of some of the other indicators, which reduces the sample size. Even so, without exception Table 4.3 shows that GDP, income, poverty, hunger, and anthropometric indicators are significantly correlated with the two GWP indicators, and almost invariably at the one percent level. The correlations are particularly strong for the (logarithmic) income and poverty indicators. In a very small sample—that also excludes six important outliers—the correlation between the GWP indicators and the body mass index (BMI) of adult women is also very high (0.73 and 0.68 for hunger and food insecurity respectively). Appendix Table A.1 also shows that the correlations between the GWP measures and the other indicators are least as strong as the closest alternatives to the GWP indicators—the FAO hunger measures—if not stronger.

[14] Indeed, in the context of critiquing standard poverty measures, Deaton (2010) suggested that the Gallup indicators used herein might even be more reliable than the World Bank estimates. As a rough demonstration of their suitability, Deaton showed that the food security variable is correlated with GDP.

Table 4.3—Correlations between the self-reported food security indicators and other indicators of income, poverty, hunger, and malnutrition, circa 2005

Alternative poverty/hunger indicator (source)		Self-reported hunger	Self-reported food insecurity
GDP per capita, PPP, log	Correlation	-0.71***	-0.62***
(World Bank)	# Obs.	44	41
Household income per capita, US$, log	Correlation	-0.68***	-0.61***
(World Bank Povcal)	# Obs.	59	54
Prevalence of hunger	Correlation	0.58***	0.49***
(FAO)	# Obs.	62	57
Prevalence of poverty, US$1/day	Correlation	0.77***	0.64***
(World Bank Povcal)	# Obs.	58	54
Prevalence of poverty, US$2/day	Correlation	0.67***	0.63***
(World Bank Povcal)	# Obs.	49	46
Prevalence of low-BMI women, excluding outliers	Correlation	0.73***	0.68***
(DHS & WHO)	# Obs.	17	15
Prevalence of underweight preschoolers, log	Correlation	0.55***	0.38**
(DHS & WHO)	# Obs.	45	42
Prevalence of stunted preschoolers, log	Correlation	0.48***	0.33**
(DHS & WHO)	# Obs.	45	42

Sources: Dependent variables are from the Gallup World Poll (Gallup 2011). Independent variables are sourced as follows: *World Bank* = World Bank (2010c) World Development Indicators. *World Bank Povcal* = World Bank (2010b). *FAO* = Food and Agriculture Organization (FAO 2011b). *DHS* = Demographic Health Surveys (Measure DHS 2010). *WHO* = World Health Organization (WHO 2010).

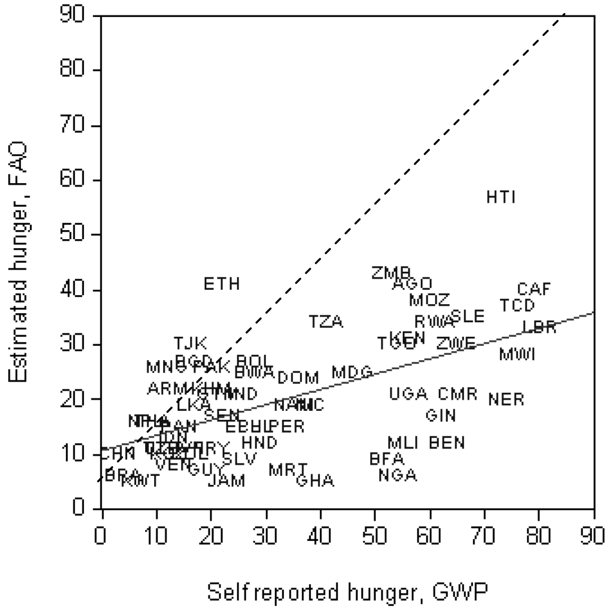
Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. All variables are measured in 2005 or the nearest available year. *Log* indicates that variable is expressed in logarithms to account for a nonlinear relationship. *Excluding outliers* refers to the exclusion of six countries with the highest prevalence of low-BMI women in the sample, all above 20%: India, Bangladesh, Ethiopia, Cambodia, Nepal, and Madagascar. Without this exclusion, the correlation is statistically insignificant. Samples vary in size because of the paucity of some of the poverty and malnutrition indicators.

In addition to the correlations in Table 4.3 it is also interesting to explore in more detail one or two relationships of particular interest. For example, the FAO Hunger Index and the GWP self-reported hunger measure are in principle trying to measure the same latent factor. Likewise, monetary measures of poverty—such as the US$1[15] per day indicator—are historically based on poverty lines designed to measure the amount of income required to purchase an adequate number of calories (although many poverty lines have often subsequently been delinked from calorie affordability—see Deaton 2001, 2010). Pairing these conceptually similar indicators shows two interesting relationships. Surprisingly, the correlation between the FAO estimate of hunger prevalence and the GWP self-reported hunger indicator is fairly weak, at just 0.55. Figure 4.2 shows a scatter plot. If the two indicators were similarly scaled, the slope of the regression line should be equal to one and the coefficient equal to zero. The slope coefficient is substantially lower than one, suggesting that the FAO estimate of hunger prevalence is generally much lower than the GWP indicator. We note that this is consistent with the study of Smith, Alderman, and Aduayom (2006), in which FAO estimates of calorie insufficiency in 11 African countries were found to be substantially lower than those derived from household surveys. An important exception to this pattern is Ethiopia (ETH), where the GWP indicator seems to underestimate hunger for 2005/06.[16]

[15] All dollar amounts are in U.S. dollars.

[16] A number of factors could explain this. Error could come from either source. On the GWP side, there may be reporting biases—Ethiopia is a highly food insecure country, so what passes for hunger may be low relative other countries. Or the year in question may have produced a relatively good harvest.

Figure 4.2—A scatter plot of the self-reported GWP and estimated FAO indicators of hunger prevalence

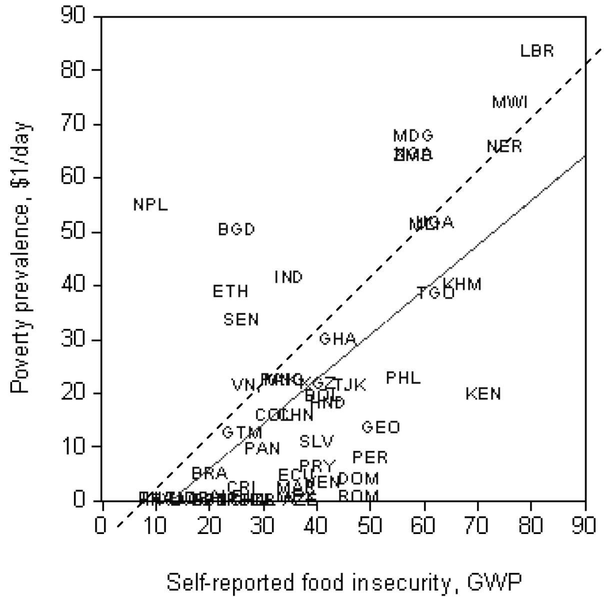


Sources: See Table 4.2 for sources.

Note: The solid line is the regression line while the dashed line is the 45-degree line.

In Figure 4.3 we compare the self-reported food insecurity indicator to the $1 per day indicator. In this case the slope coefficient is close to one, but the prevalence of poverty is generally somewhat higher than that of food insecurity. There is also considerable variation around the average relationship. Quite notably, poverty is much higher in India (IND), Bangladesh (BGD), and Nepal (NPL) than the food affordability indicators would suggest. Moreover, if one were to switch to $2 per day poverty India would be even more of an outlier since 86 percent of India's population earn less than $2 per day, whereas only 27 percent earn less than $1 per day (World Bank 2010a). In contrast to these South Asian countries, poverty in Kenya (KEN) is much lower than food insecurity, with the latter close to 70 percent. However, in 2007 the rate of self-reported food insecurity dropped to 56 percent in Kenya, suggesting that this outlier is explained by the fact that 2006 may have been an unusual year.

Figure 4.3—A scatter plot of self-reported food insecurity and US$1 per day poverty



Sources: See Table 4.2 for sources.

Note: The solid line is the regression line while the dashed line is the 45-degree line.

To more systematically explore possible regional biases, Table 4.4 reports regressions of each GWP indicator against the hunger or poverty indicator most conceptually similar to it, as well as regional dummy variables. Regression 1 suggests that self-reported hunger is much higher in Africa than the FAO measure of hunger prevalence predicts, consistent with Smith, Alderman, and Aduayom (2006). The Latin American dummy is also significant at the 10 percent level and positive. This may be because the FAO measure underestimates the extent of inequality in food consumption in Latin America, although this is only a conjecture. Regression 2 suggests that self-reported food insecurity in South Asia is much lower than is predicted by $1 per day poverty, consistent with Figure 4.3.

Table 4.4—Testing for regional anomalies in the relationships between self-reported measures and FAO and World Bank measures of hunger and poverty

Regression number	1	2
Dependent variable	Self-reported hunger	Self-reported food insecurity
Included observations	61	46
Constant	5.52	27.3***
FAO hunger prevalence	0.58***	
US$1/day poverty prevalence		0.56***
Africa dummy	33.1***	1.3
Latin America dummy	9.6*	-1.07
Transition[a] dummy	-5.5	3.8
South Asia dummy	-1.75	-25.6***
R-square	0.70	0.56
Adjusted R-square	0.69	0.52
Hunger/poverty coefficient significantly different from 1?	Yes	Yes

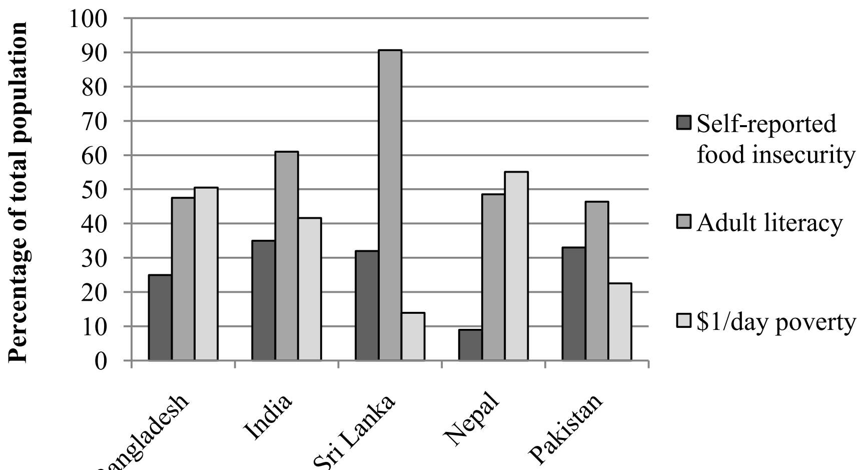
Sources: Dependent variables are from the Gallup World Poll (Gallup 2011). Independent variables are sourced as follows: US$1/day poverty from World Bank Povcal (World Bank 2010b), FAO hunger prevalence from Food and Agriculture Organization (FAO 2011b).

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. [a.] *Transition* refers to former Communist countries.

Another possible bias mentioned in the previous literature is that the food affordability indicator could be biased upward in situations where more educated individuals define *food* in terms of higher-quality items. There are several examples in the data that appear consistent with that hypothesis. Former Communist ("transition") countries with high levels of literacy often report surprisingly high levels of food insecurity, although not pervasively so. For example, while Lithuania, Latvia, Estonia, Croatia, and Hungary all have levels of self-reported food insecurity of 20 percent or below, the remaining "transition" countries have rates that vary from 22 percent in Belarus to 52 percent in Georgia, 48 in Romania, and 37–47 percent in five central Asian states. Another anomaly is Sri Lanka, where self-reported food insecurity is almost as high as that of India and about the same as that of Pakistan. Yet adult literacy rates in Sri Lanka—at 90 percent—are far above those of its South Asian neighbors and poverty is much lower (Figure 4.4). Is Sri Lanka's self-reported food insecurity higher than expected because literate Sri Lankans demand more of their diet?

Despite this suggestion, it is important to more rigorously test that hypothesis. For example, food inflation and overall inflation in Sri Lanka have been very high in recent years (Headey and Fan 2008, 2010), so the GWP indicator may be picking up genuine affordability problems there. To more systematically test for an education bias, Table 4.5 reports regressions of the self-reported food insecurity measure against literacy, after controlling for $1 per day poverty (regression 1), mean income (regression 2), and self-reported hunger (regression 3). In the first two instances the coefficient on literacy is highly insignificant, but in regression 3 the coefficient is positive and significant, suggesting that—controlling for self-reported hunger—more educated countries typically report more problems with affording food. We also conducted the same tests for the self-reported hunger measure, but none of the literacy coefficients in those regressions were positive (results not reported). Moreover, since the self-reported hunger and food insecurity variables are derived from the same survey, it is possible that the coefficients are biased. Hence all we can conclude is that there is some suggestion that there may indeed be an education bias for the food insecurity indicator. Future work could more rigorously explore whether this bias is indeed genuine, perhaps with unit-level data from these surveys.

Figure 4.4—Self-reported food insecurity is high in Sri Lanka despite higher literacy and lower poverty



Sources: Self-reported food insecurity is from the Gallup World Poll (Gallup 2011), US$1/day poverty is from the World Bank Povcal (World Bank 2010b), and adult literacy is from the World Bank (2010c).

Table 4.5—Is self-reported food insecurity biased upward by better education?

Regression no.	1	2	3
# observations	44	44	69
Constant	15.18	52.29***	-2.45
US$1/day poverty	0.57***		
Income per capita		-0.07	
Self-reported hunger			0.94***
Adult literacy	0.14	-0.02	0.20***
R-square	0.36	0.28	0.81
Adjusted R-square	0.33	0.25	0.81

Sources: Dependent variables are from the Gallup World Poll (Gallup 2011). Independent variables are sourced as follows: US$1/day poverty and income per capita from World Bank Povcal (World Bank 2010b), adult literacy from World Bank (2010c).
Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

One other means of gauging the validity of the self-reported GWP indicators is to test whether they are correlated with some indicator of food prices. In fact, the World Bank poverty indicators used above are based on a purchasing power parity (PPP) conversion factor (from 2005) that is constructed from the World Bank's International Comparison Program (ICP), an international survey of a wide range of goods and services. This PPP conversion factor can also be disaggregated into its various components, including a food and nonalcoholic beverages component. However, to measure relative food prices we take the ratio of the PPP conversion factor for food to the exchange rate (World Bank 2008b). Ratios larger than 100 percent indicate that food is expensive. In general food is more expensive in richer countries—with ratios in excess of 120 percent in virtually all of the OECD (Organisation for Economic Co-operation and Development) countries—although among the developing countries there is still considerable variation in food price ratios.[17] For example, the food price ratio in India is just over 50 percent, but it is 135 percent in Nigeria and similarly high in some other Sub-Saharan African countries. Regression 1 in Table 4.6 demonstrates this pattern more systematically. Specifically, the food price ratio rises by 2.8 percentage points for every $1,000 increase in GDP per capita (PPP). But the regression also shows regional variations through the specification of regional dummy variables. Although none of the coefficients are significant, the coefficient on the African dummy is only marginally insignificant, and the coefficient is quite large, suggesting that food appears to be unusually expensive in Africa. However, part of the interregional variation in price levels may also be related to the fact that the 2005 ICP was conducted on a region-by-region basis, with price levels initially measured relative to a regional benchmark. If this methodology induces any biases in regional price levels, then the dummy variables could be picking up methodological effects rather than true regional price differences. Hence, regression 1 in Table 4.6 indicates that it is very important to control for both GDP per capita and regional effects when exploring the impact of price ratios on food insecurity and hunger.

So in regressions 2 through 5 in Table 4.6 we regress the self-reported food insecurity and hunger indicators against this food price level and its square, while controlling for GDP per capita and its square and the regional dummies. In all the regressions, the coefficients on the food price ratio and its square are positive and negative respectively, suggesting that higher food prices are associated with high levels of self-reported food insecurity and hunger, after controlling for GDP per capita. However, in regression 2 the coefficients on food insecurity are marginally insignificant at the 10 percent level, even though the sizes of the coefficients are similar. Figure 4.5 shows these diminishing marginal impacts of price increases. In general the impact is quite large. For example, in most developing countries the ratio varies

[17] One reason that food prices vary within developing countries is that the tradability of food varies substantially, depending on diets, transport costs, and economic policies.

between 150 percent and 110 percent, and in that range a 10 percentage point increase in relative food prices would increase self-reported food insecurity or hunger by around 3 to 4 percentage points.

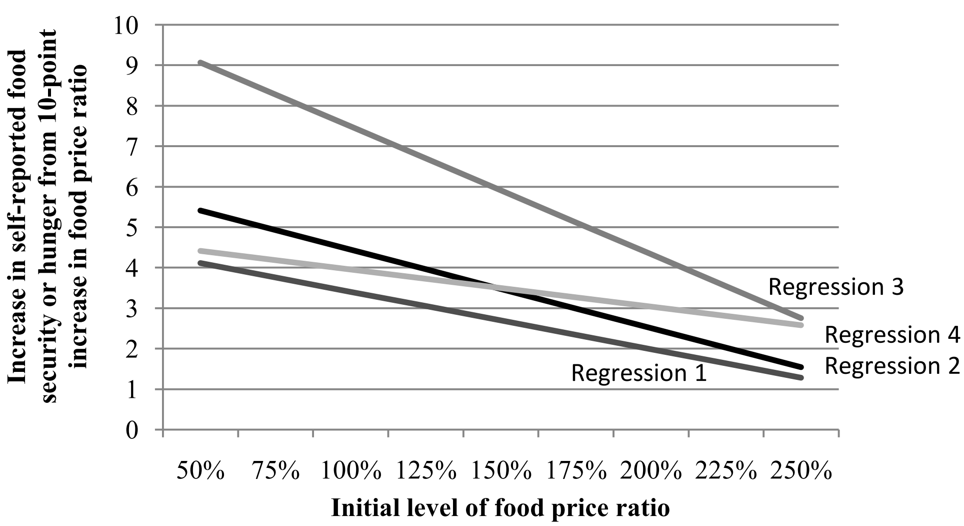
Table 4.6—Are self-reported food security measures explained by relative food prices?

