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The Impact of the Global Food Crisis on Self-Assessed Food Security

Derek D. Headey

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Abstract

The paper provides the first large-scale survey-based evidence on the impact of the global food crisis of 2007–08 using an indicator of self-assessed food security from the Gallup World Poll. For the sampled countries as a whole, this subjective indicator of food security remained the same or even improved, seemingly owing to a combination of strong economic growth and limited food inflation in some of the most populous countries, particularly India. However, these favorable global trends mask divergent trends at the national and regional levels, with a number of countries reporting substantial deterioration in food security. The impacts of the global crisis therefore appear to be highly context specific.

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The author may be contacted at D.Headey@cgiar.org.

The Impact of the Global Food Crisis on Self-Assessed Food Security

By DEREK D. HEADEY[1]

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[1] Derek Headey, Research Fellow, International Food Policy Research Institute, PO Box 5689, Addis Ababa, Ethiopia. D.Headey@cgiar.org. The author particularly wishes to thank Angus Deaton for the introduction to the GWP data as well as very detailed comments on an early draft. Thanks also to Gallup staff for answering a number of questions and to Shahla Shapouri of the USDA for providing comments and answering questions regarding the USDA model. John Hoddinott, Olivier Ecker, Paul Dorosh, Bart Minten, Maggie McMillan, Maximo Torero, and Shenggen Fan contributed useful comments and suggestions. Participants at various seminars at the FAO and IFPRI provided insightful comments. The author also thanks USAID for financial support and Yetnayet Begashaw, Teferi Mequaninte, and Sangeetha Malaiyandi for excellent research assistance. Any errors are the author's own.

The global food crisis of 2007–08 involved approximately 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. Understandably, such rapid increases in the international prices of staple foods have raised concerns about the impact on the world's poor. Household surveys suggest that most poor people earn significant shares of their incomes from agriculture but are nevertheless often net food consumers (World Bank 2008b). Consistent with this stylized fact, several multicountry World Bank simulation studies find that poverty typically increases when food prices increase (holding all else equal), with much of the increase in poverty taking place in poorer rural areas (Ivanic and Martin 2008; de Hoyos and Medvedev 2009; Ivanic, Martin and Zaman 2011). Likewise, the U.S. Department of Agriculture's (USDA 2009) simulation found that approximately 75–80 million people went hungry during the 2008 food crisis, a number that the Food and Agriculture Organization (FOA) of the UN (FAO 2009) applied to its precrisis baseline numbers in the absence of an FAO model that could simulate a food price shock.[2] Subsequent USDA simulations were used by the FAO to estimate that over one billion people went hungry in 2009, up from 873 million in 2005–06.[3]

[2] Some basic problems with the FAO model are reviewed in Headey (2011a) and FAO (2002). In the 2008 crisis, the FAO had an underlying model that only incorporated quantities, not prices, so the FAO's capacity to simulate the effects of food price increases was very limited. Therefore, the FAO relied on a USDA trade model (USDA 2009). A major shortcoming of the USDA model was that it did not include middle-income countries, including large ones such as China, Mexico, and Brazil. Headey (2011a) also shows that the USDA (2009) estimates are contradicted by the USDA's own historical production and import estimates for 2007–08 (USDA 2011).

[3] In addition to the two basic approaches described above (the World Bank poverty simulations and the FAO/USDA hunger simulations), several authors have taken mixed approaches to estimate calorie availability trends, including Anriquez et al. (2010) and Tiwari and Zaman (2010). Dessus et al. (2008) adopt the net benefit ratio approach, but only for urban areas. There are also many country-specific simulation exercises; a particularly good one is Arndt et al. (2008). See Headey (2011a) for a more extensive overview and critique.

These studies have led some observers to conclude that global poverty or hunger increased during the 2008 food crisis. Fundamentally, however, most of the simulation studies cited above aim to predict and understand the impacts of higher relative food prices, holding all else equal. The use of this kind of partial simulation approach is justifiable on several grounds. First, partial simulations have an advantage in being able to produce very timely ex ante estimates of what might happen if food prices increase. Second, more sophisticated approaches (Ivanic and Martin 2008; de Hoyos and Medvedev 2009; Ivanic, Martin, and Zaman 2011) are useful for identifying the mechanisms by which higher food prices could influence poverty and the distributional consequences of food price changes. In that sense, they are certainly policy relevant. Third, these approaches provide the scope to explore the sensitivity of results to alternative assumptions.

However, the use of partial approaches to infer actual changes in global poverty is inappropriate because there are many ways their predictions might not eventuate. For example, several simulation studies assumed rates of international price transmission to domestic markets rather than using observed price changes (e.g., Ivanic and Martin 2008). There is also the poorly informed question of whether wages (rural and urban) might adjust to higher food prices, with some evidence suggesting that agricultural wages might adjust even in the short run (Lasco et al. 2008). More generally, strong income or wage growth (even without "adjustment") may have buffered any negative impacts of higher prices in the 2000s, as Mason et al. (2011) observed in urban Kenya and Zambia. More ambiguously, households could mitigate the worst forms of hunger or poverty through any number of coping mechanisms, such as reducing dietary quality, selling assets, working longer hours, or reducing nonfood expenditures.[4]

[4] Inevitably, measurement and estimation issues constrain these studies. Headey and Fan (2010) and Headey (2011a) provide an overview of some measurement and estimation issues (see also footnote 2). Of course, measurement issues also apply to the data used in this study (see section 2).

Because of these complexities, this article takes a different route by providing the first ex post analysis of survey data collected before, during and shortly after the 2008 food crisis across a large number of countries. Specifically, we examine the results from an indicator of self-assessed problems affording sufficient amounts of food, which was collected as part of the Gallup World Poll (GWP). Although subjective data certainly have shortcomings (an issue we discuss in detail below), their advantage in this context is that they are substantially cheaper to collect relative to the more objective monetary or anthropometric indicators found in standard household welfare surveys. Hence, the country and time coverage of the GWP surveys is their primary advantage. Specifically, the GWP surveys allow us to examine self-assessed food insecurity trends in 69 low- and middle-income countries, of which China is the most prominent exclusion. This substantial cross-country coverage also allows us to test whether changes in this indicator are explained by variations in food inflation and economic growth.

The basic conclusion from the Gallup data is that at the peak of the crisis (2008), global food insecurity was either not higher or even substantially lower than it was before the crisis. The raw results for the 69 countries for which we have precrisis (2005–06) and mid-crisis (2008) data suggest that 132 million people became more food secure. If 2007 is used as the "precrisis" benchmark, the picture is more neutral because self-assessed food insecurity was essentially unchanged between 2007 and 2008. However, these surprisingly optimistic global trends mask large regional variations. Global trends are clearly driven by declining food insecurity in India and several other large developing countries. However, on average, self-assessed food insecurity increased in many African countries and most Latin American countries. It decreased somewhat in Eastern Europe and Central Asia, but it probably rose in the Middle East (for which the GWP

sample is very small). In the average Asian country, there was basically no change, although we again observe variations around the mean.

Because this article introduces a new method for gauging trends in global food security, it is especially important to investigate the reliability of the Gallup indicator and to understand the factors that might explain these somewhat surprising results. In the analysis below, we note some of the general shortcomings of subjective indicators, which are now widely used in the contexts of general well-being (e.g., Headey et al. 2010; Kahneman and Deaton 2010; Deaton 2010; 2011), poverty (Ravallion 2012), and food security (Deitchler et al. 2011), as well as some specific problems with the Gallup indicator. We also conduct econometric tests to determine whether the observed trends in self-assessed food security are plausibly explained by changes in per capita GDP and various food price indices. As expected, we find that real economic growth improves self-assessed food security. Real GDP growth already controls for aggregate price changes. We also find some additional effects of aggregate inflation, but we find no significant additional effect of relative food price changes (i.e., changes in the food terms of trade). We also show that in many of the largest developing economies (i.e., those with the largest poor populations), nominal economic growth generally outpaced food inflation, even in 2008. Hence, it appears that strong real income growth has largely offset the adverse impacts of food inflation in many developing countries, including those with the largest poor populations.

<<A>>II. AN OVERVIEW OF THE GALLUP WORLD POLL FOOD INSECURITY INDICATOR

In this section, we provide an overview of the GWP and the specific food security indicator used in this study. Our goal is limited to answering three questions. First, what is the general quality of the GWP surveys? Second, what limitations might the GWP indicator of self-assessed

food insecurity have? Third, do basic cross-country patterns in this indicator align with expectations? Because the GWP is conducted by a private organization and its collaborators, much of the description of the formal survey characteristics relies on Gallup materials. We explore correlations between the GWP indicator and non-GWP welfare indicators by conducting a correlation analysis of a cross-section of countries and, in the next section, a multivariate analysis of the full panel dataset.[5]

<<**B**>>*General characteristics of the Gallup World Poll*

Since 2005–06, the GWP has interviewed households in approximately 150 countries, although not always annually. Most questions are constructed to have yes or no answers to minimize translation errors. In developing countries, all but one of the GWP surveys are conducted face to face (China 2009 is the exception), and most take approximately one hour to complete. The surveys follow a complex design and employ probability-based samples intended to be nationally representative of the entire resident civilian noninstitutionalized population aged 15 years and older. In the first stage of sampling, primary sampling units consisting of clusters of households are stratified by population size, geography, or both, with clustering achieved through one or more stages of sampling. When 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 primary sampling unit, and Kish grids are used to select respondents within households. Finally, the data are internally assessed for consistency and validity and then centrally aggregated and cleaned. Data weighting

[5] Much of what follows is drawn directly from the Gallup *Worldwide Research Methodology* (Gallup 2010a). The present author purchased country-level data directly from Gallup and corresponded with senior Gallup staff about specific questions.

is used to ensure a nationally representative sample for each country, with oversampling corrected accordingly.[6]

This approach generates margins of error that are generally in the 3–4 percent range at the 95 percent confidence level, with a mean error margin of 3.3 percent.[7] Note, however, that because these surveys have a clustered sample design, the margin of error varies by question. It is therefore possible that the margin of error is greater for certain questions. We also note that the margins of error in China and India tend to be lower than the average (by 1.6 to 2.6 percentage points). However, in China in 2005–06, the food insecurity question followed some fairly detailed questions on income and welfare, which may have primed respondents to be more likely to answer "yes" to the food insecurity question. Although we were aware of this problem in China, there may be similar problems in other countries. It is certainly possible that the first wave of the GWP (2005–06) contains greater measurement error than subsequent waves because Gallup faced a steep learning curve in conducting such an ambitious global survey (we address this issue below in a sensitivity analysis).

<<**B**>>*The Gallup World Poll question on food security*

Although these general characteristics of the GWP surveys are pertinent, we now turn to the specific question of interest, which is phrased as follows:

[6] In a handful of cases, certain sections of the population are oversampled (see appendix S3). 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 the unusual 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.

[7] Thus, if the survey were conducted 100 times using the same procedures, the "true value" around an assessed percentage of 50 would fall within the range of 46.7 percent to 53.3 percent in 95 out of 100 cases.

"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 simplification, we refer to this as the "food insecurity" indicator rather than a more cumbersome term such as "unaffordability of food."[8] What are some of the strengths and weaknesses of this question? The strengths include a focus on access rather than availability, a recall period (12 months) capable of capturing seasonality and other short-run food price movements, and large cross-country and multiyear coverage. This last strength is a significant advantage in the absence of more regular economic or nutritional surveys, but there are also limitations with subjective data. Unlike simulation approaches, for example, subjective data do not provide much information about the mechanisms or magnitudes of welfare impacts. However, there are some indications that the simple yes/no indicator used here may not lead to much loss of information in practice. The GWP has data for Africa in which a similar question is asked that allows for five different answers based on the frequency of deprivation. Those data show a similar trend to the dichotomous indicator (see fig. S.1 in the supplemental online appendix, available at http://wber.oxfordjournals.org/).