Regression no.	1	2	3	4	5
Dependent variable	Food price level	Food insecurity	Food insecurity	Hunger	Hunger
# Observations	99	91	91	95	95
Constant	61.74***	17.0**	31.1**	-17.6**	0.4
GDP per capita (US$, 1,000s)	2.80***	-3.1***	-2.3***	-4.0***	-2.3***
GDP per capita, sq.		0.04***	0.03***	0.06***	0.04***
Food price ratio		63.8***	48.7#	106.4***	48.2***
Food price ratio, sq.		-19.4***	-9.2#	-31.6***	-14.2**
Africa dummy	30.46#		18.6#		23.0**
Latin America dummy	-12.29		10.5		7.1
Asia dummy	4.97		4.6	0.8	-2.2
Europe-plus[a] dummy	-12.53		5.9	0.8	-1.7
R-square	0.65	0.73	0.76	0.76	0.84
Adjusted R-square	0.63	0.72	0.75	0.75	0.83

Sources: Dependent variables are from the Gallup World Poll (Gallup 2011). Independent variables are sourced as follows: GDP per capita from World Bank (2010c), food price ratio from World Bank (2008c).

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, and # indicates marginal insignificance at the 10% level. a. *Europe-plus* refers to Europe, plus North America and Australasia.

Figure 4.5—The impact of a 10 percentage point increase in relative food prices on self-reported hunger and food insecurity



Source: Simulation results based on the regressions in Table 4.6, with food price ratio expressed as percentages rather than ratios, as it is Table 4.6.

Note: The food price ratio varies from a minimum of 47% to a maximum of 241%.

In summary, the results in this section suggest that the GWP indicators of food insecurity and hunger are highly correlated with other indicators of poverty and food security as well as with relative food prices. However, the correlation between self-reported hunger and the FAO hunger index is relatively low given that these indicators aim to measure the same underlying phenomenon. Yet, consistent with the findings of Smith, Alderman, and Aduayom (2006), we also find that the FAO approach may well be underestimating hunger prevalence, especially in Africa (Ethiopia is an exception, however). Finally, despite the fact that cross-country patterns in the GWP indicators look plausible, there are some indications that the food insecurity indicator may be biased upward by higher education levels, although the evidence in that regard is not robust. Finally, while the correlations with other food insecurity and poverty indicators are strong, there are some problematic outliers, especially in the first wave of the GWP (2005/06). These outliers include Nepal and Senegal (where self-reported food insecurity seems too low in 2005/06), and China, Kenya, and Ghana (where it seems too high in 2005/06). Appendix B provides the full dataset of GWP self-reported food insecurity and hunger so readers can peruse individual observations at length.

How significant these problems are for the main objective of this paper depends on whether these potential errors are biases that persist over time (in which case trends in these variables may not be biased), or whether they are one-off errors related to the 2005/06 round (which could distort trends from 2005/06 to the crisis years). In China, for example, there is some suggestion that the 2005/06 estimate was a one-off error and it may be that the first wave of the GWP involved larger measurement errors than subsequent waves. This needs to be borne in mind, and it is a problem that we aim to address in Section 7, where we conduct various sensitivity analyses in estimating trends in self-reported food insecurity.

5. ARE WITHIN-COUNTRY TRENDS IN SELF-REPORTED INDICATORS PLAUSIBLE?

While it is interesting to explore the plausibility of the GWP variables as indicators of cross-country differences in hunger and food insecurity, the main objective of this paper is to assess whether these indicators are useful for gauging global trends in food security during the food, fuel, and financial crises. To answer that question we need to look at whether changes in these variables are indeed influenced by economic growth and food inflation. However, that task is rather tricky because the GWP surveys are conducted in individual months. Since there are no monthly or even quarterly GDP data available for most developing countries, we just use the percent change in GDP per capita between the year in which the GWP survey was conducted and the year in which the previous survey was conducted. With regard to food inflation, monthly food consumer price index (CPI) data are available from the International Labour Organization. Hence we take the change in the food CPI between the respective months of consecutive GWP surveys. Note, however, that the CPI for each month actually refers to the maximum monthly CPI over the previous 12 months, since the GWP question refers to food insecurity or hunger over the previous 12 months. Also note that we run two sensitivity analyses, the results of which are reported in the appendix. First, we test overall CPI inflation rather than food inflation (Table A.4), in case nonfood inflation (for example, fuel prices) put an additional squeeze on household food expenditures. Second, since the food CPI is not usually weighted to the foods that poor people consume (staples) we use the FAO (2010) data to construct an index of staple food prices, with the calorie shares of food items used as weights in the index. We then test the impact of inflation in this staple food index on changes in self-reported food insecurity (Table A.5).

Before turning to the main results, a final consideration is whether domestic food inflation is influenced by international price changes. In other words, is the domestic food inflation in recent years generally the result of the global food and fuel crises? In appendix Table A.2 we regress monthly food and overall CPI inflation against the one-month lag of changes in international prices of fuel and food, expressed in domestic currencies (to capture the extent to which exchange rate movements influence price transmission). As predicted, the results show that international food inflation is a significant determinant of domestic food and overall inflation (for overall inflation, the effects are much stronger in low-income countries, where food is a larger part of the consumption bundle). For example, the results suggest that the 77 percent increase in the FAO food price index from June 2006 to June 2008 (the peak of the crisis) typically raised the domestic food CPI by 3.0 percent. Moreover, this is a lower-bound estimate because domestic food bundles will often vary substantially from the food bundle in the FAO food price index. As for fuel inflation, this has some impact on overall inflation but no significant effect on domestic food inflation (of course, fuel inflation could still be a determinant of international food price inflation). So the short answer to the question posed above is that domestic inflation (both food inflation and overall inflation) was certainly influenced by the global food crisis.

In Table 5.1 we therefore test whether economic growth and food CPI inflation explain changes in the GWP indicators, while Table A.2 in the appendix reports the results for overall inflation rather than food inflation. The underlying model for these regressions is that the prevalence of food insecurity (*H*) at time *t* in country *i* is a function of the log of mean level of GDP per capita (*y*) and the log of food prices over the previous 12 months (P):

$$H_{i,t} = \beta_Y \ln y_{i,t} + \beta_\pi \ln P_{i,t} + v_i + u_{i,t} \quad (1)$$

Note that *v* is a fixed-effect term whereas *u* is a time-varying error term. Hence the first difference of (1) leads to changes in food insecurity being a function of the per capita economic growth rate and the food inflation rate:

$$\Delta H_{i,t} = \beta_Y \Delta \ln y_{i,t} + \beta_\pi \Delta \ln P_{i,t} + \Delta u_{i,t}. \quad (2)$$

Several points regarding equation (2) are of note. First, we run a variation of (2) in which the percent change in H is modeled as the dependent variable—implying that y and P were measured in levels rather than logs in equation (1). This variation means the coefficients in (2) represent elasticities. Although the estimation of elasticities is standard in the growth and poverty literature, taking percent changes of a prevalence rate can cause scaling problems and create outliers (Deaton 2006; Headey 2011b).[18] However, it is useful to estimate an elasticity for the purposes of drawing comparisons with the impact of economic growth on poverty. In all regressions we are also careful to omit obvious outliers. For example, Zimbabwe is always excluded because of its hyperinflation.

Second, in all regressions we interact economic growth and inflation with income dummy variables. There is a good rationale for this. In upper-income countries the income elasticity of food consumption with respect to income is often close to zero, so economic growth has little or no potential to reduce food insecurity or hunger (moreover, hunger and food insecurity prevalence are close to zero in most upper-income countries). The effect of food inflation is also likely to be conditional because food is a smaller part of a richer household's budget, so an increase in food inflation is less likely to lead to problems of food affordability.

Third, we note that some authors add a fixed-effect term to (2) to capture country trend effects (Christiaensen, Demery, and Kühl forthcoming). However, with panel data, estimates with fixed effects are consistent only if the right-hand-side variables are strictly exogenous, meaning they are orthogonal to the error term at all lags and all leads. This means the error term cannot be correlated with future growth or future prices, which is not credible here. Yet the exclusion of fixed effects can cause other problems, such as omitted variables bias. Hence we run a variation with fixed effects included.

Fourth, we also include time trends in some of our results (regressions 3 and 4). The idea here is to pick up the effects of global events, including global economic growth (strong prior to the financial crisis and lower thereafter) and inflation trends. While potentially informative, these results come with the caveat that the panel is highly unbalanced in a temporal sense, with different surveys conducted in different months and even different years. So the time dummies in question are only very approximate in that they denote the year of the most recent survey of the differenced variable.

Finally, in the main text we report only the results with self-reported food insecurity as the dependent variable. Results with self-reported hunger as the dependent variable are reported in Appendix Table A.5, but the results are highly insignificant, most probably for two reasons. First, the sample size is much smaller (190-odd observations relative to 260 in the case of self-reported food insecurity). Second, many observations are zero, with no change being recorded between successive surveys. This not only violates the normality assumptions of least squares regressions (as confirmed by a Jarque–Bera test), but it also means that this measure is unlikely to be suitable for picking up time trends and the impacts of price or income changes.

[18] The problem with taking percent changes in prevalence rates can be illustrated with an example of a country with high food insecurity and a country with low food insecurity. In the food-insecure country, suppose that food insecurity decreases from 42 percent at time t-1 to 40 percent at time t. This yields a first difference of two percentage points and a percent change of around -4.7 percent (that is, 2/40*100). Yet an equally large reduction in malnutrition prevalence in the food-secure country from 4 to 2 percent yields a percent change of 50 percent. Not only is a 50 percent change likely to be an outlier, but it is also 10 times the value of the equally large reduction in malnutrition in the high-malnutrition country. Of course, one could argue that this may not matter if percent differences are applied to the right-hand-side variables, but in the case of per capita income, this is not true because the denominator (initial income) is invariably large enough to produce more meaningful estimates of percent change. Moreover, percent changes in income make sense if there is a diminishing marginal impact of income on food insecurity.

Table 5.1—Are changes in self-reported food insecurity explained by economic growth and food inflation?

Regression	1	2	3	4
Dependent variable[a]	Change in food insecurity	Percent change in food insecurity	Change in food insecurity	Percent change in food insecurity
Number of countries	107	109	74	74
Number of observations	254	257	185	185
Sample	All	All	Upper income excluded	Upper income excluded
Constant	0.06	2.42	-1.06***	3.43
Economic growth[b] (low income)	-0.44***	-0.99**	-0.41**	-1.17**
Food inflation[c] (low income)	0.22***	0.54***	0.12	0.27
Growth*upper income	0.26#	-0.16		
□nflation*upper income	-0.18**	-0.30		
Growth*middle income	0.37#	0.87	0.35*	0.84#
□nflation*middle income	-0.10	-0.19		
2008 dummy			3.68	4.95
2009 dummy			2.97#	5.70
2010 dummy			3.60**	5.79
2008 dummy*middle income			-0.37	2.92
2009 dummy*middle income			-3.79**	-12.18*
2010 dummy*middle income			-2.74	-7.62
R-square	0.09	0.06	0.13	0.08

Sources: Dependent variables are from the Gallup World Poll (Gallup 2011). Independent variables are sourced as follows: Economic growth from World Bank (2010c), food inflation from International Labour Organization (ILO 2011).

Notes: These are ordinary least squares (OLS) regressions. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, and # indicates marginal insignificance at the 10% level. [a.] The dependent variable is measured as the change in food insecurity between month *M* in year *Y* and the time of the previous survey (M_{t-1} and Y_{t-1}). [b.] *Economic growth* is the percent change in GDP per capita between the two years in which the GWP surveys were conducted. [c.] *Food inflation* is the percent change in the food consumer price index (CPI) between the month of the GWP survey and the month of the previous GWP survey, where the food CPI in any given month is actually the maximum food CPI in the previous 12 months. [d.] *Low income* is defined as a 2005 GDP per capita of less than US$5,000 PPP, *middle income* as US$5,000–13,000, and *upper income* as greater than US$13,000. Note that by this definition China is defined as a low-income country.

This is in marked contrast to the results in Table 5.1, where we find strong evidence that self-reported food insecurity is indeed explained by changes in mean incomes and food prices, with the effects generally varying by income level. For example, in regression 1 of Table 5.1 we observe that if mean per capita income in a low-income economy were to grow by 10 percent then the country could expect the prevalence of food insecurity to go down by 4.4 percentage points. However, the interactions with income brackets suggest that growth effects in middle- and upper-income countries are significantly smaller. In the case of middle-income countries the impact of economic growth is insignificantly different from zero. In upper-income countries the impact of growth is significantly different from zero, but the point estimate is about 60 percent lower than is the case in low-income countries. In regression 2 in Table 5.1 we measure the change in food insecurity as a percent change in order to derive a conventional elasticity that is comparable to other elasticities in the poverty–growth literature. The elasticity of food insecurity with respect to economic growth is -0.99 in low-income countries (regression 2 in Table 5.1), which is certainly commensurate to the poverty–growth elasticities obtained in that literature (Loayza and Raddatz 2010).

Food inflation also has larger impacts in lower- and middle-income countries than in upper-income countries. In low- and middle-income countries a 10 percent increase in food prices is predicted to increase food insecurity by around 2 percentage points. In regression 2 in Table 5.1 we see that the elasticity of food insecurity with respect to changes in inflation is around +0.54. It is also pertinent to compare the point estimates of the growth and food inflation coefficients. In both regressions 1 and 2 Wald tests confirm that the coefficients on food inflation are significantly smaller in absolute size than the coefficients on growth for low-income countries, although the variation in food inflation rates is also somewhat larger (a standard deviation of 8.4 percentage points relative to 6.2 for economic growth).[19] Even so, it is interesting to observe such a strong impact of economic growth on food insecurity, particularly since the relevant GWP question does not specifically ask about disposable income. And given that the developing countries—especially the most populous ones—generally grew very quickly both before and during the food crisis, this should give readers an inkling that global trends in self-reported food insecurity may not be so dire.

In regressions 3 and 4 in Table 5.1 we exclude upper-income countries and pool lower- and middle-income countries, but add time trends that are interacted with income levels. Relative to the base of 2007 (omitted from the table), we do not find strong time period effects, although for low-income countries all trend effects were positive from 2008 to 2010, but only significant for 2010 (and marginally insignificant for 2009). Interestingly, the opposite results hold for middle-income countries, which again suggests that their vulnerability to global economic shocks might be quite different. Another point of note is that the addition of time trends seems to reduce the statistical significance of the coefficient attached to food inflation, although it leaves the growth coefficient unharmed. Hence the time trend effects could indeed be picking up the effect of the global food crisis, but less so economic growth effects since growth rates vary more across countries within any given time period.

What about our sensitivity analyses? The results in Appendix Tables A.4 and A.5, in which overall inflation and staple food inflation indexes are used, respectively, are both qualitatively and quantitatively very similar to the food inflation results in Table 5.1, once each series is scale adjusted. For example, if we adjust the scale of each inflation series by its standard deviation (using Table A.3 in the appendix) we observe that the point estimates of the effects of food inflation and overall inflation are exactly the same. The point estimates of the staple food price index tend to be lower (though still highly significant), a fact perhaps related to greater measurement error (in particular, the observed staples cover a large part of the diets in some countries but a smaller part in others). The fact that food inflation and overall inflation yield very similar results is interesting from a theoretical standpoint, although one should be cautious in drawing strong inferences. It may be that nonfood inflation (for example, increasing fuel prices) squeezed the food budget, but the reality in many developing countries is that overall inflation is heavily affected by food inflation since food makes up a large share of the budget and since food prices vary substantially over time (within years and between years). Unfortunately, nonfood inflation data are not publicly reported for all countries, but future work could explore whether there is indeed a specific effect of nonfood inflation on self-reported food insecurity.

[19] If one conducts a Wald test of the null hypothesis that the low-income growth coefficient is equal to 8.6/6.2 times the inflation coefficient, the null hypothesis is rejected at the 14% level.

Table 5.2—Are changes in self-reported food insecurity explained by economic growth and food inflation? Results with fixed effects included

Regression	1	2	3	4
Dependent variable[a]	Change in food insecurity	Percent change in food insecurity	Change in food insecurity	Percent change in food insecurity
Number of countries	107	107	74	74
Number of observations	254	254	185	185
Sample	All	All	Upper income excluded	Upper income excluded
Constant	0.54	6.81	-0.32	11.35
Economic growth[b] (low income)	-0.70***	-2.10***	-0.32	-1.53#
Food inflation[c] (low income)	0.30***	0.74***	0.15#	0.36
Growth*upper income	0.62**	1.43#		
□nflation*upper income	-0.33**	-1.69		
Growth*middle income	0.63*	2.13*	-0.35	-0.99
□nflation*middle income	-0.24#	-0.77#		
2008 dummy			5.60#	9.20
2009 dummy			5.98#	10.85
2010 dummy			4085*	10.05
2008 dummy*middle income			-7.97**	-20.96#
2009 dummy*middle income			-13.31**	-42.51**
2010 dummy*middle income			-5.40	-17.70
R-square	0.37	0.43	0.41	0.40

Sources: Dependent variables are from the Gallup World Poll (Gallup 2011). Independent variables are sourced as follows: Economic growth from World Bank (2010c), food inflation from International Labour Organization (ILO 2011).

Notes: These are ordinary least squares (OLS) regressions with fixed effects. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, and # indicates marginal insignificance at the 10% level. [a] The dependent variable is measured as the change in food insecurity between month M in year Y and the previous survey (M_{t-1} and Y_{t-1}). [b] *Economic growth* is the percent change in GDP per capita between the two years in which the GWP surveys were conducted. [c] *Food inflation* is the percent change in the food consumer price index (CPI) between the month of the GWP survey and the month of the previous GWP survey, where the food CPI in any given month is actually the maximum food CPI in the previous 12 months. [d] *Low income* is defined as a 2005 GDP per capita of less than US$5,000 PPP, *middle income* as US$5,000–13,000, and *upper income* as greater than US$13,000. Note that by this definition China is defined as a low-income country.

In addition to these sensitivity tests, recall that we also re-estimated the regressions in Tables 5.2, A.3, and A.4 with fixed effects. Although this was not our preferred approach because the assumptions of a fixed effects panel model are unlikely to hold, it turns out that the decision was immaterial since the inclusion of fixed effects makes little difference to the results (Table 5.2). Indeed, if anything, the magnitude of the coefficients increases in absolute size. For example, the coefficient on economic growth for low-income countries (regression 1, Table 5.2) increases from -0.44 to -0.70, and the analogous coefficient on food inflation increases from 0.22 to 0.30. The interaction terms with middle- and upper-income dummies also become significant (or marginally insignificant) in all cases. Hence the association between self-reported food insecurity trends, economic growth, and food inflation is quite a robust one, at least for the time period in question.

In summary, what can we take from all of these results? First, the fact that changes in self-reported food insecurity are strongly explained by both economic growth (negatively) and domestic inflation (positively) suggests that changes in self-reported food insecurity are measuring precisely what we want them to: changes in disposable income. The only significant caveat is that because of measurement error and other omitted variables, the coefficients of determination for these regressions are quite low. Without fixed effects, economic growth and food inflation explain about 10 percent of the variation in self-reported food insecurity trends over time.

6. ESTIMATING BASIC TRENDS IN SELF-REPORTED FOOD INSECURITY AT THE GLOBAL AND REGIONAL LEVELS DURING THE FOOD, FUEL, AND FINANCIAL CRISES

Although we have noted potential problems with the GWP indicators in previous sections, in this section we take a first stab at estimating trends in self-reported food insecurity without making any allowances for possible errors. In the subsequent section, however, we conduct a range of sensitivity analyses on the assumption that there are possible measurement errors in the 2005/06 GWP round, particularly in China.

As for the measurement of basic trends, this is complicated slightly by two issues. First, the GWP surveys are not conducted in the same months in all countries. Some surveys are conducted in the beginning of a calendar year, others toward the end. This is important because the food crisis covered the second half of 2007 and at least the first half of 2008, so some surveys in 2007 may not be picking up the effects of the crisis. Hence we ignore 2007 data on the grounds that it is ambiguous vis-à-vis picking up the effects of rising food and fuel prices. Another timing issue is that in the first wave of the GWP some surveys were conducted in 2005 and others in 2006. In order to pick up the effects of the food–fuel and financial crises, three periods were therefore selected: (1) a pre-crisis period covering surveys conducted in 2005 *or* 2006 (the first wave of the GWP); (2) a food–fuel crisis period of surveys conducted in 2008, mostly the latter half (the third wave of the GWP);[20] and (3) a financial crisis period (2009), which may pick up some of the early effects of the financial crisis as well as late effects of the food crisis (the fourth wave of the GWP). Note that since the GWP food insecurity question is retrospective over a 12-month period, we denote these three periods as 2005/06, 2007/08, and 2008/09.

A second issue is that our sample of countries is large but not universal. After excluding high-income countries,[21] our sample of 70 developing countries over 2005/06–2007/08 covers 79 percent of the population of the developing world (and 67 percent of the total world population), including China, India, Indonesia, Brazil, Pakistan, Nigeria, and many other large developing countries. We also use a subsample of 57 developing countries for which data for 2008/09 are also available, which covers 77 percent of the developing-world population. However, there are also important exclusions from both samples because of lack of data for one or more time periods. These include all five North African countries (Morocco, Tunisia, Algeria, Libya, Egypt); Ethiopia, the Democratic Republic of Congo, and Sudan (the second-, third-, and fifth-largest Sub-Saharan African countries); and the Philippines (a country of around 85 million). The exclusion of these countries is unfortunate not only because they are populous but also because there are strong reasons to suspect that many of them suffered considerably from rising prices. Hence in the sensitivity analysis below we will estimate some food insecurity trends in these countries in order to gauge how important their exclusion from the present sample is.

Turning now to our core results, Table 6.1 reports trends in food insecurity in the 70-country sample and the 57-country subsample. For both samples we report unweighted means and population-weighted means. The results for these two means are very different. In an "average" developing country, self-reported food insecurity rose slightly from 2005/06 to 2007/08 in all 70 countries and fell very slightly in the subsample of 57 countries. However, the population-weighted mean dropped very sharply over these two periods, from 35.3 percent to 26.2 percent in the 70-country sample, and from 34.7 percent to 25.3 percent in the 57-country subsample. The latter sample does show, however, that food insecurity increased slightly from 2007/08 to 2008/09 (from 25.3 percent to 27.5 percent). Yet the overall trend in global self-reported food insecurity is undoubtedly very favorable over the entire period. Specifically,

[20] In 2008 only one sampled survey was conducted before April (Indonesia, where the survey finished on March 25, when international food prices were already very high). Hence all the 2008 values for food insecurity—which are 12-month retrospective answers—cover the first half of 2008, and most cover the last few months of 2007 as well.

[21] The exclusion of high-income countries is based on the grounds that (1) self-reported food insecurity in these countries is more likely to pertain to less exigent definitions of *food* and (2) these countries show little change in food insecurity and are less likely to be influenced by rising international prices because of the greater consumption of processed foods, in which raw materials are only a small component of total cost.

Table 6.2 shows that there was a huge decline in the number of self-reported food-insecure people from 2005/06 to 2008/09: around 400 million people are estimated to fallen out of this type of food insecurity, although 100 million fell into food insecurity in 2008/09.

Table 6.1—Trends in self-reported food insecurity in the developing world: Weighted and unweighted means

	2005/06	2007/08	2008/09
Total sample (70 countries)			
Unweighted mean	39.1%	39.8%	
Population-weighted mean	35.3%	26.2%	
All three years (57 countries)			
Unweighted mean	36.9%	36.6%	38.3%
Population-weighted mean	34.7%	25.3%	27.5%

Source: Author's calculations from GWP (Gallup 2011) self-reported food insecurity prevalence rates and 2006 World Bank (2010c) population numbers.

Table 6.2—Estimated trends in the numbers of food-insecure people (millions) in 57 developing countries

	2005/06	2007/08	2008/09
Estimated "food-insecure" population	1502.1	1094.2	1191.3
Change in "food-insecure" population		-407.9	97.1

Source: Author's calculations from GWP (Gallup 2011) self-reported food insecurity prevalence rates and 2006 World Bank (2010c) population numbers.

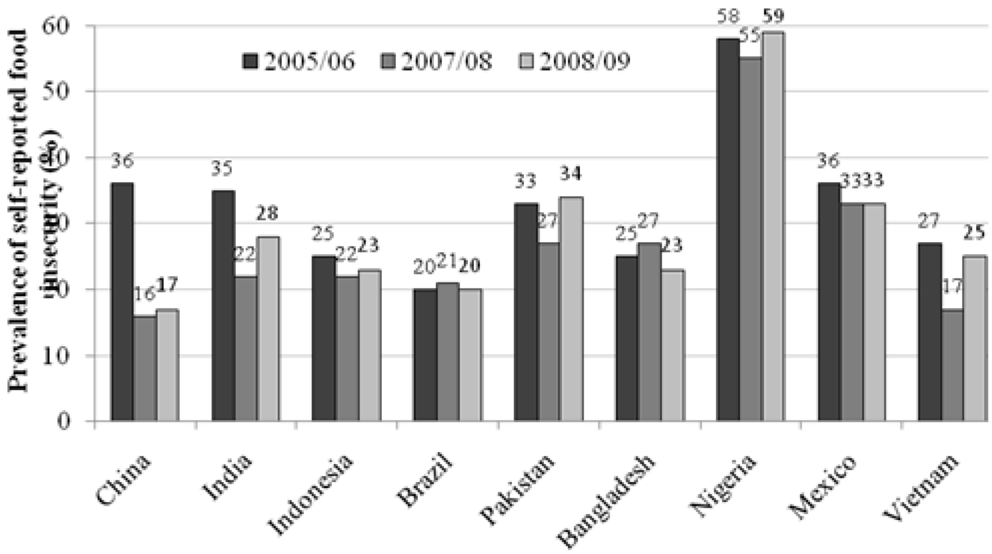
Table 6.3—Regional trends in self-reported food insecurity (% prevalence)

Developing region	# obs.	2005/06	2007/08	2008/09
Big and fast growing*	9	33.1	26.7	29.1
Sub-Saharan Africa	14	55.8	54.6	57.2
West Africa, coastal	4	48.5	51.3	58.0
West Africa, Sahel	5	59.6	49.2	55.2
Eastern & southern Africa	5	57.8	62.8	58.6
Latin America & Caribbean	15	33.2	36.4	35.7
Central America, Caribbean	7	38.4	41.4	40.3
South America	8	28.6	32.0	31.6
Middle East	3	19.7	26.0	21.3
Transition countries	13	31.9	30.2	34.6
Eastern Europe	6	21.8	19.7	25.8
Central Asia	7	40.6	39.1	42.1
Asia	12	30.6	28.3	29.7
East Asia	7	33.3	29.3	30.4
South Asia	5	26.8	26.8	28.6

Source: Author's calculations from GWP (Gallup 2011) self-reported food insecurity prevalence rates.
Note: *"Big and fast growing" includes China, India, Indonesia, Brazil, Pakistan, Bangladesh, Nigeria, Mexico, and Vietnam.

What could explain this remarkable result? One means of accounting for the change is to break up developing countries by region, and another is to examine the largest countries separately. In the top row of Table 6.3, for example, we group the largest nine developing countries together: China, India, Indonesia, Brazil, Pakistan, Bangladesh, Nigeria, Mexico, and Vietnam. Together these countries account for 57 percent of the total population of the 70-country sample, so what happens in these countries largely determines the overall trends observed in Tables 6.1 and 6.2. This is indeed evident in Table 6.3, where average (unweighted) self-reported food insecurity among these countries fell from 33.1 percent in 2005/06 to 26.7 percent in 2008, before rising again to 29.1 percent in 2009. Figure 6.1 also shows the individual trends for these nine countries. The huge reductions in self-reported food insecurity in China and India are perhaps the most striking results, given that these countries contain about 40 percent of the population of our 70-country sample. In India the trend of declining insecurity was reversed somewhat from 2007/08 to 2008/09, and similar patterns hold for Pakistan, Nigeria, and Vietnam. In the other countries there are no major changes. In China self-reported food insecurity fell by a scarcely credible 20 percentage points (an issue we take up in the next section).

Figure 6.1—Self-reported food insecurity trends in the most populous developing countries



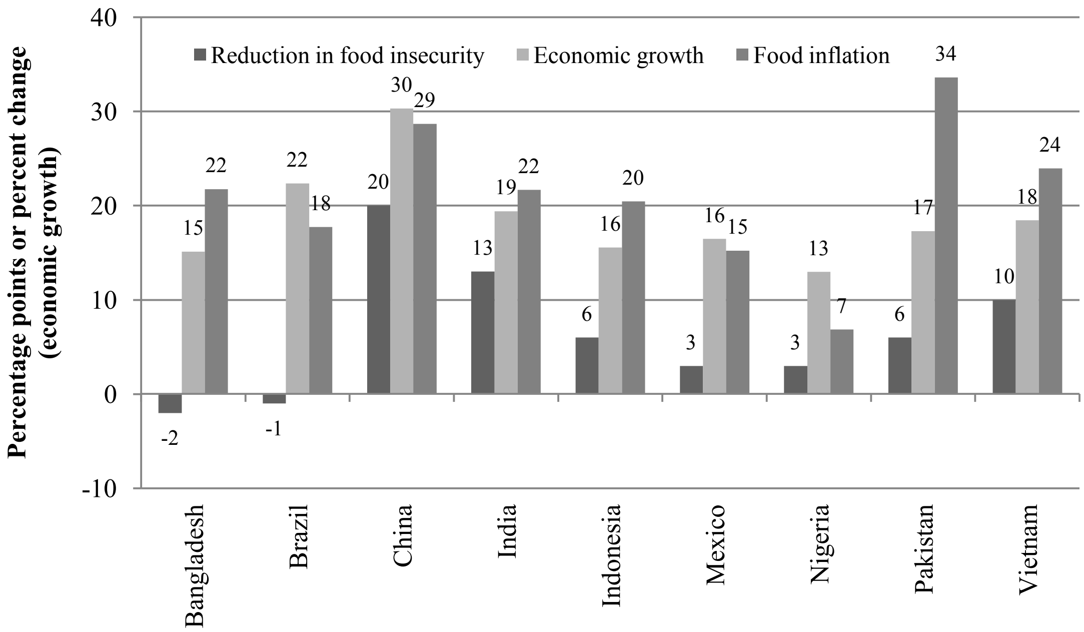
Source: Author's calculations from GWP (Gallup 2011) self-reported food insecurity prevalence rates.

Are the results for these large countries plausible? In Figure 6.2 we plot trends in three statistics for these countries for the period from 2005/06 to 2007/08: the reduction in self-reported food insecurity, the annual per capita economic growth rate over that period, and the change in CPI inflation over that period. There are several striking features of Figure 6.2. First, from 2005 or 2006 to 2008 these countries saw per capita incomes rise from anywhere between 13 percent (Nigeria) and 29 percent (China). Second, the percentage changes in food prices was high, but lower than in most other developing countries, and about the same as the percentage change in per capita incomes. Third, looking at the relationships between the three variables one observes a very strong correlation between economic growth rates and reductions in food insecurity (the lightest and darkest lines, respectively). The correlation between the two variables for all nine countries is 0.67, but if one excludes Bangladesh and Brazil (two countries where food insecurity rose slightly), the correlation rises to an astonishing 0.93. In other words, it looks like the main driver of reduced food insecurity in the developing world's largest countries was rapid economic growth. Changes in food prices, however, are perversely positively correlated with reductions in food insecurity (at 0.54). This may be because food inflation has some positive relationship with economic growth (at 0.57). So all in all, it looks like economic growth has been the main driver of food-insecurity trends in these big countries.

We will further explore the plausibility of these trends in China and India below, but for now we turn back to the trends within other developing regions reported in Table 6.3. Previous research showed that much of Sub-Saharan Africa experienced relatively rapid food inflation in 2008 (Headey and Fan

2010; Minot 2010). Our results show very diverse patterns across African regions, however. West African countries saw some increase in food insecurity, which is perhaps unsurprising given that many import substantial amounts of rice and, in some cases, other cereals as well. The inland Sahelian and Saharan countries in West Africa actually saw substantial declines in food insecurity, on average, while eastern and southern African countries saw substantial increases in food insecurity. If Ethiopia were added to this last group, the increase might be even more pronounced, since 2005 and 2006 GWP data report rising self-reported food insecurity while the unsurveyed years of 2007 and 2008 constitute a period of very rapid food inflation in that country (see our sensitivity analysis below).

Figure 6.2—Trends in food insecurity, economic growth, and inflation in the developing world's ten most populous countries: 2005/06 to 2007/08



Sources: Reduction in food insecurity is from the Gallup World Poll (Gallup 2011). Economic growth is total growth in GDP per capita between 2005/06 and 2007/08, and is sourced from World Bank (2010c). Change in inflation is the total change in the inflation rate between 2005/06 and 2007/08 from World Bank (2008a).

In Latin America, self-reported food insecurity rose by around 4 percentage points, a result broadly consistent with survey-based simulation analyses for Latin America—for example, Robles and Torero (2010), who estimated about a 2 percentage point rise in poverty for a 10 percent increase in food prices. Moreover, the observed increases in the GWP measure are about the same for Central America and the Caribbean as they are for South America. Among the countries witnessing the largest increases in self-reported food insecurity are El Salvador (from 40 percent to 48 percent), Honduras (from 42 percent to 48 percent), and the Dominican Republic (from 48 percent to 59 percent). In Haiti, where there were widely publicized food riots, which in turn caused a regime change, food insecurity actually fell over this period (from 63 percent to 60 percent), although the levels in both years were easily the highest in the region. In South America it appears that Ecuador was the worst-affected country, since food insecurity rose from 36 percent before the crisis to 46 percent during the crisis period of 2007/08.

We have data for only three Middle Eastern countries (Turkey, Lebanon, and Jordan), so the sharp increase in this region may be very sensitive to the inclusion of more countries (see Section 7 below). Moreover, the result is heavily driven by Turkey, where self-reported food insecurity rose from

26 percent in 2005/06 to 47 percent in 2007/08 before falling again to 37 percent in 2008/09. It is quite likely that food insecurity rose in other Middle Eastern and North African countries, as we discuss below.

Among the formerly Communist "transition" countries there was very little change on average, but this masks considerable diversity across the countries. Some transition countries saw significant declines in food insecurity, on the order of 6–15 percentage points (Romania, Kyrgyzstan, Armenia, Tajikistan), but Azerbaijan was a big exception, with food insecurity rising from 37 percent to 60 percent.