A more significant problem is that the definition of food needs is not universal. For a well-off or well-educated family accustomed to a high-quality diet, "food" may mean a food bundle of

[8] We note that there are other welfare indicators measured by Gallup, including a question pertaining to hunger rather than food affordability as well as a general life satisfaction question (scaled from one to ten). In earlier versions of this paper, we considered the hunger variable, but the sample size for that indicator was much smaller, and trends in that variable could not be significantly explained by economic growth or food inflation. The life satisfaction question was not explored because it is not obvious that changes in this indicator over 2006–08 would be substantially related to food inflation. Even so, that indicator generally suggests sizeable improvements in well-being in developing countries, with only a handful of exceptions (Pakistan, Sierra Leone, Egypt, and Afghanistan). Hence, we concentrate on the more relevant food insecurity question.

sufficiently high quality (e.g., meat, eggs, dairy). 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. There is some indication of such biases in the data, although formal tests of the presence of biases proved to be inconclusive (Headey 2011a). For example, there is surprisingly high self-assessed food insecurity in developing countries with relatively high levels of education/literacy, such as the former Soviet Bloc countries and Sri Lanka (see the online supplemental appendix S2 for individual country-year observations). At the other extreme, food insecurity appears too low in several countries where we know that undernutrition is quite prevalent. In Ethiopia, for example, where diets are very monotonous and undernutrition is very high, self-assessed food insecurity was just 14 percent in 2006 (although it subsequently rose rapidly). However, in cross-country regressions, we did not find an impact of education on food insecurity after controlling for income (see Headey 2011a). There are no indications that large numbers of poor countries systematically underreport food insecurity.

To illustrate this issue, table 1 reports regional means (the full Gallup data are presented in appendix S2). At the bottom of table 1, we observe that the mean "global" prevalence of households reporting problems with affording food is almost 32 percent. As expected, however, there are large variations around the world, with some countries reporting almost no food insecurity and others reporting that 80 percent of households had problems affording food. For the most part, the pattern across continents is plausible. Food insecurity is highest in sub-Saharan Africa, which is by far the poorest region in the world in monetary terms. Food insecurity in South Asia is higher than in East Asia, as expected, but only when two large outliers, Nepal and

Cambodia, are excluded.[9] In Latin America, food insecurity is surprisingly high (34 percent). This may relate to the greater prevalence of urban poverty and of relatively poor net food consumers, although this is only a speculation.

Table 1. Regional Unweighted Means for the Two GWP Measures, Circa 2005, for Developing Countries Only (Percent)

	Food insecurity	
	Mean	**No. of obs.**
sub-Saharan Africa	58.3	27
South Asia*	31.2	5
East Asia*	24.0	6
Middle East & North Africa	26.5	2
Central America & Caribbean	34.7	9
South America	36.0	10
Transition[a] countries	29.1	23
OECD[b]	8.3	22
Low income[c]	48.6	49
Middle income[c]	29.6	28
Upper income[c]	11.0	34
Mean, total sample	31.7	433

Source: Data are from the GWP (Gallup 2011).

Note: *Note that two outliers are excluded. Nepal is excluded from the South Asia results, and Cambodia is excluded from the East Asia results. In the case of Nepal, its food insecurity score is much lower than that of the other South Asian countries, whereas Cambodia's is much higher. With the inclusion of these two outliers, the food insecurity scores for South Asia and East Asia are roughly equal at 31 percent. [a] *Transition* refers to former Communist countries. [b] Members of Organization for Economic Co-operation and Development. [c]. *Low income* is defined as a 2005 GDP per capita of less than USD 5,000 purchasing power parity; *middle income*, as USD 5,000–13,000; and *upper income*, as greater than USD 13,000.

The data also suggest a strong income gradient for food insecurity. Low-income countries have food insecurity rates that are 17 percentage points higher than middle-income countries, and the same difference is observed between middle- and upper-income countries. In terms of correlations with other welfare indicators (table 2), there is some support that cross-country patterns impart meaningful information. Of course, extremely high correlations are not necessarily expected given the well-known problems associated with measuring hunger and

[9] Self-assessed food insecurity in Cambodia is unusually high (67 percent), but in Nepal, it is extremely low (9 percent). Including these two countries leaves the South and East Asian means roughly equal, at 31 percent.

poverty[10] and the fact that anthropometric indicators are heavily influenced by nonfood factors, such as health, education, family planning, and cultural norms. Bearing this in mind, we find that GDP per capita, mean household income, poverty rates, hunger rates, and anthropometric indicators are significantly correlated with the two GWP indicators, almost invariably at the one-percent level (table 2). The correlations are particularly strong for the (logarithmic) income and poverty indicators. In a very small sample—which excludes six important outliers—the correlation between the GWP indicators and the body mass index (BMI) of adult women is also very high (0.68). Table S1.1 in the appendix presents the full correlation matrix among the variables. It shows that the correlations between the GWP measure and the various benchmarks are at least as strong as the benchmark correlations for the FAO hunger measure and the World Bank poverty measure, if not stronger.

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

Table 2. Correlations between the Self-Reported Food Security Indicator and Other Indicators of Income, Poverty, Hunger, and Malnutrition, Circa 2005

Alternative poverty/hunger indicator (source)		Self-reported hunger
GDP per capita, purchasing power parity, log	Correlation	−0.71***
(World Bank)	No. of obs.	44
Household income per capita, USD, log	Correlation	−0.68***
(World Bank Povcal)	No. of obs.	59
Prevalence of hunger	Correlation	0.58***
(FAO)	No. of obs.	62
Prevalence of poverty, USD 1/day	Correlation	0.77***
(World Bank Povcal)	No. of obs.	58
Prevalence of poverty, USD 2/day	Correlation	0.67***
(World Bank Povcal)	No. of obs.	49
Prevalence of low-BMI women, excluding outliers	Correlation	0.73***
(DHS & WHO)	No. of obs.	17
Prevalence of underweight preschoolers, log	Correlation	0.55***
(DHS & WHO)	No. of obs.	45
Prevalence of stunted preschoolers, log	Correlation	0.48***
(DHS & WHO)	No. of obs.	45

Source: Dependent variable is from the GWP (Gallup 2011) . The sources of the independent variables are as follows: *World Bank*, World Bank (2010b) *WDI*; *World Bank Povcal*, World Bank (2010a); *FAO*; Food and Agriculture Organization (2011); *DHS*; Demographic Health Surveys (2010); *WHO*, World Health Organization (2010).