Finally, self-reported food insecurity in eastern and southern Asia declined on average. Among East Asian countries food insecurity declined by 4 percentage points on average, but there is again a lot of diversity. China, Cambodia, and Vietnam saw large decreases, while Laos and Thailand saw increases of 8–12 percentage points, and as we discuss below, food insecurity probably increased somewhat in the Philippines. In South Asia, food insecurity fell in India and Pakistan, as we noted above, but rose slightly in Bangladesh and sharply in Sri Lanka, where inflation was in double digits as a result of the large government deficits run up during the civil war (Headey and Fan 2008).[22]

[22] One final point of interest is the issue of tradability in Asian rice markets, with the data suggesting that both importers and exporters can be adversely affected by rising international prices. For example, the Philippines is regularly the world's largest importer of rice, so it is obvious that domestic food inflation would be directly related to the higher cost of rice imports. But exporters can be affected too. Previous research has shown that Thailand's decision not to restrict its rice exports during the crisis did indeed lead to a sharp increase in domestic rice prices, in contrast with India, where rice exports were heavily restricted (Headey 2010).

7. SENSITIVITY ANALYSIS

The results above suggest that self-reported food insecurity in around 70 percent of the developing world's population fell sharply from 2005/06 to 2007/08 by around 400 million people before rising by around 100 million from 2007/08 to 2008/09. Since this is undoubtedly a controversial result, it behooves us to consider whether the result is sensitive to the exclusion of some important countries or to alternative assumptions about events in China and India (the two countries that account for the largest country shares of this huge decline) or to more general measurement error.

Beginning with the China–India question, a first point of note is that excluding these two countries from our sample would suggest that self-reported food insecurity did indeed rise among the remaining 68-country sample, but only by 9 million people (and then by another 12 million people from 2007/08 to 2008/09). This result still conflicts with estimates of the FAO, USDA, and World Bank of the change in poverty and hunger resulting from the crisis, which put the rise somewhere between 75 million and 160 million people. Moreover, the fact that self-reported food insecurity did not rise by a greater number still mainly seems to stem from the strong economic performance of other large developing countries (Figure 6.2 above).

More importantly, the exclusion of China and India is obviously not a valid one if one wants to assess global poverty trends. That said, in Section 3 we noted concerns over the self-reported food insecurity trends in China because in the 2005/06 round the food affordability question followed more general questions about income, which may have primed respondents in that year to be more likely to answer yes to the question about food affordability. Certainly the 20 percentage point reduction in self-reported food insecurity from 2006 to 2008 is not very credible. Suppose, then, that we re-estimate global food insecurity trends after using an alternative series for China and India. Specifically, if we take the extreme position of keeping self-reported food insecurity constant in China (or equivalently, excluding China from the calculations), but keep the Indian series as is, then global self-reported food insecurity still falls by about 132 million people. Or suppose that we use the margins of error reported by the GWP, which are around 3 percentage points at the 95 percent confidence interval, to re-estimate flatter trends for India and China by reducing their reported food insecurity rates by 3 points in 2005/06 and increasing the reported values by 3 points in 2007/08. If we carry out that exercise, then global food insecurity still falls by 250 million people. If one adopts an even stricter but more arbitrary assumption regarding China, namely that self-reported food insecurity in China fell by just 10 percentage points rather than 20 points from 2005/06 to 2007/08, then global self-reported food insecurity fell by around 200 million people. Finally, suppose we discredit the GWP numbers for China and India entirely, and instead arbitrarily assume that self-reported food insecurity fell by just 3 percentage points in both countries (after all, their economic growth and food inflation were conducive to at least this much reduction). Under that assumption, global food insecurity still fell by 63 million people. In short, various assumptions about the nature of any error in the 2005/06 GWP surveys in China and India still suggest that global food insecurity fell by a large number.

What about some potentially important omissions from the 70 countries on which our "global" estimates in Tables 6.1 and 6.2 were based? As we noted above, most of the developing world's largest countries have complete data for the three periods considered, but there are some sizable countries excluded. North Africa is excluded entirely, while three of Sub-Saharan Africa's largest countries are also excluded, as well as three medium-size countries on that continent. In Latin America, Peru is a reasonably large country, while Paraguay is small. And in East Asia there is only one major exclusion, the Philippines, but that country has almost 85 million people, making it another sizable omission.

These 16 excluded countries are listed in Table 7.1, where we note that their total population comprises nearly half a billion people. Table 7.1 therefore also reports what data are available for these countries, before estimating some plausible trends in the self-reported food insecurity indicator based on trends in real domestic staple food prices from the FAO (2010), inflation data from the IMF (2011) when FAO data are unavailable, and post-2008 trends in the GWP self-reported food insecurity indicator (that is, if this indicator fell after 2008, this would suggest that food insecurity in 2008 might have been unusually high).

We note that in all cases we have made very generous assumptions about the extent of change in the food insecurity indicator. Even so, there are also good grounds to think that many of these 16 countries were quite adversely affected by the global food crisis. North Africa, for example, is a huge wheat importer (Egypt is typically the largest wheat importer in the world) that has experienced significant inflation in recent years and subsequent civil unrest in early 2011, including regime changes in Tunisia and Egypt. Ethiopia experienced very rapid food inflation from 2005 onward. From 2005/06 to 2006/07 self-reported food insecurity in Ethiopia rose by 14 percentage points. Since overall inflation peaked at around 60 percent in July 2008, it is highly likely that food insecurity kept rising in Ethiopia after the early GWP surveys terminated there. The Democratic Republic of the Congo (DRC) and Sudan also saw sharp increases in staple food prices (Table 7.1). And finally, the Philippines is typically the largest rice importer in the world, and in the first quarter of 2008 it made what is widely regarded as a "panic purchase" that contributed to a further increase in international rice prices (specifically, the Philippines purchased more rice in the first quarter of 2008 that it did in all of 2007, mostly from Vietnam—see Headey 2011a).

These omissions are sizable enough to suggest that the "global" trends reported in Tables 6.1 and 6.2 could be influenced by the exclusion of these 16 countries. Hence in the last column of Table 7.1 we report upper-bound estimates of the possible rise in food insecurity among the 16. In the Middle East and North Africa we typically assume that food insecurity rose by around 10 percentage points, with a similar assumption for Sudan, the DRC, and Sierra Leone. In Ethiopia we assume a 20-point increase because of the country's rapid food inflation and because its population is undoubtedly very vulnerable to food price increases. But in Malawi and Rwanda—where many poor people are smallholders—we make the more modest assumption of a 5-point increase (in any case these countries are much smaller than Ethiopia, Sudan, or the DRC), an assumption that also pertains to Peru and Paraguay. Finally, we assume that food insecurity rose by 14 points in the Philippines. Based on these upper-bound assumptions we find that these 16 countries could have added as many as 62 million to the ranks of the global numbers of self-reported food insecure. This is a big enough number to influence the global estimates discussed above, although even if subtracted from the China–India sensitivity tests above, we would still find that global food insecurity rose under every assumption.

Table 7.1—Countries excluded from the "global" estimates and likely impacts of the 2007/08 food crisis on their food insecurity

Country	Self-reported food insecurity data					Clues as to impact of global food crisis[a]	Assumed impact[b]
	2005/06	2006/07	2007/08	2008/09	2009/10		
Seven Middle Eastern and North African countries; total population = 230 million							
Afghanistan		49	38	38		All countries are dependent on wheat imports, and GIEWS data often show rising domestic wheat prices, while overall inflation was often high (exceptionally high in Yemen). In many instances self-reported food insecurity fell from 2008 to 2009, suggesting 2008 might have been a year of unusually high food insecurity.	11 points
Algeria			22	15	13		7 points
Iraq			25	12	18		13 points
Egypt			31	23	28		8 points
Morocco	36	29					5 points
Tunisia			22	11	9		11 points
Yemen			47	48			10 points
Three large African countries; total population = 190 million							
Ethiopia	24	38				In DRC and Sudan, GIEWS data suggest that many food items increased in price by 50–100%. In Ethiopia overall inflation peaked at 60% in July 2008 but was already high before the global food crisis.	20 points
DRC			61				10 points
Sudan		27		38	50		10 points
Three medium-sized African countries; total population = 30 million							
Malawi	76	51		60		GIEWS data suggest rapid increases in maize, bean, and rice prices in Rwanda and Malawi, although many poor people produce maize and beans. Sierra Leone is a large importer of rice; inflation rose to 17% by mid-2008.	5 points
Rwanda	61			43			5 points
Sierra Leone	58	63					10 points
Two medium-sized Latin American countries; total population = 33 million							
Paraguay	40	36		31		In Paraguay there is no strong evidence on food inflation. In Peru, maize, potato, and wheat prices rose by 50%, but many poor people produce maize and potatoes.	5 points
Peru	50	45		46			5 points
One large East Asian country; total population = 86 million							
Philippines	56	64		68	62	Rice prices rose by 50%, and food insecurity trend is upward.	14 points
Total estimated change in self-reported food insecurity in all 16 countries							***62.4 million people***

Source: Self-reported food insecurity data are from the Gallup World Poll (Gallup 2011).

Notes: [a] These clues include an assessment of FAO Global Information and Early Warning System (GIEWS) data (FAO 2010), IMF inflation data (IMF 2011), and trends in the self-reported food insecurity reported in columns 2 through 6. [b] This is the assumed change in self-reported food insecurity between 2005/06 and 2007/08.

Finally, we conduct a more systematic sensitivity test by disregarding the 2005/06 GWP results—because of concerns that Gallup was still improving its survey design in this first round (see Section 3)—and instead "predicting" the 2005/06 food insecurity levels based on trends in economic growth and food inflation from 2005/06 to 2007/08 and the coefficients estimated in Table 5.1. This backcasting approach is basically an instrumented variables (IV) approach, and like IV it may have the effect of reducing measurement error. Put another way, it will also "iron out" the influential outlying observations, such as those from China. A second advantage is that the country coverage becomes almost universal, including all the countries listed in Table 7.1 and rectifying other smaller omissions from the calculations of the previous section (the only sizable omission is Morocco). A final advantage is that we can decompose the predicted change in self-reported food insecurity into an economic growth component and a food inflation component, examining how each of these factors appears to have been driving global food insecurity trends.

So what do we find? The basic result, shown in Table 7.2, is that 87.3 million people are still thrown out of self-reported food insecurity from 2005/06 to 2007/08. Note that in these IV results, self-reported food insecurity falls by just under three percentage points in China and just under two percentage points in India. By decomposing the results into growth and inflation effects, one can conduct the kind of *ceteris paribus* experiments that simulation exercises pursue. For example, if food inflation changed as it did from 2005/06 to 2007/08 without any change in income—the experiment conducted in most LSMS-based simulations—then food insecurity is indeed predicted to have risen by 128.2 million people. This is somewhere in between the 80 or so million predicted by the FAO and USDA, and the 160 million estimate derived by de Hoyos and Medvedev (2009), who also used food inflation in their experiment.[23] However, the difference between our results and those others is that we find that the benefits of rapid economic growth easily outweighed the costs of food price inflation. Had economic growth followed its historical path with no increase in food prices, then 215 million people would be predicted to leave the ranks of the food insecure.

Table 7.2—Estimating changes in self-reported food insecurity by backcasting and forecasting

	2005/06 to 2007/08 (2006/06 backcast from 2007/08)	2007/08 to Dec. 2009 (2009 forecast from 2007/08)
Change in self-reported food insecurity	-87.3 million	+1.0 million
Change due to economic growth	-215.4 million	+17.2 million
Change due to food inflation	+128.2 million	-16.2 million

Source: Author's calculations based on the Gallup World Poll (Gallup 2011).

Notes: In the second column changes in self-reported food insecurity are estimated by backcasting 2005/06 food insecurity levels (June 2006) from 2007/08 levels by using regression results from Table 5.1, which model food insecurity changes as a function of economic growth and food inflation. For countries in which food inflation data are not available, overall inflation is used. For countries in which 2008 food insecurity data are not available, 2009 levels are used as the base. In the third column 2007/08 results are combined with economic growth and food inflation trends to forecast self-reported food insecurity in December 2009, in roughly the middle of the financial crisis.

Table 7.2 also finds an interesting result vis-à-vis the financial crisis. While economic growth slowed in 2009, the slowdown was very modest in many of the most populous countries, so our results do

[23] Without China, we find that food inflation would have raised self-reported food insecurity by 90 million people. Since de Hoyos and Medvedev (2009) do not include China in their sample, this estimate of 90 million people is actually the more relevant comparison. There are other differences too. We measure the food price increase from June 2006 to June 2008, but de Hoyos and Medvedev measure it from January 2005 to December 2007 (although the magnitude of the change is very similar). More importantly, de Hoyos and Medvedev measure the impacts of food price changes relative to nonfood price changes, whereas our regressions use only nominal food price changes.

not estimate a large negative impact via this channel. On the other hand, food inflation slowed and in some cases was negative, thus mitigating the most severe impacts of the financial crisis on food insecurity.

Let us summarize the results of this section. First, many of the sensitivity analyses employed above were purposively designed to reduce the magnitude of the food insecurity reduction in China. While it is difficult to assess which of the assumptions regarding Chinese trends is most plausible, all of the assumed reductions in the Chinese trends show that global self-reported food insecurity still fell by a large number from 2005/06 to 2007/08. Making some generous assumptions about the adversity of food insecurity trends in some omitted countries would reduce the scale of the global reduction in food insecurity still further, but again, the magnitude of that reduction is still considerable. Finally, using the regression results from Section 5 to backcast and forecast trends—in what is more or less an instrumental variables regression—still suggests that the numbers of self-reported food insecure in the developing world fell by around 87 million. So while various assumptions and techniques used in this section sizably reduce the admittedly improbable raw trends calculated in the previous section, the qualitative result remains the same: Self-reported food insecurity appears to have fallen from 2005/06 to 2007/08. Table 7.3 summarizes these results.

Table 7.3—Alternative estimates of global food insecurity trends

Estimation scenarios	Estimated change in global food insecurity, 2005/06 to 2007/08
Raw results, 70 countries	-408 million
Raw results, 70 countries, plus upper-bound assumptions for 16 omissions	-326 million
Raw results, 68 countries, after excluding China and India	+9 million
Raw results, 69 countries, after excluding China	-132 million
Raw results, China and India trends adjusted by maximum margins of error	-250 million
Raw results, food insecurity in China and India falls by 3 percentage points	-63 million
As above plus upper-bound assumptions for 16 omitted countries	-1 million
Predicted change after backcasting 2005/06 level, 88 countries	-87 million

Source: Author's calculations from Gallup World Poll data (Gallup 2011), FAO Global Information and Early Warning System (GIEWS) data (FAO 2010), and ILO food inflation data (ILO 2011).

Note: See text in this section for more details regarding the assumptions and data.

8. CAVEATS AND CONCLUSIONS

This paper has explored the usefulness of the Gallup World Poll indicators of self-reported food insecurity and hunger for assessing global food insecurity patterns and trends. In this concluding section we overview the strengths and weaknesses of these data, and summarize our main findings regarding trends in the two indicators of interest. To reiterate the main findings, our main result is that in 2007/08—the food crisis period—there were *fewer* people reporting trouble affording food than in 2005/06. We are hesitant to say exactly how many, though two of our most conservative estimates suggest that global food insecurity fell by 60–90 million people, although these would be lower-bound estimates if the trends in China and India were somewhat stronger than a 2–3 percentage point reduction in food insecurity assumed or predicted in these scenarios. Certainly the fantastic growth rates and muted food inflation in these two countries could warrant a strong downward trend. Of course this conclusion does not mean that the global food crisis did not hurt. On the contrary, it hurt poor people in many countries, particularly in Africa. Yet our main finding is that the food crisis had a very limited impact in the most populous countries, thus casting into doubt existing estimates of global trends in food insecurity and hunger.

This last point is particularly important because all existing simulation-based estimates of the impacts of the food crisis omit China, and many omit other large countries. Yet our results suggest that strong economic growth prevented the surge in international food prices from resulting in a genuine global crisis. Moreover, the fact that populous countries tend to be wary of heavily relying on international cereal markets—and the fact that many large countries also imposed export restrictions to protect domestic prices (Headey 2011a)—prevented them from experiencing significant food inflation. However, on this last point we add a note of caution. The events of 2005–2008 are not necessarily a good predictor of food price impacts in 2010/11. While countries like China and India are still growing rapidly, a notable difference in the current crisis (2010/11) is that some of these large countries are now experiencing quite rapid food inflation (although not yet rice price inflation). Hence the global impact of the current crisis could potentially be significantly worse than that of the 2007/08 crisis.

Our results also suggest that the Gallup World Poll indicator of food affordability may be a good metric for assessing the impacts of price shocks in the future, although much more work needs to be done to further assess the reliability of this indicator. Existing work on subjective indicators has often found them to have low test–retest reliability or to be quite sensitive to the phrasing or placement of questions (Bertrand and Mullainathan 2001; Krueger and Schkade 2008). Further appraisal of the GWP indicators would certainly be useful. We know very little about how people define food security across countries or socioeconomic groups, or how self-reported food insecurity varies within countries according to income or food consumption measures. Nevertheless, the fact that economic growth and food inflation explain trends in this indicator is encouraging, and it may be that further refinements to the survey question could be very useful. Moreover, a number of cross-country surveys ask self-reported food security questions, often with a more refined five-point scale. These include Gallup (for Africa and Asia only), but also Afrobarometer, the World Bank's Core Welfare Indicator Questionnaires (CWIQs), and the World Food Programme's comprehensive food security surveys. At the moment, however, there is no coordination, comparison, or systematic validation of these various surveys and indicators. Given the flaws of "objective" indicators of hunger and food insecurity, these institutions and others (such as FAO) should seriously consider scaling up and improving these indicators as a basis for improved measurement of this critical dimension of human welfare.