Note: *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent 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 percent: 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 table 3, we also show that the GWP food insecurity indicator is significantly explained by "relative food prices," which is measured as the ratio of the purchasing power parity for food items to the exchange rate (both measured in 2005). This index can be interpreted as the extent to which a country's food basket is expensive or cheap relative to the costs of importing food

(values of more than 100 imply that food is relatively expensive, whereas values of less than 100 imply that food is relatively cheap). However, because of Balassa-Samuelson effects, this indicator is likely to be higher in richer countries than in poorer countries. Hence, we use multivariate regressions to control for GDP per capita. However, even after controlling for GDP per capita, there are still substantial variations in food prices across developing countries (as the continent dummies in regression 1 suggest), which could be explained by transport costs, variations in agricultural productivity, the limited tradability of food (partly due to tastes), or even exchange rate distortions. Indeed, regression 2 suggests that variation in "relative food prices" across countries significantly explains variations in self-assessed food security after controlling for GDP per capita. However, the relationship is nonlinear: at low levels of food prices, the marginal effects of higher prices are quite large, but at the highest observed levels of relative food prices, the marginal effects are insignificantly different from zero. A caveat is that the result of regression 2 in table 3 is not very robust to the inclusion of continental dummies (introduced in regression 3), particularly the dummy for sub-Saharan Africa. This lack of robustness appears to be because relative food prices and self-assessed food insecurity are both very high in Africa.[11] Specifically, the inclusion of continent dummies results in the food price coefficients no longer being significant at the 10 percent level, although this insignificance also applies to the continent dummy coefficients, suggesting that multicollinearity is an issue.

[11] An issue here is that food prices may be higher in Africa because of the way in which the 2005 round of the International Comparison Program was conducted on a continental basis. Specifically, it is possible that food prices in Africa are biased upward by methodological issues, although it is difficult to substantiate such a claim. A more general problem with purchasing power parities is the challenge of finding common items to compare across countries. Exchange rate distortions may be problematic for this index, although data on black market premia on exchange rates suggest that most exchange rate distortions have declined markedly over time.

Table 3. Whether Self-Assessed is Food Security Explained by Relative Food Prices

Regression No.	1	2	3
Dependent variable	Food price level	Food insecurity	Food insecurity
No. of observations	99	91	91
Constant	61.74***	17.0**	31.1**
GDP per capita ($1,000s)	2.80***	−3.1***	−2.3***
GDP per capita, squared		0.04***	0.03***
Food price ratio		63.8***	48.7
Food price ratio, squared		−19.4***	−9.2
Africa dummy	30.4		18.6
Latin America dummy	−12.3		10.5
Asia dummy	5.0		4.6
Europe-plus dummy	−12.5		5.9
R-squared	0.65	0.73	0.76
Adjusted R-squared	0.63	0.72	0.75

Source: "Food insecurity" is from the GWP (Gallup 2011) and is described in the text. GDP per capita is from the World Bank (2010) and is measured in constant purchasing power parity dollars. "Relative food prices" are measured as the purchasing power parity of food and nonalcoholic beverages relative to the nominal exchange rate for the year 2005. Information is from the World Bank (2008b).
Note: *, **, and *** indicate significant at the 10 percent, 5 percent, and 1 percent levels, respectively. "Europe-plus" includes Eastern European countries plus North America and Australasia. Note that self-reported food insecurity data are measured in 2005 or 2006, whereas the food price ratio is measured in 2005.

Overall, the results reported above present a mixed picture of the validity of cross-country patterns in the Gallup data. On the one hand, there are certainly some worrying outliers in the GWP indicator (particularly in the 2005–06 round). On the other hand, the data as a whole are plausibly patterned across countries and strongly correlated with other welfare indicators and relative food prices. However, we acknowledge that many social scientists are wary of subjective

indicators of welfare, even if this skepticism has been moderated in recent decades. There is, of course, an immense body of economic literature that uses indicators of self-assessed well-being and health (e.g., Headey et al. 2010), including indicators collected by Gallup (Kahneman and Deaton 2010; Deaton 2010; 2011). On the positive front, comparisons of self-assessed poverty and objectively measured indicators of poverty have uncovered close relationships between the two (Ravallion 2012). A recent assessment of food insecurity questions in six developing countries also found that questions pertaining to more severe forms of deprivation were highly comparable across countries, although concepts related to anxiety and dietary quality were not (Deitchler et al. 2010). In addition, there are longstanding concerns that such measures are sensitive to framing, question ordering, and other response biases. In terms of the third item, there is an extensive body of literature that examines biases in self-reported indicators (see, e.g., Benitez-Silva et al. 2004; Krueger and Schkade 2008; Ravallion 2012). A specific concern in the context of food security is that respondents may believe that more negative answers increase their chances of accessing food or cash transfers. Many such biases may only exist at certain levels but disappear when trends in the data are observed. However, any changes in question ordering could bias results, as a recent paper by Deaton (2011) shows. Substantial measurement errors could also mean that subjective indicators perform adequately in the cross-section but poorly in first differences (Bertrand and Mullainathan 2001). Clearly, there are important reasons to explore the validity of trends in the Gallup indicator, not just at certain levels.

<<A>>III. EXPLAINING CHANGES IN SELF-ASSESSED FOOD INSECURITY

In this section, we explore the validity of changes in self-assessed food insecurity at the national level by gauging whether trends in the GWP indicators are explained by changes in

disposable income. The underlying model for these regressions is that the prevalence of food insecurity (F) at time *t* in country *i* is a function of disposable income per capita, or nominal income per capita (Y), deflated by a relevant set of prices (P):

(1) $F_{i,t} = f\left(Y_{i,t}/P_{i,t}\right)$.

Although intuitive in principle, in practice, disposable income at the national level is measured with considerable error for several reasons. First, income inequality means that GDP per capita may be a flawed indicator of the purchasing power of a poor or vulnerable household in a country (the same is true of GDP growth as an indicator of changes in welfare). Second, the price index (P) used to deflate GDP per capita (the GDP deflator) may not represent the consumption patterns of the food-insecure population because the budget share they allocate to food expenditures will typically be higher than the share employed in calculating the (consumer price index) CPI.

Because of these complications, it is not obvious that changes in real GDP per capita adequately capture trends in the purchasing power of the poor. Hence, in the regressions below, we estimate several different specifications. First, we vary the choice of price index used to deflate growth in per capita GDP (the GDP deflator, the total CPI, and the food CPI). Second, we test whether changes in the total CPI or changes in relative food prices (i.e., the food CPI over the nonfood CPI) provide some additional explanatory power. Third, we test whether these relationships vary over income levels, in accordance with Engel effects and the fact that welfare programs may play a larger role in determining food security in wealthier countries than economic growth. Finally, we add fixed effects to the specifications to partially control for unobservable factors, such as income inequality and social safety net.[12]

[12] Although adding fixed effects would seem desirable in principle, the valid addition of fixed effects rests on the

In addition to these issues of specification, there are some measurement considerations. First, in our preferred regression models, we specify the dependent variables as the change in the prevalence of food insecurity across two successive periods. This approach is in contrast to most of the analogous growth-poverty literature, in which it is common to measure the dependent variable as a percentage change. However, taking the percentage changes of a prevalence rate can cause scaling problems and create outliers (Deaton 2006; Headey 2011c**[[There is no "Heady 2011c" listed in the references section. Do you mean 2011a or 2011b?]]**).[13] The only significant advantage of using a percentage change is that it allows for the derivation of elasticities that can be directly compared to the literature that examines the impact of economic growth on poverty. Therefore, in some of our results, we also report these elasticities, although our preferred estimates focus on first differences.

A second issue pertains to measurement error in the Gallup data. Some apparent outliers are indicative of this measurement error. In figure 1, we consider potential outliers more systematically with scatter plots between changes in food security and various indicators of

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assumption that both right-hand side variables are strictly exogenous at all leads and lags, which is unlikely. Hence, we do not solely rely on the fixed effects estimator.

[13] 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 approximately −4.7 percent (that is, $2/40 \times 100$). However, 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. In the case of per capita income, however, 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.

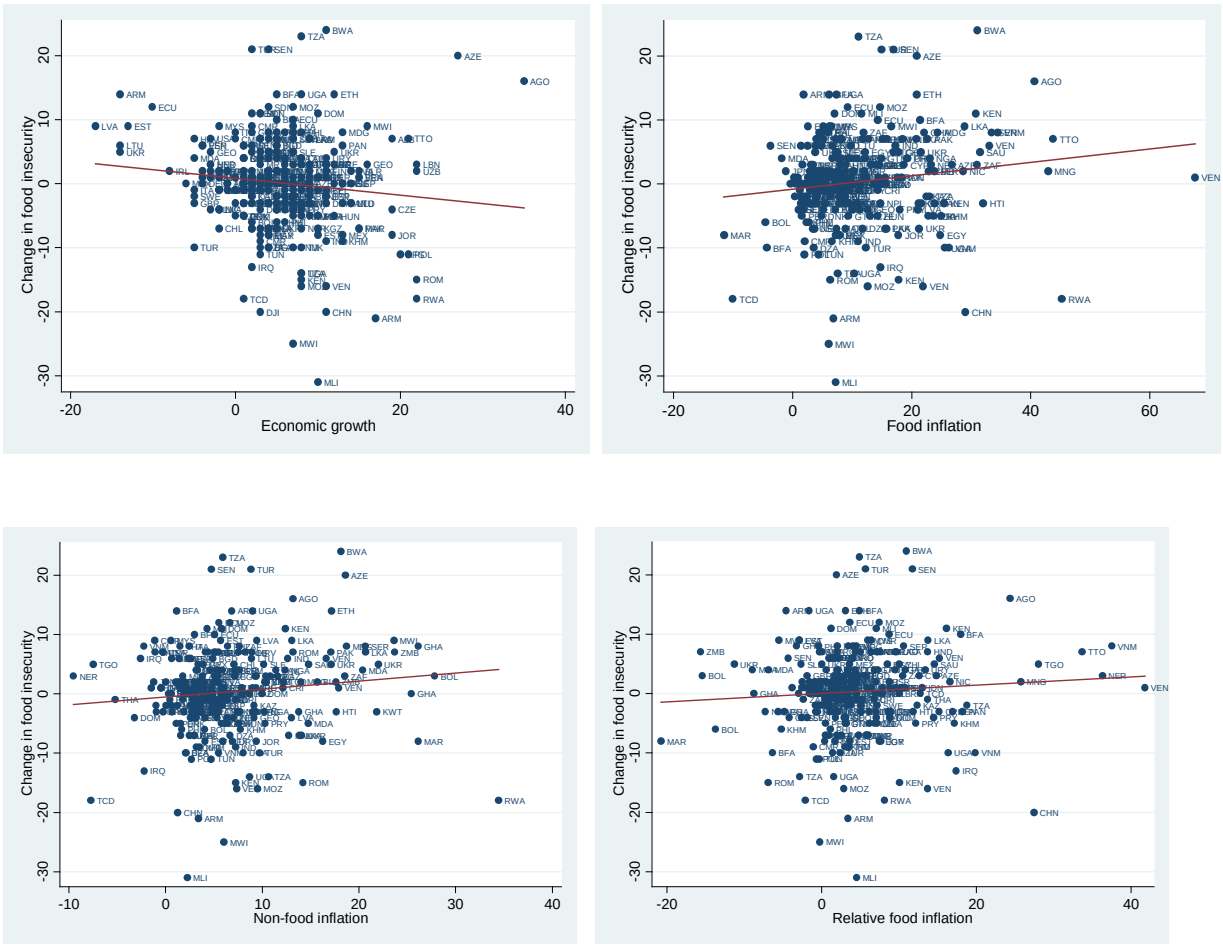
economic growth and price changes.[14] In all of the scatter plots, there are some potentially influential outliers, including Azerbaijan, Angola, and Venezuela, which are three oil producers, several Eastern European countries (Armenia, Latvia, Estonia, and Ukraine) and several African countries (Tanzania, Mali, and Malawi). Note that these outliers are sometimes driven by large changes in the dependent variable as well as by unusual economic growth or inflation rates. Measurement error is therefore a problem in both the left- and right-hand side variables.

To gauge the influence of outlying observations, we calculated *dfbetas* (an indicator of the influence of outliers) and earmarked observations with *dfbetas* greater than 0.2.[15] One option is to run regressions that exclude outliers, which we do in the case of fixed effects regressions. Another option is to use a robust regressor that downweights outlying observations without completely discounting them. Hence, we use both robust regressors and fixed effects estimates that exclude these outlying observations. Furthermore, we report ordinary least squares regressions in appendix S1, in which all outliers are included.

[14] Note that in all our regressions, we exclude observations for Zimbabwe because of its hyperinflationary episode, which leaves the country as an enormous outlier on the food inflation-food insecurity relationship.

[15] This cut-off is fairly conservative. The usual cut-off for this sample size, 2/sqrt(N), is equal to 0.12. We calculate these *dfbetas* for various models and exclude a common set of outlying observations: Algeria, 2009; Angola, 2008; Armenia, 2007 and 2009; Azerbaijan, 2007; Botswana, 2008; China, 2008; Denmark 2007 and 2008, and 2009; Djibouti, 2009; Iraq, 2008 and 2009; Kenya, 2007; Kuwait, 2009 and 2010; Romania, 2007; Rwanda, 2009; Tanzania, 2008; Trinidad and Tobago, 2008; Vietnam, 2009; and Zimbabwe, all observations. A good explanation of *dfbetas* can be found in *Stata Web Books: Regressions with Stata, Chapter 2 – Regression Diagnostics*: http://128.97.141.26/stat/stata/webbooks/reg/chapter2/statareg2.htm

Figure 1. Scatter plots of self-reported food insecurity, economic growth, and various inflation indicators.