APPENDIX A. ADDITIONAL STATISTICS AND ECONOMETRIC RESULTS

Table A.1—The full correlation matrix between various indicators of food insecurity, poverty, and hunger

	GWP hunger	GWP food insecurity	GDP per capita (log)	Income per capita (log)	FAO hunger	US$1/day poverty	US$2/day poverty	Low BMI, women	Under-weight children	Stunted children
GWP hunger	1.00***									
GWP food insecurity	0.90***	1.00***								
GDP per capita (log)	-0.79***	-0.82***	1.00***							
Income per capita (log)	-0.67***	-0.61***	0.93***	1.00***						
FAO hunger	0.58***	0.49***	-0.59***	-0.61***	1.00***					
US$1/day poverty	0.77***	0.64***	-0.90***	-0.90***	0.60***	1.00***				
US$2/day poverty	0.68***	0.63***	-0.93***	-0.95***	0.69***	0.92***	1.00***			
Low BMI, women	-0.14	-0.18**	-0.57***	-0.65***	0.37**	0.56***	0.78***	1.00***		
Underweight children	0.55***	0.38***	-0.76***	-0.79***	0.46***	0.71***	0.76***	0.80***	1.00***	
Stunted children	0.48***	0.33***	-0.73***	-0.76***	0.45***	0.68***	0.72***	0.63***	0.90***	1.00***

Sources: Dependent variables (indicated by *GWP*) are from the Gallup World Poll (Gallup 2011). Independent variables are sourced as follows: GDP per capita is from World Bank (2010c) World Development Indicators. Poverty and income per capita are from household surveys collated in the World Bank Povcal data bank (2010b). FAO hunger is from Food and Agriculture Organization (FAO 2011b). Low BMI, women, is from the Demographic Health Surveys (Measure DHS 2010), and underweight and stunted children are from the Demographic Health Surveys (Measure DHS 2010) and the World Health Organization (WHO 2010).

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. All variables are measured in 2005 or the nearest available year. Log indicates that variable is expressed in logarithms to account for a nonlinear relationship. Samples vary in size because of the paucity of some of the poverty and malnutrition indicators.

Table A.2—Regressions of domestic food and overall inflation against international oil and food inflation

Regression number	1	2	1	2
Dependent domestic inflation variables	Overall CPI	Overall CPI	Food CPI	Food CPI
Periods included	70	70	70	70
Cross-sections included	135	135	131	131
Observations	8,871	8,871	7,318	7,318
No. of autoregressive terms included	8	8	8	8
Effects of international oil inflation, lagged 1 month				
All income levels (interaction not significant)	0.0016***		-0.0040	0.0013
Low income[a]		0.0060***		
Middle income[a]		0.0059***		
Upper income[a]		0.0022**		
Effects of international food inflation, lagged 1 month				
	Food price index	Cereals price index	Food price index	Cereals price index
Low income	0.0220***	0.0118***	0.0390***	0.0230***
Middle Income	0.0015***	0.0066***		
Upper income	0.0010***	0.0076***		
R-square	0.95	0.95	0.99	0.99
Evidence that international inflation effects are different across income levels?[b]	Yes, but only for food	Yes	No	No
Evidence that low-income food price effects are at least twice as large as oil price effects?[c]	Yes	No	Yes	Yes

Source: Author's estimates from International Monetary Fund data on overall consumer price index (CPI) inflation and oil price inflation (IMF 2011), International Labour Organization data on food inflation (ILO 2011), and Food and Agriculture Organization data on food and cereal prices (FAO 2011a).

Notes: All inflation measures are the percent difference between the price level in month M and month M-12. International prices are converted into domestic currency units using IMF (2011) exchanges rates. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. The number of autoregressive terms was determined as part of a panel unit root test, which also determined that all variables are I(0). Also note that very similar results are obtained if domestic food inflation is used rather than overall inflation. [a]. *Low income* is defined as a 2005 GDP per capita of less than US$5,000 PPP, *middle income* as US$5,000–13,000, and *upper income* as greater than US$13,000. [b]. This is based on the significance of interaction terms, which are not reported. c. This is based on Wald tests of the null hypothesis that food inflation coefficients are twice as large as their counterparts for oil inflation. The rationale for this is that international oil inflation over 2007–2008 was twice as high as international food inflation. Hence the test is designed to see whether the scales of oil and food inflation impacts are significantly different.

Table A.3—Descriptive statistics for staple food price index and food consumer price index (CPI) (percent changes)

	Food CPI	Overall CPI	Staples index
Mean	11.4	8.9	11.5
Median	8.8	7.2	4.8
Maximum	49.3	35.6	90.1
Minimum	-19.1	-14.8	-75.4
Std. dev.	11.4	7.9	28.2
Correlation with food CPI	1.00	0.87	0.44
Observations	120	120	120

Sources: The staples index is the weighted average of staples prices reported by the Food and Agriculture Organization (FAO 2010), where the weight for each item is based on its share of calorie intake. The Overall CPI is from the IMF (2011). The Food CPI is from the International Labour Organization (ILO 2011).

Table A.4—Are changes in the GWP measures explained by economic growth and overall inflation?

Regression no.	1	2	3	4
Dependent variable[a]	Change in food insecurity	Percent change in food insecurity	Percent change in food insecurity	Change in hunger
Number of countries	107	99	102	102
Number of observations	259	228	181	181
Constant	0.38	10.34***	-1.60**	-3.85
Economic growth[b]	-0.66***	-1.58***	-0.03	0.38
☐ overall inflation[c]	0.32***	0.68**	0.04	-0.25
Growth*upper income[d]	0.423**	-0.15	0.05	-0.79
☐ inflation*upper income[d]	-0.25**	-0.26	0.09	-0.36
Growth*middle income[d]	0.52**	1.11*	0.08	-0.26
☐ inflation*middle income[d]	-0.09	-0.03	0.02	0.36
R-square	0.14	0.11	0.02	0.01
Adjusted R-square	0.12	0.09	-0.01	-0.02
Growth effects in middle- and upper-income countries greater than zero?	Yes for upper, no for lower	Yes for upper, no for lower	---	---
Low-income countries' growth effects larger in absolute value than inflation effects?	Yes	Yes	---	---

Sources: Dependent variables are from the Gallup World Poll (Gallup 2011). Independent variables are sourced as follows: Economic growth from World Bank (2010c), overall inflation from International Monetary Fund (IMF 2011).

Notes: These are ordinary least squares (OLS) regressions. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, and # indicates marginal insignificance at the 10% level. [a]. The dependent variable is the change in the GWP indicator between month *M* in year *Y* and the previous survey (M_{t-1} and Y_{t-1}). [b]. Economic growth is the percent change in GDP per capita between the two years in which the GWP surveys were conducted. [c]. Overall inflation is the percent change in the food CPI between the month of the GWP survey and the month of the previous GWP survey, where the CPI in any given month is actually the maximum CPI in the previous 12 months. This is because the GWP question asks about food affordability over the previous 12 months. [d]. *Low income* is defined as a 2005 GDP per capita of less than US$5,000 PPP, *middle income* as UA$5000–13,000, and *upper income* as greater than US$13,000. Note that by this definition China is included as a low-income country.

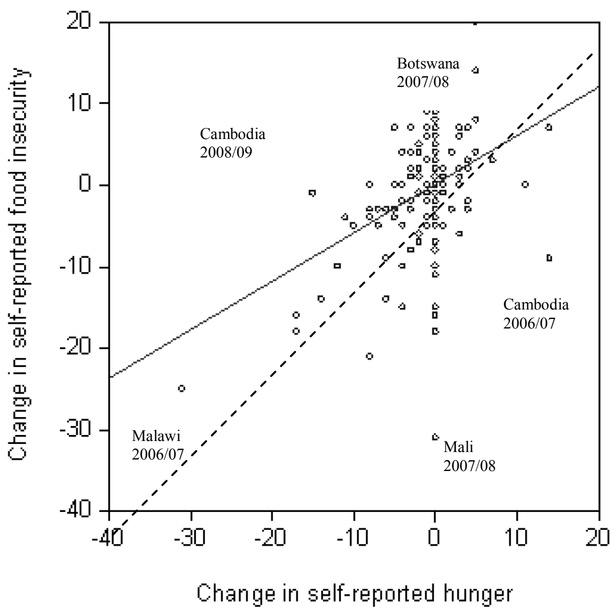
Table A.5—Are changes in self-reported food insecurity and hunger explained by economic growth and inflation of staple food prices?

Regression	1	2	3	4
Dependent variable[a]	Percent change in food inflation	Change in food insecurity	Percent change in food insecurity	Change in hunger
Number of countries	48	52	52	45
Number of observations	123	127	127	68
Constant	9.33***	1.72*	5.63**	-1.55
Economic growth[b]		-0.51***	-0.83*	0.18
□ staples inflation[c]	0.18***	0.07**	0.18*	-0.03#
Growth*middle income[d]		0.50**	1.10#	-0.08
□□ staples inflation*middle income[d]		-0.06	-0.19	0.07#
R-square	0.20	0.13	0.01	0.04
Adjusted R-square	0.19	0.10		-0.02

Sources: Dependent variables are from the Gallup World Poll (Gallup 2011). Independent variables are sourced as follows: Economic growth from World Bank (2010c), food inflation from ILO (2011), staples inflation from ILO (2011).

Notes: These are ordinary least squares (OLS) regressions. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, and # indicates marginal insignificance at the 10% level. [a] The dependent variable is the change between month *M* in year *Y* and the previous survey (M_{t-1} and Y_{t-1}). [b]. Economic growth is the percent change in GDP per capita between the two years in which the GWP surveys were conducted. [c] Staples inflation is the percent change in an index of staple food prices between the month of the GWP survey and the month of the previous GWP survey, where the staple foods index in any given month is actually the maximum value in the previous 12 months. The staples index is the weighted average of reported staples, where the weight for each item is based on its share of calorie intake. [d]. *Low income* is defined as a 2005 GDP per capita of less than US$5,000 PPP and *middle income* as US$5,000–13,000. This sample does not contain upper-income countries because staple food prices are not available for them.

Figure A.1—A scatter plot of changes in the two GWP indicators



Source: Data are from the Gallup World Poll (Gallup 2011).

Note: The slope coefficient on the regression line (the solid line) is 0.60 with an R-square of 0.16. The dashed line is a 45-degree line.

APPENDIX B: RAW GALLUP DATA

Table B.1—Self-reported food insecurity and hunger data from the Gallup World Poll

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
AFG	Afghanistan	December 2008	49	Not available	low
AFG	Afghanistan	October 2009	38	22	low
AFG	Afghanistan	April 2010	38	33	low
ALB	Albania	January 2006	23	Not available	middle
ALB	Albania	September 2008	30	Not available	middle
DZA	Algeria	June 2008	22	Not available	middle
DZA	Algeria	September 2009	15	Not available	middle
DZA	Algeria	March 2010	13	Not available	middle
AGO	Angola	May 2006	63	Not available	low
AGO	Angola	September 2008	79	57	low
ARG	Argentina	May 2006	23	11	middle
ARG	Argentina	August 2007	26	11	middle
ARG	Argentina	August 2008	27	Not available	middle
ARG	Argentina	August 2009	24	Not available	middle
ARM	Armenia	July 2006	47	12	low
ARM	Armenia	July 2007	26	4	low
ARM	Armenia	August 2008	33	8	low
ARM	Armenia	July 2009	47	Not available	low
AUS	Australia	December 2005	8	Not available	upper
AUS	Australia	April 2007	9	3	upper
AUS	Australia	June 2008	11	4	upper
AUS	Australia	March 2010	10	3	upper
AUT	Austria	April 2006	3	Not available	upper
AUT	Austria	April 2008	6	Not available	upper
AZE	Azerbaijan	September 2006	37	11	low
AZE	Azerbaijan	December 2007	57	16	low
AZE	Azerbaijan	November 2008	60	15	low
AZE	Azerbaijan	August 2009	60	Not available	low
BHR	Bahrain	September 2009	22	Not available	upper
BHR	Bahrain	April 2010	21	Not available	upper
BGD	Bangladesh	May 2006	25	Not available	low
BGD	Bangladesh	May 2007	24	18	low
BGD	Bangladesh	June 2008	27	22	low
BGD	Bangladesh	May 2009	23	17	low
BGD	Bangladesh	April 2010	29	20	low
BLR	Belarus	June 2006	22	4	middle
BLR	Belarus	July 2007	22	4	middle
BLR	Belarus	December 2008	24	4	middle
BLR	Belarus	July 2009	28	Not available	middle
BEL	Belgium	July 2005	7	1	upper
BEL	Belgium	May 2007	6	1	upper
BEL	Belgium	June 2008	7	1	upper
BLZ	Belize	October 2007	Not available	22	middle
BEN	Benin	July 2006	66	63	low

Table B.1—Continued

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
BEN	Benin	August 2008	64	63	low
BOL	Bolivia	June 2006	41	28	low
BOL	Bolivia	July 2007	39	24	low
BOL	Bolivia	September 2008	42	Not available	low
BOL	Bolivia	August 2009	36	Not available	low
BIH	Bosnia-Herzegovina	January 2006	Not available	6	middle
BIH	Bosnia-Herzegovina	September 2008	15	6	middle
BIH	Bosnia-Herzegovina	September 2009	Not available	6	middle
BWA	Botswana	May 2006	35	28	middle
BWA	Botswana	July 2008	59	28	middle
BRA	Brazil	November 2005	20	4	middle
BRA	Brazil	August 2007	21	4	middle
BRA	Brazil	October 2008	21	4	middle
BRA	Brazil	September 2009	20	4	middle
BGR	Bulgaria	January 2007	35	10	middle
BGR	Bulgaria	March 2010	Not available	10	middle
BFA	Burkina Faso	June 2006	52	52	low
BFA	Burkina Faso	July 2007	42	40	low
BFA	Burkina Faso	April 2008	56	Not available	low
BFA	Burkina Faso	May 2010	66	Not available	low
BDI	Burundi	July 2008	74	Not available	low
BDI	Burundi	August 2009	67	Not available	low
KHM	Cambodia	August 2006	67	20	low
KHM	Cambodia	August 2007	58	34	low
KHM	Cambodia	July 2008	53	35	low
KHM	Cambodia	June 2009	55	12	low
KHM	Cambodia	May 2010	49	15	low
CMR	Cameroon	June 2006	66	65	low
CMR	Cameroon	June 2007	57	59	low
CMR	Cameroon	May 2008	66	Not available	low
CMR	Cameroon	April 2009	73	Not available	low
CMR	Cameroon	March 2010	75	Not available	low
CAN	Canada	December 2005	7	2	upper
CAN	Canada	September 2007	9	2	upper
CAN	Canada	September 2008	7	2	upper
CAN	Canada	August 2009	8	2	upper
CAF	Central African Rep.	November 2007	75	79	low
TCD	Chad	November 2006	72	76	low
TCD	Chad	November 2007	54	59	low
TCD	Chad	November 2008	54	Not available	low
TCD	Chad	December 2009	56	Not available	low
CHL	Chile	May 2006	27	17	middle
CHL	Chile	August 2007	28	14	middle
CHL	Chile	September 2008	33	Not available	middle
CHL	Chile	September 2009	26	Not available	middle
CHN	China	October 2006	36	3	low

Table B.1—Continued

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
CHN	China	November 2008	16	4	low
CHN	China	September 2009	17	4	low
COL	Colombia	June 2006	32	16	middle
COL	Colombia	July 2007	36	13	middle
COL	Colombia	August 2008	33	Not available	middle
COL	Colombia	August 2009	37	Not available	middle
COM	Comoros	March 2009	70	Not available	low
COM	Comoros	March 2010	65	Not available	low
COG	Congo, D. Rep.	September 2008	69	Not available	low
CRI	Costa Rica	July 2006	26	7	middle
CRI	Costa Rica	September 2007	27	10	middle
CRI	Costa Rica	September 2008	24	Not available	middle
CRI	Costa Rica	August 2009	23	Not available	middle
CIV	Côte d'Ivoire	April 2009	53	Not available	low
HRV	Croatia	January 2007	10	3	upper
HRV	Croatia	September 2009	17	3	upper
CYP	Cyprus	September 2006	7	4	upper
CYP	Cyprus	May 2009	10	4	upper
CZE	Czech Republic	July 2005	17	2	upper
CZE	Czech Republic	June 2007	13	2	upper
CZE	Czech Republic	January 2009	8	2	upper
DNK	Denmark	July 2005	9	2	upper
DNK	Denmark	May 2007	6	2	upper
DNK	Denmark	April 2008	1	2	upper
DNK	Denmark	December 2009	3	2	upper
DJI	Djibouti	September 2008	44	Not available	low
DJI	Djibouti	August 2009	24	Not available	low
DOM	Dominican Republic	July 2006	48	36	middle
DOM	Dominican Republic	September 2007	59	37	middle
DOM	Dominican Republic	November 2008	59	Not available	middle
DOM	Dominican Republic	September 2009	55	Not available	middle
ECU	Ecuador	June 2006	36	26	middle
ECU	Ecuador	July 2007	36	25	middle
ECU	Ecuador	September 2008	46	Not available	middle
ECU	Ecuador	September 2009	58	Not available	middle
EGY	Egypt, Arab Rep.	September 2005	Not available	23	low
EGY	Egypt, Arab Rep.	July 2007	Not available	23	low
EGY	Egypt, Arab Rep.	May 2008	31	23	low
EGY	Egypt, Arab Rep.	August 2009	23	23	low
EGY	Egypt, Arab Rep.	March 2010	28	23	low
SLV	El Salvador	June 2006	40	25	middle
SLV	El Salvador	September 2007	47	22	middle
SLV	El Salvador	September 2008	48	Not available	middle
SLV	El Salvador	July 2009	44	Not available	middle
EST	Estonia	July 2006	20	6	upper
EST	Estonia	August 2007	12	3	upper