Sources: The Y-axis variable is from the GWP (Gallup 2011) . Economic growth data are from the IMF (2010), and food inflation data are from the ILO (ILO, 2011).

Turning to some results, we begin with descriptive statistics and correlations for our dependent and independent variables (tables 4 and 5). Over the entire period, the mean change in the first difference of the food insecurity measure was close to zero (0.2), although the standard deviation and range of this variable is quite large. The statistics for the percentage change in food insecurity show a similar pattern and indicate the presence of some of the previously mentioned problems with the use of percentages of a prevalence variable. There is a tendency to inflate

small changes at lower levels of food insecurity due to the small base. Next, the three economic growth indicators show similar variation around the mean, but the relatively rapid rate of food inflation over this period means that the GDP growth deflated by the food CPI has a mean of only 0.4, whereas deflating by the GDP or CPI deflators results in means of 2.7 percent and 2.9 percent, respectively. Thus, food inflation typically exceeded nonfood inflation. Turning to table 5, it is noteworthy that the correlations among different price indices are quite large, as high as 0.82 in the case of the relationship between food inflation and total inflation. Table 5 also presents some bivariate evidence that changes in food security are significantly related to both economic growth and overall inflation but not to our estimates of relative food inflation.

Table 4. Descriptive Statistics for Dependent and Independent Variables

	Count	Mean	Std. De.	Min.	Max.
Change in food insecurity	296	0.2	7.2	−31.0	24.0
Percent change in food insecurity	290	4.9	31.6	−83.0	200.0
Economic growth (GDP deflator)	291	2.9	5.7	−17.6	32.1
Economic growth (CPI deflator)	276	2.7	8.4	−27.1	41.1
Economic growth (food CPI deflator)	271	0.4	8.4	−34.2	34.0
Total CPI inflation	276	8.6	7.5	−8.9	51.8
Food CPI inflation	276	10.9	9.6	−11.5	67.6
Nonfood CPI inflation	276	6.4	6.2	−9.5	34.4
Relative food inflation	276	4.4	7.7	−20.8	41.8

Source: Food insecurity is from the GWP (Gallup 2011**)**. Economic growth data are from the IMF (2010), and all inflation data are from the ILO (ILO 2011).
Note: All data are in percent or percentage points. Economic growth is reported with three different means of deflation: the GDP deflator, the CPI deflator, and the food CPI deflator. Relative food inflation is the change in the ratio of the food CPI to the nonfood CPI.

Table 5. Correlations between Changes in Food Insecurity and Various Explanatory Variables

	Change in food insecurity	Economic growth[a]	Total inflation	Food inflation	Nonfood inflation
Economic growth[a]	−0.10**				
Total inflation	0.18***	0.20***			
Food inflation	0.15***	0.19***	0.82***		
Nonfood inflation	0.19***	0.19***	0.71***	0.51***	
Relative food inflation[b]	0.04	0.06	0.41***	0.76***	−0.17***

Note: *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively. [a] Growth in GDP per capita deflated by the GDP deflator. [b] Changes in the ratio of the food CPI to the nonfood CPI.

Table 6 reports the results for the full sample of countries with first differences in food insecurity as the dependent variable and various indicators of economic growth as the sole explanatory variable. Regressions 1 through 3 report results from the analysis using the robust regressor, and regressions 4 through 6 report results from using the fixed effects estimator. The main finding from table 6 is that the economic growth coefficient is always highly negative, significant, and quite large in magnitude. In terms of the size of the coefficients, the point estimates suggest that doubling the GDP per capita would reduce the rate of food insecurity by 12 to 24 percentage points, depending on the estimator and the indicator of economic growth. In general, the fixed effects estimators produce larger estimates. When fixed effects are used and outliers are removed, the choice of deflator makes virtually no difference. In table 6, we report elasticities in addition to the first difference coefficients. The elasticities are quite large, varying from 0.47 to 1.25, and are commensurate in size to growth-poverty elasticities (for example, those reported in Christiaensen et al. 2011).

Table 6. Regressions of Changes in Self-Reported Food Insecurity against Economic Growth

Regression No.		1	2	3	4	5	6
Means of deflating economic growth		GDP deflator	Total CPI	Food CPI	GDP deflator	Total CPI	Food CPI
Outliers removed?		No	No	No	Yes	Yes	Yes
Regressor		Robust regressor	Robust regressor	Robust regressor	Fixed effects	Fixed effects	Fixed effects
Economic growth	Coefficients	−0.24***	−0.14***	−0.12***	−0.21***	−0.22***	−0.23***
		(0.06)	(0.04)	(0.04)	(0.08)	(0.06)	(0.07)
	Elasticities	−0.56**	−0.55***	−0.47**	−1.25**	−0.93***	−0.82***
		(0.27)	(0.20)	(0.19)	(0.48)	(0.29)	(0.30)
No. of observations		291	275	271	271	256	252
No. of countries		120	112	111	113	106	105
R-squared		0.05	0.04	0.03	0.06	0.05	0.05

Source: Dependent variables are from the GWP (Gallup 2011**)** . Economic growth data are from the IMF (2010), and food and total CPI data are from the ILO (ILO 2011).
Note: *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively. Standard errors are reported in parentheses. The robust regressions are estimated using the *rreg* command in stata, with default settings. For fixed effects regressions, standard errors are adjusted for country clusters. Outliers are identified based on *dfbetas* greater than 0.20. *Economic growth* is the percent change in GDP per capita between the two years in which the GWP surveys were conducted. Note that the robust regressor does calculate a pseudo R-squared, but it is generally regarded as inappropriate to report this value. Hence, the R-squared reported in this table is derived from an ordinary least squares regression that excludes outlying values.