Table B.1—Continued

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
EST	Estonia	July 2008	13	6	upper
EST	Estonia	July 2009	22	Not available	upper
ETH	Ethiopia	May 2006	24	22	low
ETH	Ethiopia	July 2007	38	27	low
FIN	Finland	April 2006	5	1	upper
FIN	Finland	April 2008	7	1	upper
FRA	France	July 2005	12	2	upper
FRA	France	December 2006	10	2	upper
FRA	France	June 2008	7	2	upper
FRA	France	May 2009	9	2	upper
GEO	Georgia	February 2006	52	18	low
GEO	Georgia	May 2007	55	18	low
GEO	Georgia	June 2008	51	17	low
GEO	Georgia	May 2009	56	Not available	low
DEU	Germany	July 2005	7	2	upper
DEU	Germany	January 2007	7	2	upper
DEU	Germany	October 2008	6	2	upper
DEU	Germany	October 2009	6	2	upper
GHA	Ghana	March 2006	44	39	low
GHA	Ghana	February 2007	41	33	low
GHA	Ghana	April 2008	41	Not available	low
GHA	Ghana	July 2009	49	Not available	low
GRC	Greece	July 2005	Not available	4	upper
GRC	Greece	May 2007	9	4	upper
GRC	Greece	October 2009	9	4	upper
GTM	Guatemala	June 2006	26	21	low
GTM	Guatemala	September 2007	21	11	low
GTM	Guatemala	September 2008	25	Not available	low
GTM	Guatemala	July 2009	27	Not available	low
GUY	Guyana	October 2007	Not available	19	low
HTI	Haiti	October 2006	63	73	low
HTI	Haiti	December 2008	60	73	low
HND	Honduras	June 2006	42	29	low
HND	Honduras	September 2007	41	30	low
HND	Honduras	September 2008	48	Not available	low
HND	Honduras	July 2009	51	Not available	low
HUN	Hungary	July 2005	20	4	upper
HUN	Hungary	May 2007	15	4	upper
HUN	Hungary	January 2009	Not available	4	upper
IND	India	February 2006	35	Not available	low
IND	India	May 2007	26	26	low
IND	India	July 2008	22	15	low
IND	India	November 2009	28	18	low
IND	India	June 2010	27	19	low
IDN	Indonesia	July 2006	28	Not available	low
IDN	Indonesia	April 2007	25	15	low

Table B.1—Continued

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
IDN	Indonesia	March 2008	22	7	low
IDN	Indonesia	May 2009	23	7	low
IDN	Indonesia	April 2010	25	11	low
IRQ	Iraq	June 2008	25	Not available	middle
IRQ	Iraq	August 2009	12	Not available	middle
IRQ	Iraq	February 2010	18	Not available	middle
IRL	Ireland	May 2006	4	1	upper
IRL	Ireland	April 2008	5	1	upper
IRL	Ireland	April 2009	7	1	upper
ISR	Israel	July 2006	14	5	upper
ISR	Israel	August 2007	12	5	upper
ISR	Israel	October 2008	14	5	upper
ISR	Israel	November 2009	15	5	upper
ITA	Italy	July 2005	11	3	upper
ITA	Italy	May 2007	8	3	upper
ITA	Italy	June 2008	16	3	upper
ITA	Italy	May 2009	15	3	upper
JAM	Jamaica	November 2006	Not available	23	middle
JPN	Japan	November 2005	8	Not available	upper
JPN	Japan	August 2007	6	2	upper
JPN	Japan	March 2008	6	2	upper
JPN	Japan	August 2009	7	Not available	upper
JPN	Japan	June 2010	9	1	upper
JOR	Jordan	September 2005	17	7	low
JOR	Jordan	October 2007	9	7	low
JOR	Jordan	August 2008	12	7	low
JOR	Jordan	October 2009	9	7	low
JOR	Jordan	April 2010	10	7	low
KAZ	Kazakhstan	September 2006	25	8	middle
KAZ	Kazakhstan	December 2007	28	7	middle
KAZ	Kazakhstan	November 2008	26	4	middle
KAZ	Kazakhstan	August 2009	26	Not available	middle
KEN	Kenya	April 2006	71	56	low
KEN	Kenya	June 2007	56	52	low
KEN	Kenya	August 2008	67	Not available	low
KEN	Kenya	April 2009	64	Not available	low
KEN	Kenya	February 2010	57	Not available	low
KOR	Korea, Rep.	March 2006	15	6	upper
KOR	Korea, Rep.	May 2007	12	1	upper
KOR	Korea, Rep.	September 2008	17	Not available	upper
KOR	Korea, Rep.	September 2009	16	Not available	upper
KWT	Kuwait	August 2006	6	7	upper
KWT	Kuwait	August 2009	3	7	upper
KWT	Kuwait	April 2010	9	7	upper
KGZ	Kyrgyz Republic	March 2006	40	12	low
KGZ	Kyrgyz Republic	May 2007	33	10	low

Table B.1—Continued

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
KGZ	Kyrgyz Republic	July 2008	34	8	low
KGZ	Kyrgyz Republic	July 2009	32	Not available	low
LAO	Lao PDR	July 2006	14	11	low
LAO	Lao PDR	July 2007	21	15	low
LAO	Lao PDR	August 2008	25	13	low
LVA	Latvia	July 2006	16	6	upper
LVA	Latvia	July 2007	18	4	upper
LVA	Latvia	August 2008	14	4	upper
LVA	Latvia	August 2009	23	Not available	upper
LBN	Lebanon	September 2005	16	8	middle
LBN	Lebanon	October 2006	16	8	middle
LBN	Lebanon	May 2008	19	8	middle
LBN	Lebanon	March 2009	20	8	middle
LBN	Lebanon	March 2010	18	8	middle
LBR	Liberia	February 2007	81	80	low
LBR	Liberia	May 2008	78	80	low
LBY	Libya	October 2009	14	Not available	middle
LTU	Lithuania	July 2006	13	2	upper
LTU	Lithuania	August 2007	10	4	upper
LTU	Lithuania	June 2008	10	3	upper
LTU	Lithuania	August 2009	16	Not available	upper
MKD	Macedonia, FYR	September 2008	Not available	7	middle
MKD	Macedonia, FYR	September 2009	Not available	7	middle
MDG	Madagascar	July 2006	58	46	low
MDG	Madagascar	August 2008	66	46	low
MWI	Malawi	October 2006	76	76	low
MWI	Malawi	June 2007	51	45	low
MWI	Malawi	September 2009	60	Not available	low
MYS	Malaysia	June 2007	9	3	middle
MYS	Malaysia	September 2008	11	6	middle
MYS	Malaysia	July 2009	20	6	middle
MYS	Malaysia	June 2010	17	3	middle
MLI	Mali	June 2006	60	55	low
MLI	Mali	June 2008	29	55	low
MLI	Mali	October 2009	40	55	low
MRT	Mauritania	September 2006	39	34	low
MRT	Mauritania	August 2007	39	26	low
MRT	Mauritania	July 2008	39	Not available	low
MRT	Mauritania	March 2009	40	Not available	low
MRT	Mauritania	March 2010	43	Not available	low
MEX	Mexico	November 2005	36	19	middle
MEX	Mexico	July 2007	28	19	middle
MEX	Mexico	August 2008	33	19	middle
MEX	Mexico	August 2009	33	19	middle
MDA	Moldova	April 2006	31	10	low
MDA	Moldova	June 2007	35	6	low

Table B.1—Continued

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
MDA	Moldova	October 2008	30	5	low
MDA	Moldova	July 2009	34	Not available	low
MNG	Mongolia	September 2007	34	12	low
MNG	Mongolia	October 2008	36	13	low
MON	Montenegro	January 2007	21	7	middle
MON	Montenegro	September 2009	22	7	middle
MAR	Morocco	August 2005	36	24	low
MAR	Morocco	December 2007	29	24	low
MAR	Morocco	August 2009	Not available	24	low
MAR	Morocco	March 2010	Not available	24	low
MOZ	Mozambique	May 2006	62	60	low
MOZ	Mozambique	July 2007	46	43	low
MOZ	Mozambique	June 2008	58	Not available	low
NAM	Namibia	September 2007	Not available	35	low
NPL	Nepal	June 2006	9	8	low
NPL	Nepal	July 2007	13	13	low
NPL	Nepal	October 2008	10	6	low
NPL	Nepal	July 2009	17	9	low
NPL	Nepal	May 2010	18	10	low
NLD	Netherlands	July 2005	7	1	upper
NLD	Netherlands	May 2007	4	1	upper
NLD	Netherlands	June 2008	4	1	upper
NZL	New Zealand	March 2006	11	4	upper
NZL	New Zealand	February 2007	9	3	upper
NZL	New Zealand	June 2008	13	3	upper
NZL	New Zealand	March 2010	13	6	upper
NIC	Nicaragua	June 2006	Not available	38	low
NIC	Nicaragua	September 2007	51	35	low
NIC	Nicaragua	September 2008	53	Not available	low
NIC	Nicaragua	July 2009	49	Not available	low
NER	Niger	June 2006	75	74	low
NER	Niger	June 2008	68	Not available	low
NER	Niger	June 2009	71	Not available	low
NGA	Nigeria	May 2006	58	54	low
NGA	Nigeria	May 2007	55	58	low
NGA	Nigeria	April 2008	55	Not available	low
NGA	Nigeria	August 2009	59	Not available	low
NGA	Nigeria	April 2010	56	Not available	low
NOR	Norway	May 2006	6	3	upper
NOR	Norway	June 2008	5	3	upper
PAK	Pakistan	September 2005	33	Not available	low
PAK	Pakistan	June 2007	26	20	low
PAK	Pakistan	June 2008	27	23	low
PAK	Pakistan	May 2009	34	22	low
PAK	Pakistan	May 2010	38	22	low
PAN	Panama	July 2006	30	14	middle

Table B.1—Continued

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
PAN	Panama	September 2007	36	13	middle
PAN	Panama	August 2009	33	Not available	middle
PRY	Paraguay	May 2006	40	20	low
PRY	Paraguay	July 2007	36	12	low
PRY	Paraguay	August 2009	31	Not available	low
PER	Peru	June 2006	50	34	middle
PER	Peru	July 2007	45	30	middle
PER	Peru	August 2009	46	Not available	middle
PHL	Philippines	March 2006	56	28	low
PHL	Philippines	August 2007	64	33	low
PHL	Philippines	June 2009	68	35	low
PHL	Philippines	April 2010	62	33	low
POL	Poland	July 2005	29	6	upper
POL	Poland	May 2007	18	6	upper
PRT	Portugal	September 2006	10	2	upper
PRT	Portugal	January 2010	Not available	2	upper
PRI	Puerto Rico	June 2006	Not available	6	upper
QAT	Qatar	March 2009	8	Not available	upper
ROM	Romania	July 2005	48	8	middle
ROM	Romania	May 2007	33	8	middle
ROM	Romania	April 2009	40	8	middle
RWA	Rwanda	October 2006	61	61	low
RWA	Rwanda	August 2009	43	61	low
SAU	Saudi Arabia	September 2005	13	9	upper
SAU	Saudi Arabia	March 2009	18	9	upper
SEN	Senegal	May 2006	26	22	low
SEN	Senegal	February 2007	22	21	low
SEN	Senegal	June 2009	43	Not available	low
SEN	Senegal	April 2010	49	Not available	low
SER	Serbia	January 2007	17	5	middle
SER	Serbia	September 2009	25	5	middle
SLE	Sierra Leone	July 2006	58	67	low
SLE	Sierra Leone	June 2007	63	67	low
SGP	Singapore	March 2006	4	7	upper
SGP	Singapore	May 2007	4	3	upper
SGP	Singapore	February 2008	3	1	upper
SGP	Singapore	June 2009	2	Not available	upper
SGP	Singapore	June 2010	2	1	upper
SVN	Slovenia	May 2009	11	1	upper
ZAF	South Africa	March 2006	45	39	middle
ZAF	South Africa	September 2007	48	46	middle
ZAF	South Africa	September 2008	56	Not available	middle
ZAF	South Africa	April 2009	55	Not available	middle
ESP	Spain	July 2005	11	1	upper
ESP	Spain	April 2007	9	1	upper
ESP	Spain	April 2008	8	1	upper

Table B.1—Continued

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
ESP	Spain	April 2009	14	1	upper
LKA	Sri Lanka	March 2006	32	17	low
LKA	Sri Lanka	May 2007	39	12	low
LKA	Sri Lanka	May 2008	48	11	low
LKA	Sri Lanka	June 2009	41	11	low
LKA	Sri Lanka	May 2010	39	15	low
SDN	Sudan	January 2008	27	24	low
SDN	Sudan	March 2009	38	24	low
SDN	Sudan	March 2010	50	24	low
SWE	Sweden	July 2005	7	1	upper
SWE	Sweden	April 2007	7	1	upper
SWE	Sweden	April 2008	7	1	upper
SWE	Sweden	December 2009	5	1	upper
CHE	Switzerland	May 2006	6	1	upper
CHE	Switzerland	December 2009	4	1	upper
SYR	Syrian Arab Republic	August 2008	16	Not available	low
SYR	Syrian Arab Republic	March 2009	16	Not available	low
TJK	Tajikistan	June 2006	46	16	low
TJK	Tajikistan	November 2007	41	9	low
TJK	Tajikistan	November 2008	31	5	low
TJK	Tajikistan	August 2009	36	Not available	low
TZA	Tanzania	March 2006	53	41	low
TZA	Tanzania	June 2007	39	35	low
TZA	Tanzania	July 2008	62	Not available	low
TZA	Tanzania	November 2009	60	Not available	low
THA	Thailand	July 2006	10	9	middle
THA	Thailand	August 2007	18	14	middle
THA	Thailand	September 2008	18	9	middle
THA	Thailand	November 2009	17	Not available	middle
TGO	Togo	August 2006	62	54	low
TGO	Togo	August 2008	67	54	low
TTO	Trinidad and Tobago	November 2006	26	11	upper
TTO	Trinidad and Tobago	October 2008	33	11	upper
TUN	Tunisia	June 2008	22	Not available	middle
TUN	Tunisia	August 2009	11	Not available	middle
TUN	Tunisia	April 2010	9	Not available	middle
TUR	Turkey	August 2005	Not available	11	middle
TUR	Turkey	May 2007	26	11	middle
TUR	Turkey	July 2008	47	11	middle
TUR	Turkey	November 2009	37	11	middle
UGA	Uganda	March 2006	62	56	low
UGA	Uganda	June 2007	48	42	low
UGA	Uganda	July 2008	62	Not available	low
UGA	Uganda	June 2009	52	Not available	low
UGA	Uganda	March 2010	59	Not available	low
UKR	Ukraine	June 2006	29	7	middle

Table B.1—Continued

World Bank code	Country name	Date of survey completion	Self-reported food insecurity	Self-reported hunger	Income level
UKR	Ukraine	July 2007	34	5	middle
UKR	Ukraine	May 2008	27	5	middle
UKR	Ukraine	May 2009	32	Not available	middle
ARE	United Arab Emirates	August 2006	6	4	upper
ARE	United Arab Emirates	September 2009	6	4	upper
ARE	United Arab Emirates	April 2010	4	4	upper
GBR	United Kingdom	June 2005	8	3	upper
GBR	United Kingdom	January 2007	11	3	upper
GBR	United Kingdom	June 2008	12	3	upper
GBR	United Kingdom	May 2009	9	3	upper
USA	United States	July 2006	17	3	upper
USA	United States	August 2007	10	3	upper
USA	United States	August 2008	9	3	upper
USA	United States	July 2009	16	3	upper
URY	Uruguay	June 2006	25	10	middle
URY	Uruguay	July 2007	24	10	middle
URY	Uruguay	September 2008	28	Not available	middle
URY	Uruguay	August 2009	20	Not available	middle
UZB	Uzbekistan	June 2006	37	11	low
UZB	Uzbekistan	July 2008	39	8	low
UZB	Uzbekistan	June 2009	38	Not available	low
VEN	Venezuela	November 2005	41	13	middle
VEN	Venezuela	December 2006	25	13	middle
VEN	Venezuela	September 2008	26	13	middle
VEN	Venezuela	August 2009	32	13	middle
VNM	Vietnam	March 2006	27	17	low
VNM	Vietnam	April 2008	17	6	low
VNM	Vietnam	May 2009	25	6	low
VNM	Vietnam	May 2010	25	7	low
YEM	Yemen, Rep.	September 2009	47	Not available	low
YEM	Yemen, Rep.	February 2010	48	Not available	low
ZMB	Zambia	April 2006	58	53	low
ZMB	Zambia	July 2007	65	67	low
ZMB	Zambia	June 2008	67	Not available	low
ZMB	Zambia	November 2009	69	Not available	low
ZWE	Zimbabwe	April 2006	72	65	low
ZWE	Zimbabwe	July 2007	71	50	low
ZWE	Zimbabwe	March 2008	79	Not available	low
ZWE	Zimbabwe	July 2009	73	Not available	low
ZWE	Zimbabwe	March 2010	53	Not available	low

Source: Gallup World Poll (Gallup 2011).