In table 7, we run the same regressions with the addition of separate price change indicators to determine whether certain types of inflation have additional explanatory power over real economic growth rates. Specifically, we add inflation in the total CPI and food CPI relative to the nonfood CPI. The first represents an aggregate price effect, and the second represents a relative food price effect. Table 7 shows that overall inflation has a significant positive effect on

the prevalence of food insecurity. Again, the coefficient point estimates are larger in the fixed effects regressions (0.22 versus 0.11), but these marginal effects are relatively large for both estimators. Doubling the CPI, for example, is expected to increase the prevalence of food insecurity by 11 to 22 percentage points, holding real economic growth constant.

Somewhat surprisingly, the relative food inflation coefficients in table 7 are insignificant at the 10 percent level, but they are still positive (in one regression, the relative food inflation coefficient is significant at the 13 percent level). One explanation may be greater measurement error in relative food inflation because we were required to estimate nonfood inflation rates for approximately half of our sample.[16] Nevertheless, the fact that food inflation was the main driver of overall inflation over the period in question (food inflation explained almost 80 percent of variation in total inflation from 2006 to 2008 in developing countries) indirectly points to the generally adverse role of higher food prices on self-assessed food insecurity. Moreover, a significant additional effect of overall price inflation on food insecurity could be consistent with microeconomic theories of labor markets. Specifically, most poor people engaged in wage labor (i.e., those who are not self-employed, such as farmers) tend to work in labor markets that are characterized by substantial slack (unemployment or underemployment). If various food and nonfood prices increase, then the nominal wages of workers in such markets would not be expected to increase commensurately, leading to a fall in real incomes (Headey et al. 2012).

[16] The reason for the larger error in the relative food inflation measure is that the ILO only reports the total CPI and the food CPI. Because relative food inflation is measured as changes in the ratio of the food CPI to the nonfood CPI, we had to derive the nonfood CPI from the total CPI, the food CPI, and the share of food in the total CPI. However, only approximately 50 percent of countries reported the food weight to the ILO, so we were required to estimate food CPI weights for the remaining countries using regressions against GDP per capita (i.e., Engel effects). This interpolation is the best we could do, but it may mean that relative food inflation is measured with sizeable error. That said, alternative indicators of relative food prices, such as the change in the food CPI minus the change in the total CPI, essentially yield the same insignificant results.

Hence, it is possible for nominal price increases to induce real wage declines, and there is significant evidence pointing to the adverse impact of inflation on poverty reduction (see Ferreira, Prennushi, and Ravallion 2000).[17]

[17] Ferreira et al. (2000) write, "While changes in the relative short-term returns to holding bonds versus stocks may redistribute income only among the non-poor, there is one major asset-type impact which affects the poor: inflation. The rate of inflation is a tax on money holdings. Because there are barriers to entry in most markets for non-money financial assets, the poor are constrained in their ability to adjust their portfolio to rises in inflation. Typically, they will hold a greater proportion of their wealth in cash during inflationary episodes than do the non-poor. The non-poor are generally better able to protect their living standards from inflationary shocks than the poor."

They go on to cite evidence from India, Brazil, the Philippines, and a larger cross-country review.

Table 7. Augmenting the Regressions with Measures of Inflation

Regression No.	1	2	3	4
Means of deflating economic growth	Total CPI	Total CPI	Total CPI	Total CPI
Regressor	Robust regressor	Robust regressor	Fixed effects	Fixed effects
Economic growth (CPI)	−0.14***	−0.13***	−0.22***	−0.19***
	(0.04)	(0.04)	(0.06)	(0.07)
Relative food inflation	0.04		0.12	
	(0.05)		(0.08)	
Total inflation		0.11***		0.22**
		(0.05)		(0.11)
Number of countries	105	105	105	105
Number of observations	252	252	252	252
R-squared: overall	0.05	0.04	0.05	0.06

Source: Dependent variables are from the GWP (Gallup 2011**)** . Economic growth data are from the IMF (2010), and food and total CPI data are from the ILO (ILO 2011).

Note: *, **, and *** indicate significance at the 10 percent, 5 percent, and 1 percent levels, respectively. Standard errors are reported in parentheses. Note that outliers are removed for all regressions. Outliers are identified based on *dfbetas* greater than 0.20. The robust regressions are estimated using the *rreg* command in stata with default settings. For fixed effects regressions, standard errors are adjusted for country clusters. *Economic growth* is the percent change in GDP per capita between the two years in which the GWP surveys were conducted deflated by the total CPI. *Total 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 food CPI in any given month is actually the average food CPI in the previous 12 months. *Relative food inflation* is the percentage change in the ratio of the food CPI to the nonfood CPI, where the both CPIs in any given month are actually the average CPIs in the previous 12 months. Note that the robust regressor does calculate a pseudo R-squared, but it is generally regarded as inappropriate to report this value. Hence, the R-squared reported in this table is derived from an ordinary least squares regression that excludes outlying values.

Finally, we ran a number of additional specification tests related to income-level effects and alternative inflation effects. Specifically, we ran interaction terms with GDP per capita (in linear and log form) and with income dummy variables (low, middle, upper). Although we strongly expected that changes in food insecurity would be more sensitive to changes in disposable income at lower levels of income, there were no significant interaction terms (results available upon request). We suspect that this result may be driven by the fact that growth rates, inflation rates, and changes in food insecurity were all much lower in upper-income countries, which would have the effect of making the relationships approximately linear.

From the perspective of providing validation that changes in self-assessed food insecurity impart useful information, the results in tables 6 and 7 are encouraging. It is particularly encouraging that changes in real GDP per capita significantly explain changes in self-assessed food insecurity, suggesting that the latter is sensitive to changes in disposable income.

Despite significant and robust marginal effects, there are some caveats to these results. First, there is the influence of outliers. In the online appendix (table S1.2), we report the results of reestimating the regressions in table 6 and including outliers. Although all of the economic growth coefficients are still significant at the 10 percent level or higher, the standard errors are significantly larger, and the point estimates are sometimes larger and sometimes smaller in magnitude than those in table 6. Our treatment of outliers therefore does not lead to qualitatively different results.

Nevertheless, the presence of outliers and the low explanatory power of the regressions reemphasize our concerns about measurement error. These concerns must be tempered, however, because the analogous literature on the impact of economic growth on poverty reduction reports regression models with similarly low explanatory power (see Christiaensen et al. 2011, for

example), suggesting that these types of short-run poverty/food insecurity episodes suffer from the measurement errors and misspecification problems noted above. Although the presence of large marginal effects of economic growth and inflation rates on self-assessed food insecurity are encouraging, we must interpret trends in the latter quite cautiously.