APPENDIX C: GALLUP DETAILS

Table C.1—Gallup World Poll survey details including design effects and margins of error

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	Mode of Interviewing	Languages	Exclusions or oversampling?
Afghanistan	Jun 4–Jun 16, 2009	1,000	1.66	4	Face-to-face	Dari, Pashto	
Afghanistan	Sep 20–Oct 12, 2009	1,000	1.68	4	Face-to-face	Dari, Pashto	
Albania	Sep 7–Oct 2, 2009	1,000	1.45	3.7	Face-to-face	Albanian	
Algeria	Feb 21–Mar 22, 2009	1,000	1.27	3.5	Face-to-face	Arabic	Deep south excluded (25% of the population).
Algeria	Aug 1–Sep 12, 2009	1,000	1.24	3.5	Face-to-face	Arabic	Deep south excluded (25% of the population).
Argentina	Jul 4–Aug 12, 2009	1,000	1.36	3.6	Face-to-face	Spanish	
Armenia	Jun 10–Jul 7, 2009	1,000	1.3	3.5	Face-to-face	Armenian, Russian	
Austria	Dec 4–Jan 28, 2010	1,000	1.47	3.8	Telephone	German	
Azerbaijan	Jul 29–Aug 16, 2009	1,000	1.32	3.6	Face-to-face	Azeri,	Nagorno-Karabakh and territories excluded (10% of the population).
Bahrain	Feb 23–Mar 19, 2009	1,051	1.28	3.4	Face-to-face	Arabic	Non-Arabs excluded (25% of the population).
Bahrain	Aug 17–Sep 15, 2009	1,077	1.27	3.3	Face-to-face	Arabic	Non-Arabs excluded (25% of the population).
Bangladesh	Apr 29–May 14, 2009	1,000	1.22	3.4	Face-to-face	Bengali	
Belarus	Jun 3–Jul 10, 2009	1,077	1.29	3.4	Face-to-face	Russian	
Bolivia	Jul 29–Aug 31, 2009	1,000	1.47	3.8	Face-to-face	Spanish	
Bosnia and Herzegovina	Sep 8–Sep 30, 2009	1,023	1.81	4.2	Face-to-face	Bosnian, Croatian, Serbian	
Brazil	Aug 11–Sep 1, 2009	1,031	1.19	3.3	Face-to-face	Portuguese	

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effecta	Margin of Errorb	Mode of Interviewing	Languages	Exclusions or oversampling?
Bulgaria	Jan 25–Mar 2, 2010	1,000	1.24	3.4	Face-to-face	Bulgarian	
Burundi	Jul 24–Aug 1, 2009	1,000	1.31	3.5	Face-to-face	French, Kirundi	
Cambodia	Jun 4–Jun 27, 2009	1,000	1.44	3.7	Face-to-face	Khmer	
Cameroon	Mar 24–Apr 7, 2009	1,000	1.71	4.04	Face-to-face	French, English,	
Canada	Aug 7–Aug 25, 2009	1,011	1.64	4	Face-to-face	English, French	Yukon, Northwest Territories, and Nunavut excluded.
Chad	Nov 20–2–Dec–09	1,000	1.92	4.3	Face-to-face	Chadian Arabic, French, Ngambaya	Eastern part of country excluded (20% of the population). Oversampled educated population.
Chile	Jul 3–Sep 8, 2009	1,009	1.36	3.6	Face-to-face	Spanish	
China	Aug 14–Sep 28, 2009	4,201	1.95	2.1	Face-to-face and telephone	Chinese	Beijing, Shanghai, Guangzhou oversampled.
Colombia	Jul 14–Aug 1, 2009	1,000	1.35	3.6	Face-to-face	Spanish	
Comoros	Feb 23–Mar 5, 2009	1,000	1.44	3.7	Face-to-face	French, Comorian	
Comoros	Jul 15–Oct 10, 2009	1,000	1.5	3.8	Face-to-face	French, Comorian	
Congo (DRC)	Nov 1–Nov 24, 2009	1,000	1.62	3.9	Face-to-face	French, Lingala, Kiswahili	North and South Kivu, Ituri, and Haut-Uele excluded (20% of the population).
Costa Rica	Jul 6–Aug 8, 2009	1,000	1.26	3.5	Face-to-face	Spanish	
Croatia	Sep 4–Sep 28, 2009	1,009	1.07	3.2	Face-to-face	Croatian	
Cyprus	Apr 23–May 19, 2009	502	1.46	5.3	Telephone	Greek	
Czech Republic	Dec 18–Jan 24, 2009	1,077	1.19	3.3	Face-to-face	Czech	

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	Mode of Interviewing	Languages	Exclusions or oversampling?
Denmark	Dec 7–Dec 22, 2009	1,000	1.48	3.8	Telephone	Danish	
Djibouti	Mar 2–Mar 12, 2009	1,000	1.89	3.4	Face-to-face	French, Afar, Somali	
Djibouti	Jul 25–Aug 2, 2009	1,000	1.25	3.5	Face-to-face	French, Afar, Somali	
Dominican Rep.	Jul 21–Sep 2, 2009	1,000	1.37	3.6	Face-to-face	Spanish	
Ecuador	Jul 12–Sep 1, 2009	1,000	1.31	3.6	Face-to-face	Spanish	
Egypt	Mar 7–Mar 22, 2009	1,080	1.29	3.4	Face-to-face	Arabic	
Egypt	Aug 11–Aug 19, 2009	1,032	1.28	3.5	Face-to-face	Arabic	
El Salvador	Jul 4–Jul 17, 2009	1,006	1.14	3.3	Face-to-face	Spanish	
Estonia	Jun 13–Jul 7, 2009	607	1.19	4.3	Face-to-face	Estonian, Russian	
France	Apr 16–May 18, 2009	1,000	1.57	3.9	Telephone	French	
Georgia	May 2–May 13, 2009	1,000	1.26	3.5	Face-to-face	Georgian, Russian, Armenian	South Ossetia and Abkhazia excluded (7% of the population).
Germany	Sep 28–Oct 18, 2009	1,000	1.27	3.5	Telephone	German	
Ghana	Jul 9–Jul 31, 2009	1,000	1.52	3.8	Face-to-face	English, Hausa, Ewe, Twi, Dagbani	
Greece	Oct 1–Oct 15, 2009	1,000	1.44	3.7	Face-to-face	Greek	
Guatemala	Jul 8–Jul 21, 2009	1,015	1.18	3.3	Face-to-face	Spanish	
Honduras	Jul 11– Jul 25, 2009	1,002	1.17	3.3	Face-to-face	Spanish	
Hong Kong	Nov 23–Dec 16, 2009	755	1.48	4.3	Telephone	Chinese	
India	May 1 – Jun 17, 2010	6,000	1.72	1.66	Face-to-face	11 national languages	Northeast states and remote islands excluded (<10% of the population).

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effecta	Margin of Errorb	Mode of Interviewing	Languages	Exclusions or oversampling?
India	Oct 1–Nov 30, 2009	3,010	2.07	2.6	Face-to-face	11 national languages	Northeast states and remote islands excluded (<10% of the population).
Indonesia	Apr 18–May 5, 2009	1,080	1.41	3.5	Face-to-face	Bahasa Indonesia	
Indonesia	Apr 4–Apr 24, 2010	1,080	1.36	3.5	Face-to-face	Bahasa Indonesia	
Iraq	Feb 20–Mar 12, 2009	1,000	1.43	3.7	Face-to-face	Arabic	
Iraq	Aug 10–Aug 20, 2009	1,000	1.41	3.6	Face-to-face	Arabic, Kurdish	
Iraq	Feb 17–Feb 27, 2010	1,000	1.33	3.6	Face-to-face	Arabic, Kurdish	
Ireland	Apr 17–Apr 27, 2009	500	1.55	5.5	Telephone	English	
Israel	Oct 11–Nov 5, 2009	1,000	1.27	3.5	Face-to-face	Arabic, Hebrew	
Italy	Apr 21–May 6, 2009	1,005	1.71	4	Telephone	Italian	
Ivory Coast	Apr 4–Apr 15, 2009	1,000	1.26	3.5	Face-to-face	Dioula, French	
Japan	Jul 31–Aug 31, 2009	1,000	1.7	4	Telephone	Japanese	
Japan	June 5 – Jun 24, 2010	1,000	1.37	3.6	Telephone	Japanese	
Jordan	Mar 18–Apr 2, 2009	1,015	1.19	3.4	Face-to-face	Arabic	
Jordan	Sep 23–Oct 10, 2009	1,001	1.23	3.4	Face-to-face	Arabic	
Jordan	Mar 20–Apr 9, 2010	1,000	1.29	3.5	Face-to-face	Arabic	
Kazakhstan	Jul 2–Aug 6, 2009	1,000	1.3	3.5	Face-to-face	Kazakh, Russian	
Kenya	Feb 5–Feb 17, 2010	1,000	1.51	3.8	Face-to-face	English, Kishwahili	

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	Mode of Interviewing	Languages	Exclusions or oversampling?
Kenya	Mar 30–Apr 10, 2009	1,000	1.42	3.7	Face-to-face	English, Kiswahili	
Kosovo	Sep 8–Sep 24, 2009	1,000	1.82	4.2	Face-to-face	Albanian, Serbian, Montenegrin	
Kuwait	Feb 23–Mar 18, 2009	1,000	1.23	3.4	Face-to-face	Arabic	Non-Arabs excluded (20% of the population).
Kuwait	Aug 10–Aug 30, 2009	1,000	1.15	3.3	Face-to-face	Arabic	Non-Arabs excluded (20% of the population).
Kuwait	Apr 8–Apr 17, 2010	1,000	1.25	3.5	Face-to-face	Arabic	Non-Arabs excluded (20% of the population).
Kyrgyzstan	Jun 13–Jul 10, 2009	1,000	1.55	3.9	Face-to-face	Kyrgyz, Russian, Uzbek	
Latvia	Aug 15–Aug 24, 2009	515	1.19	4.7	Face-to-face	Latvian, Russian	
Lebanon	Feb 18–Mar 20, 2009	1,002	1.23	3.4	Face-to-face	Arabic	
Lebanon	Aug 2–Aug 30, 2009	1,008	1.28	3.5	Face-to-face	Arabic	
Lebanon	Feb 3–Mar 25, 2010	1,008	1.61	3.9	Face-to-face	Arabic	
Libya	Aug 17–Oct 19, 2009	1,000	1.59	3.9	Face-to-face	Arabic, English	Sample includes only Tripoli, Benghazi, and Al Kufra (50% of population). Sample skews male and employed.
Libya	Feb 20–Mar 18, 2010	1,000	1.18	3.4	Face-to-face	Arabic	Sample includes only Tripoli, Benghazi, and Al Kufra (50% of population). Sample skews male and employed.
Lithuania	Jul 24–Aug 10, 2009	500	1.46	5.3	Face-to-face	Lithuanian	
Macedonia	Sep 10–Sep 22, 2009	1,008	1.34	3.6	Face-to-face	Albanian, Bosnian, Macedonian	

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effecta	Margin of Errorb	Mode of Interviewing	Languages	Exclusions or oversampling?
Malawi	Sep 5–Sep 17, 2009	1,000	1.47	3.8	Face-to-face	Chichewa, English, Tumbuka	
Malaysia	Jun 12–Jul 26, 2009	1,011	2.04	4.4	Face-to-face	Bahasa Malay, Chinese, English	
Malaysia	May 15 – Jun17, 2010	1000	1.34	3.6	Face-to-face	Bahasa Malay, Chinese, English	
Mali	Oct 15–Oct 30, 2009	1,000	1.31	3.6	Face-to-face	Bambara, French	
Mauritania	Feb 20–Mar 1, 2009	1,000	1.43	3.7	Face-to-face	Arabic, French, Poulaar, Wolof, Soninke	
Mauritania	Jul 25–Sep 26, 2009	984	1.75	4.1	Face-to-face	Arabic, French, Poulaar, Wolof, Soninke	
Mauritania	Feb 28–Mar 11, 2010	1,000	1.52	3.8	Face-to-face	Arabic, French, Poulaar, Wolof, Soninke	Tiris and Adrar excluded (5% of the population).
Mexico	Jul 21–Aug 5, 2009	1,000	1.35	3.6	Face-to-face	Spanish	
Moldova	Jun 12–Jul 4, 2009	1,000	1.34	3.3	Face-to-face	Romanian/ Moldovan, Russian	Transnistria (Prednestrovie) excluded (13% of the population).
Montenegro	Sep 6–Sep 21, 2009	1,003	2.1	4.5	Face-to-face	Albanian, Bosnian, Montenegrin, Serbian	
Morocco	Feb 26–Mar 18, 2009	1,000	1.21	3.4	Face-to-face	Arabic, French	
Morocco	Aug 7–Aug 24, 2009	1,031	1.41	3.6	Face-to-face	Arabic, French	
Morocco	Feb 18–Mar 23, 2010	1,002	1.26	3.5	Face-to-face	Arabic and French	
Nepal	Apr 4–May 4, 2010	1,000	1.65	4	Face-to-face	Nepali	

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effecta	Margin of Errorb	Mode of Interviewing	Languages	Exclusions or oversampling?
Nepal	Jun 19–Jul 25, 2009	1,002	1.37	3.6	Face-to-face	Nepali	
New Zealand	Feb 11–Mar 10, 2010	750	1.38	4.2	Telephone	English	
Nicaragua	Jul 4–Jul 23, 2009	1,012	1.16	3.3	Face-to-face	Spanish	
Niger	Jun 19–Jun 28, 2009	1,000	1.29	3.5	Face-to-face	French, Zarma, Haussa	Agadez region excluded (5% of the population).
Nigeria	Jul 15–Aug 6, 2009	1,000	1.35	3.6	Face-to-face	English, Yoruba, Hausa, Igbo	
Nigeria	Mar 19–Apr 4, 2010	1,000	1.32	3.5	Face-to-face	(Pidgin) English, Hausa, Igbo, Yoruba	
Pakistan	May 5 – May 25, 2010	1,030	1.51	3.7	Face-to-face	Urdu	FATA/FANA excluded (5% of the population).
Pakistan	May 1–May 17, 2009	842	1.41	4	Face-to-face	Urdu	FATA/FANA excluded (5% of the population). Urban oversampled.
Pakistan	May 1–Jun 30, 2009	1,133	1.57	3.7	Face-to-face	Urdu	FATA/FANA excluded (5% of the population).
Pakistan	Nov 14–Dec 7, 2009	1,147	1.56	3.6	Face-to-face	Urdu	FATA/FANA excluded (5% of the population).
Palestine	Feb 13–Feb 23, 2009	1,014	1.44	3.7	Face-to-face	Arabic	
Palestine	Aug 3–Aug 17, 2009	1,000	1.42	3.7	Face-to-face	Arabic	
Palestine	Feb 4–Feb 20, 2010	1,000	1.5	3.8	Face-to-face	Arabic	
Panama	Jul 9–Aug 3, 2009	1,018	1.19	3.4	Face-to-face	Spanish	
Paraguay	Jul 6–Aug 26, 2009	1,000	1.33	3.6	Face-to-face	Spanish	
Peru	Jul 25–Aug 17, 2009	1,000	1.59	3.9	Face-to-face	Spanish	
Philippines	Apr 9–Apr 15, 2010	1,000	1.41	3.7	Face-to-face	7 national languages	

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effecta	Margin of Errorb	Mode of Interviewing	Languages	Exclusions or oversampling?
Philippines	Jun 4–Jun 10, 2009	1,000	1.6	3.9	Face-to-face	7 national languages	
Poland	Dec 12, 2009–Jan 16, 2010	1,000	1.3	3.5	Face-to-face	Polish	
Portugal	Dec 5, 2009–Jan 5, 2010	1,000	1.39	3.7	Telephone	Portuguese	
Qatar	Mar 11–Mar 25, 2009	1,016	1.44	3.69	Face-to-face	Arabic	Non-Arabs excluded (50% of the population)
Romania	Mar 3–Apr 5, 2009	1,000	1.46	3.75	Face-to-face	Romanian	
Russia	Apr 2–Jun 14, 2009	2,042	1.65	2.8	Face-to-face	Russian	Urban oversampled.
Russia	April 29 – Jun 16, 2010	2,000	1.62	2.8	Face-to-face	Russian	
Rwanda	Aug 10–Aug 18, 2009	1,000	1.55	3.9	Face-to-face	French, Kinyarwandan	
Saudi Arabia	Feb 17–Mar 20, 2009	1,031	1.23	3.39	Face-to-face	Arabic	Non-Arabs excluded (20% of the population).
Saudi Arabia	Aug 1–Aug 21, 2009	1,021	1.41	3.6	Face-to-face	Arabic	Non-Arabs excluded (20% of the population).
Senegal	Apr 5–Apr 15, 2010	1,000	1.66	4	Face-to-face	French, Wolof	
Senegal	May 23–Jun 1, 2009	1,000	2.42	4.8	Face-to-face	French, Wolof	
Serbia	Sep 4–Sep 17, 2009	1,008	1.24	3.4	Face-to-face	Montenegrin, Serbian	
Singapore	May 15 – Jun 9, 2010	1,001	1.42	3.7	Face-to-face	Chinese, English	
Singapore	May 30–Jun 18, 2009	1,005	1.41	3.7	Face-to-face	Chinese, English, Bahasa Malay	
Slovenia	Apr 16–May 5, 2009	500	1.67	5.7	Telephone	Slovene	
Somaliland	Mar 6–Mar 17, 2009	1,000	1.21	3.4	Face-to-face	Arabic, Somali, Afar	

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effecta	Margin of Errorb	Mode of Interviewing	Languages	Exclusions or oversampling?
Somaliland	Aug 1–Aug 11, 2009	1,000	1.24	3.4	Face-to-face	Arabic, Somali, Afar	
Somaliland	Feb 27–Mar 11, 2010	1,000	1.24	3.4	Face-to-face	Somali	
South Africa	Mar 21–Apr 7, 2009	1,000	1.68	4	Face-to-face	Afrikaans, English, Sotho, Zulu, Xhosa	
South Korea	Sep 2–Sep 27, 2009	1,000	1.29	3.5	Landline	Korean	
Spain	Apr 14–Apr 24, 2009	1,005	1.64	4	Telephone	Spanish	
Sri Lanka	April 24 – May 21, 2010	1030	1.68	4	Face-to-face	Sinhalese, Tamil	
Sri Lanka	May 16–Jun 8, 2009	1,000	1.73	4.1	Face-to-face	Sinhalese, Tamil	Northern and Eastern parts of Sri Lanka excluded (10% of the population).
Sudan	Mar 2–Mar 12, 2009	1,000	1.89	4.2	Face-to-face	Arabic, English	Southern and southwestern parts, including Darfur excluded (25% of the population).
Sudan	Jul 29–Aug 9, 2009	1,000	1.74	4.1	Face-to-face	Arabic, English	Southern and southwestern parts, including Darfur excluded (25% of the population).
Sudan	Feb 19–Mar 4, 2010	1,000	1.74	4.1	Face-to-face	Arabic, English	Darfur excluded (15% of the population).
Sweden	Dec 3–Dec 20, 2009	1,002	1.41	3.7	Telephone	Swedish	
Switzerland	Dec 2–Dec 18, 2009	1,003	1.29	3.5	Telephone	French, German, Italian	
Syria	Feb 20–Mar 16, 2009	1,082	1.29	3.4	Face-to-face	Arabic	
Syria	Aug 10–Sep 30, 2009	1,018	1.29	3.4	Face-to-face	Arabic	
Syria	Mar 3–Apr 30, 2010	1,029	1.27	3.4	Face-to-face	Arabic	

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	Mode of Interviewing	Languages	Exclusions or oversampling?
Tajikistan	Jul 27–Aug 14, 2009	1,000	1.44	3.7	Face-to-face	Russian, Tajik	
Tanzania	Nov 2–Nov 14, 2009	1,000	1.83	4.2	Face-to-face	English, Kishwahili	
Thailand	Oct 1–Nov 1, 2009	1,019	1.5	3.8	Face-to-face	Thai	
Tunisia	Feb 20–Mar 25, 2009	1,008	1.11	3.3	Face-to-face	Arabic	
Tunisia	Aug 2–Aug 22, 2009	1,006	1.15	3.3	Face-to-face	Arabic	
Tunisia	Feb 3–Apr 27, 2010	1,059	1.35	3.5	Face-to-face	Arabic	
Turkey	Oct 24–Nov 17, 2009	999	1.47	3.8	Face-to-face	Turkish	
Turkmenistan	Jul 1–Aug 9, 2009	1,000	1.2	3.4	Face-to-face	Turkmen, Russian	
Uganda	Mar 19–Mar 30, 2010	1,000	1.45	3.7	Face-to-face	Ateso, English, Luganda, Runyankole	Northern region excluded (10% of the population). Educated population oversampled.
Uganda	May 23–Jun 3, 2009	1,000	1.58	3.9	Face-to-face	English, Luganda, Ateso, Runyankole	Northern region excluded (10% of the population). Educated population oversampled.
Ukraine	May 11–May 25, 2009	1,081	1.73	3.9	Telephone	Russian, Ukrainian	Urban oversampled.
UAE	Mar 1–Mar 31, 2009	1,013	1.35	3.5	Face-to-face	Arabic	Non-Arabs excluded (50% of the population).
UAE	Aug 8–Sep 18, 2009	1,041	1.34	3.5	Face-to-face	Arabic	Non-Arabs excluded (50% of the population).
UAE	Feb 21–Apr 20, 2010	1,037	1.35	3.5	Face-to-face	Arabic	Non-Arabs excluded (50% of the population).
UK	Apr 17–May 6, 2009	1,002	1.45	3.7	Telephone	English	

Table C.1—Continued

Country	Collection Dates	# of Interviews	Design Effecta	Margin of Errorb	Mode of Interviewing	Languages	Exclusions or oversampling?
United States	May 5–Jul 8, 2009	1,003	1.48	3.8	Telephone	English	
Uruguay	Aug 1–Aug 30, 2009	1,000	1.29	3.5	Face-to-face	Spanish	
Uzbekistan	May 20–Jun 8, 2009	1,000	1.34	3.6	Face-to-face	Russian, Uzbek	
Venezuela	Jul 22–Aug 12, 2009	1,000	1.69	4	Face-to-face	Spanish	
Vietnam	Apr 11–May 26, 2009	1,009	1.6	3.9	Face-to-face	Vietnamese	
Vietnam	Apr 6–May 11, 2010	1,000	1.35	3.6	Face-to-face	Vietnamese	
Yemen	Feb 24–Mar 19, 2009	1,000	1.51	3.8	Face-to-face	Arabic	Gender-matched sampling used during the final stage of selection.
Yemen	Aug 4–Sept 2, 2009	1,000	1.43	3.7	Face-to-face	Arabic	Gender-matched sampling used during the final stage of selection.
Yemen	Feb 12–Feb 27, 2010	1,000	1.57	3.9	Face-to-face	Arabic	
Zambia	Nov 8–Nov 19, 2009	1,000	1.75	4.1	Face-to-face	Bemba, English, Lozi, Nyanja, Tonga	Educated population oversampled.
Zimbabwe	Mar 12–Mar 25, 2010	1,000	1.19	3.38	Face-to-face	English, Ndebele, Shona	

Source: Gallup (2010a).
Notes: [a] The design effect calculation reflects the weights and does not incorporate the intraclass correlation coefficients. Design effect calculation: n*(sum of squared weights)/[(sum of weights)*(sum of weights)]. [b]. Margin of error is calculated around a proportion at the 95% confidence level. The maximum margin of error was calculated assuming a reported percentage of 50% and takes into account the design effect. Margin of error calculation: (0.25/N)^0.5*1.96*(DE)^0.5.

REFERENCES

Aksoy, M. A., and A. Isik-Dikmelik. 2008. *Are Low Food Prices Pro-Poor? Net Food Buyers and Sellers in Low-Income Countries*. Policy Research Working Paper 4642. Washington, DC: The World Bank.

Arndt, C., R. Benfica, N. Maximiano, A. M. D. Nucifora, and J. T. Thurlow. 2008. "Higher Fuel and Food Prices: Impacts and Responses for Mozambique." *Agricultural Economics* 39 (Supplement): 497–511.

Beegle, K., and J. De Weerdt. 2010. *Methods of Household Consumption Measurement through Surveys: Experimental Results from Tanzania*. Policy Research Working Paper 5501. Washington, DC: World Bank.

Benitez-Silva, H., M. Buchinsky, H. M. Chan, S. Cheidvasser, and J. Rust. 2004. "How Large Is the Bias in Self-Reported Disability?" *Journal of Applied Econometrics* 19:649–670.

Bertrand, M., and S. Mullainathan. 2001. "Do People Mean What They Say? Implications for Subjective Survey Data." *The American Economic Review* 91 (2): 67–72.

Christiaensen, L., L. Demery, and J. Kühl. Forthcoming. "The Role of Agriculture in Poverty Reduction: An Empirical Perspective." *Journal of Development Economics.*

Dawe, D. 2008. *Have Recent Increases in International Cereal Prices Been Transmitted to Domestic Economies? The Experience in Seven Large Asian Countries*. ESA Working Paper No. 08-03. Rome: Agricultural Development Economics Division, Food and Agriculture Organization of the United Nations (FAO).

de Hoyos, R., and D. Medvedev. 2009. *Poverty Effects of Higher Food Prices: A Global Perspective*. Policy Research Working Paper No. 4887. Washington, DC: World Bank.

Deaton, A. 1989. "Rice Prices and Income Distribution in Thailand: A Non-Parametric Analysis." *Economic Journal* 99 (Supplement): 1–37.

________. 2001. "Counting the World's Poor: Problems and Possible Solutions." *World Bank Research Observer* 16 (2): 125–147.

________. 2006. *Global Patterns of Income and Health: Facts, Interpretations, and Policies*. NBER Working Paper No. 12735. Cambridge, MA, US: National Bureau of Economic Research.

________. 2010. "Price Indexes, Inequality, and the Measurement of World Poverty." Paper presented at annual meeting of the American Economic Association, Atlanta, GA, January 3.

Deaton, A., and J. Dreze. 2008. "Food and Nutrition in India: Facts and Interpretations." *Economic and Political Weekly* 44 (7): 42–65.

Dessus, S., S. Herrera, and R. de Hoyos. 2008. *The Impact of Food Inflation on Urban Poverty and Its Monetary Cost: Some Back-of-the-Envelope Calculations*. Policy Research Working Paper 4666. Washington, DC: World Bank.

Ecker, O., and M. Qaim. 2010. *Analyzing Nutritional Impacts of Policies*. IFPRI Discussion Paper No. 1017. Washington, DC: International Food Policy Research Institute (IFPRI).

FAO (Food and Agriculture Organization). 2002. *Summary of Proceedings: Measurement and Assessment of Food Deprivation and Undernutrition, International Scientific Symposium, Rome, 26–28 June 2002.* Rome: FAO.

________. 2009. *The State of Food Insecurity in the World 2008*. Rome: FAO.

________. 2010. National Basic Food Prices—Data and Analysis Tool. Accessed October 30. www.fao.org/giews/pricetool/.

________. 2011a. FAO Food Price Index Database. Accessed January 26. www.fao.org/worldfoodsituation/FoodPricesIndex/en/.

________. 2011b. Food Security Statistics. Accessed January 23. www.fao.org/faostat/foodsecurity/index_en.htm.

Gallup. 2010a. *Worldwide Research Methodology*. Washington, DC: Gallup.

________. 2010b. *Worldwide Research—Country Data Set Details*. Washington, DC: Gallup.

________. 2011. Gallup World Poll. Accessed January 21. https://worldview.gallup.com.

Haddad, L., J. Hoddinott, and H. Alderman. 1996. *Intrahousehold Resource Allocation in Developing Countries: Models, Methods and Policy*. Baltimore: Johns Hopkins University Press.

Haggblade, S., P. Hazell, and T. Reardon. 2007. *Transforming the Rural Nonfarm Economy*. Baltimore: John Hopkins University Press.

Headey, D. 2010. *Rethinking the Global Food Crisis: The Role of Trade Shocks*. IFPRI Discussion Paper No. 00958. Washington, DC: International Food Policy Research Institute (IFPRI).

________. 2011a. "Rethinking the Global Food Crisis: The Role of Trade Shocks." *Food Policy* 36 (2): 136–146.

________. 2011b. "Turning Economic Growth into Nutrition-Sensitive Growth." Paper presented at IFPRI conference "Leveraging Agriculture for Improving Nutrition and Health," New Delhi, February 10–12.

Headey, D., and S. Fan. 2008. "Anatomy of a Crisis: The Causes and Consequences of Surging Food Prices." *Agricultural Economics* 39 (Supplement): 375–391.

________. 2010. *Reflections on the Global Food Crisis: How Did It Happen? How Has It Hurt? And How Can We Prevent the Next One?* IFPRI Research Monograph 165. Washington, DC: International Food Policy Research Institute.

Headey, D., A. Chiu, and S. Kadiyala. 2010. "Agriculture's Role in the Indian Enigma: Help or Hindrance to the Malnutrition Crisis?" Paper presented at conference of the Chronic Poverty Research Centre, Manchester, UK, September 8–10.

Headey, B., R. Muffels, and G. G. Wagner. 2010. "Long-Running German Panel Survey Shows that Personal and Economic Choices, Not Just Genes, Matter for Happiness." *Proceedings of the National Academy of Sciences* 107 (42): 17922–17926. www.pnas.org/content/early/2010/09/27/1008612107.abstract.

ILO (International Labour Organization). 2011. LABORSTA Internet. Accessed January 22. http://laborsta.ilo.org/.

IMF (International Monetary Fund). 2010. *World Economic Outlook—October 2010*. Washington, DC: IMF.

________. 2011. International Financial Statistics (IFS). Accessed January 26. www.imfstatistics.org/imf/.

Ivanic, M., and W. Martin. 2008a. "Implications of Higher Global Food Prices for Poverty in Low-Income Countries." *Agricultural Economics* 39 (Supplement): 405–416.

________. 2008b. *Implications of Higher Global Food Prices for Poverty in Low-Income Countries*. Policy Research Working Paper 4594. Washington, DC: The World Bank.

Kahneman, D., and A. Deaton. 2010. "High Income Improves Evaluation of Life but Not Emotional Well-Being." *Proceedings of the National Academy of Sciences* 107 (38): 16489–16493.

Krueger, A. B., and D. A. Schkade. 2008. "The Reliability of Subjective Well-Being Measures." *Journal of Public Economics* 92 (8–9): 1833–1845.

Lasco, Christine D., Myers, Robert J., Richard H. Bernsten. 2008. Dynamics of rice prices and agricultural wages in the Philippines. *Agricultural Economics* 38: 339–348.

Loayza, N. V., and C. Raddatz. 2010. "The Composition of Growth Matters for Poverty Alleviation." *Journal of Development Economics* 93:137–151.

Measure DHS. 2010. Demographic Health Surveys. Accessed November 22. www.statcompiler.com/.

Minot, N. 2010. "Transmission of World Food Price Changes to Markets in Sub-Saharan Africa." Mimeo, International Food Policy Research Institute, Washington, DC.

Passa Orio, J. C., and Q. Wodon. 2008. "Impact of Higher Food Prices on Cost of Living: Assessing Multiplier Effects using Social Accounting Matrices." Mimeo, World Bank, Washington, DC.

Polaski, S., A. Ganesh-Kumar, S. McDonald, M. Panda, and S. Robinson. 2008. *India's Trade Policy Choices: Managing Diverse Challenges*. Washington, DC: Carnegie Endowment for International Peace.

Pradhan, M., and M. Ravallion. 2000. "Measuring Poverty using Qualitative Perceptions of Consumption Adequacy." *Review of Economics and Statistics* 82 (3): 462–471.

Robles, M., and M. Torero. 2010. "Understanding the Impact of High Food Prices in Latin America." *Economía* 10 (2): 117–164.

Smith, L. C., H. Alderman, and D. Aduayom. 2006. *Food Insecurity in Sub-Saharan Africa: New Estimates from Household Expenditure Surveys*. Research Report 146. Washington, DC: International Food Policy Research Institute (IFPRI).

Svedberg, P. 2000. *Poverty and Undernutrition: Theory, Measurement, and Policy*. Oxford, UK: Oxford University Press.

Swinnen, J. 2010. *The Right Price of Food: Reflections on the Political Economy of Policy Analysis and Communication*. LICOS Discussion Paper 25910. LICOS Centre for Institutions and Economic Performance, Katholieke Universiteit Leuven, Leuven, Belgium.

Tiwari, S., and H. Zaman. 2010. *The Impact of Economic Shocks on Global Undernourishment*. Policy Research Working Paper Series No. 5215. Washington, DC: World Bank.

USDA (US Department of Agriculture). 2008. *Food Security Assessment, 2007*. Washington, DC: USDA Economic Research Service.

________. 2009. *Food Security Assessment, 2008–09.* Washington, DC: USDA Economic Research Service.

________. 2011. Production, Supply and Distribution Online. Accessed March 4. www.fas.usda.gov/psdonline/psdQuery.aspx.

Warr, P. 2008. "World Food Prices and Poverty Incidence in a Food Exporting Country: A Multihousehold General Equilibrium Analysis for Thailand." *Agricultural Economics* 39 (Supplement): 525–537.

WHO (World Health Organization). 2010. Global Database on Child Growth and Malnutrition. Accessed November 22. www.who.int/nutgrowthdb/database/en/.

Winters, P., T. Essam, B. Davis, A. Zezza, C. Carletto, and K. Stamoulis. 2008. *Patterns of Rural Development: A Cross-Country Comparison using Microeconomic Data*. ESA Working Paper No. 08-06. Rome: Food and Agriculture Organization.

World Bank. 2006. *Repositioning Nutrition as Central to Development: A Strategy for Large-Scale Action*. Washington, DC: The World Bank.

________. 2008a. *Addressing the Food Crisis: The Need for Rapid and Coordinated Action.* Background paper for the Group of Eight meeting of finance ministers, Osaka, Japan, June 13–14. Washington, DC: World Bank.

________. 2008b. *2005 International Comparison Program Tables of Final Results*. Washington, DC: World Bank.

________. 2008c. *World Development Report 2008: Agriculture for Development*. Washington, DC: World Bank.

________. 2010a. *Perspectives on Poverty in India: Stylized Facts from Survey Data*. New Delhi: World Bank.

________. 2010b. PovcalNet. World Bank. Accessed June 10. http://iresearch.worldbank.org/PovcalNet/povcalSvy.html.

________. 2010c. World Development Indicators Online. World Bank. Accessed November 22. http://devdata.worldbank.org/dataonline/.

Zezza, A., B. Davis, C. Azzarri, K. Covarrubias, L. Tasciotti, and G. Anriquez. 2008. The Impact of Rising Food Prices on the Poor. *Rome: Food and Agriculture Organization.*

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