<<A>>IV. MEASURING AND INTERPRETING KEY TRENDS IN THE GALLUP DATA

In the introduction to this paper, we noted our basic result at the global level: 132 million fewer people were food insecure in 2008 relative to 2005–06. In this section, we examine Gallup trends in more detail by observing regional variations within this global trend, considering important exclusions from the sample, engaging in an important sensitivity analysis, and exploring the factors that might explain the surprisingly positive global trend.

In table 8, we report simple averages of the GWP food insecurity indicator by various regions of the developing world for 2005–06, 2008, and 2009. These years quite neatly correspond to a precrisis survey round, a food crisis round, and an early financial crisis round. Starting at the top of table 8, we observe what superficially explains the very positive global trend: in the eight most populous developing countries (excluding China), food insecurity decreased by 4.7 percentage points between 2005–06 and 2008. However, in many other regions of the world, food insecurity increased, including coastal West Africa (but not the Sahel), Eastern and Southern Africa, and Latin America. In other developing regions, there was either no change or some improvement. We also note that the deterioration of food insecurity in much of Africa and Latin America is consistent with a number of simulation studies (see Headey and Fan 2010 for a review).

Table 8. Regional Trends in Self-Reported Food Insecurity (Percent Prevalence)

Developing region	No. of obs.	2005–06 surveys (precrisis)	2008 surveys (food crisis)	2009 surveys (financial crisis)
Eight most populous developing countries*	8	32.7	28.0	30.6
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 (including Turkey)	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	28.8	29.0	30.8
East Asia	7	30.1	30.6	32.7
South Asia	5	26.8	26.8	28.6

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

Although the results in table 8 cover the majority of the developing world's population, there are still sizeable omissions. Although the GWP surveys cover China, we excluded the 2005–06 rounds due to specific concerns about biases in the responses to the food insecurity question. However, a number of other countries are lacking the requisite data for 2005–06 or 2008. China, of course, has a population of over a billion people, but 16 other omitted developing countries

represent close to 600 million people. Hence, one way to explore the sensitivity of our "global" estimate to the omission of these countries is to posit some plausible trends for these omitted countries and then recalculate the global figures.

With regard to China, the assessed GWP observations for 2006 and 2008 suggest an unrealistically large drop in food insecurity over that time (20 percentage points), which is probably related to the aforementioned problems with the ordering of questions in the 2006 round. It is therefore pertinent to consider a more plausible scenario for China and what this scenario would suggest about global trends in food insecurity. Given China's phenomenal economic growth and rather limited level of food inflation (nominal mean incomes increased by 65 percent over 2006–08, whereas the food CPI increased by approximately 30 percent), it is plausible that food insecurity fell several percentage points in China. We thus consider a 3-percentage-point reduction from 2006 to 2008 to be relatively conservative. However, the countries omitted from one of more rounds of the GWP include many that could be suspected to have experienced rapid food inflation, including the Philippines (the largest rice importer in the world), a number of Middle Eastern and North African countries (some of the largest wheat importers in the world), and Ethiopia (the second largest country in Africa, one of the poorest countries in the world, and a country that experienced one of the fastest inflation rates in the world over 2007–08). In table S1.3 in the appendix, we make rather pessimistic assumptions about trends in food insecurity in these 16 countries (based largely on observed food inflation data) and adjust the raw GWP estimates by adding the assumed changes in food insecurity from the omitted countries. The results of this exercise are assessed in table 9. The inclusion of assumed changes for these 16 countries adds 62 million people falling into food insecurity rather than coming out it, but the assumed trend in China would result in close to 40 million people

coming out of poverty. In short, the core results reported in the introduction are not highly sensitive to the omission of these admittedly important countries.

Table 9. Alternative Estimates of Global Self-Reported Food Insecurity Trends after Allowing for Omitted Countries (Millions of People)

Estimation scenarios	Estimated change in global food insecurity, 2005–06 to 2007–08
Raw results, 69 countries (excluding China), *covering 57% of developing world population*	−132
As above, plus pessimistic assumptions for 16 omissions, *covering 67% of developing world population*	−60
As above, plus a 3-percentage-point reduction in China, *covering 87% of world population*	−100

Source: Author's calculations from GWP data (Gallup 2011), FAO Global Information and Early Warning System data (2010), and ILO food inflation data (2011).
Note: See text in this section for more details regarding the assumptions and data as well as table A3.

Another objection may be that the 2005–06 GWP results are less reliable than subsequent rounds because the first round of the GWP may be regarded as a trial run for Gallup. We have the option of using the second round of the GWP (2007) as a base year instead of the 2005–06 round, but the 2007 round contains fewer countries and does not include China. Nevertheless, the 2007 GWP round includes India and other large countries and therefore covers approximately 43 percent of the population in the developing world. A second potential problem with using the 2007 round as a base year is that maize and wheat prices were already increasing in 2007, so it is difficult to regard 2007 as a pure precrisis period. Thus, we might underestimate the food insecurity impacts of the crisis if the 2005–06 round is shown to be unreliable. However, we note that there is no analogous problem with the 2008 data. The vast majority of the GWP surveys in

2008 were conducted in the last three quarters of the year after international food prices peaked. Therefore, they cover the period of peak international prices. Some lag in domestic food inflation may still be a problem, although we have already assessed results for surveys conducted in 2009, which may capture the twin effects of slower growth (due to the financial crisis) and higher food prices.

Bearing these caveats in mind, table 10 reports the results of calculating the population-weighted averages of food insecurity prevalence and population numbers for 2007 and 2008. The results thus suggest that there was basically no change in the "global" prevalence of food insecurity between 2007 and 2008. However, table 8 also shows that this result is heavily driven by trends in India, where food insecurity fell 4 percentage points from 2007 to 2008. The bottom half of table 8 calculates trends excluding India (which, admittedly, represents approximately one-quarter of the developing world's population) and finds that population-weighted food insecurity in the rest of the sample went up by 2.53 percentage points, representing approximately 43 million people. Therefore, using the 2007 round as a base suggests that many developing countries were somewhat worse off in the peak food crisis year relative to the previous year. The largest increases in self-assessed food insecurity occur in Tanzania (23 points), Turkey (21 points), Burkina Faso (14 points), Uganda (14 points), Mozambique (12 points), Kenya (11 points), Ecuador (10 points), Cameroon (9 points), Sri Lanka (9 points), Armenia (7 points), and Honduras (7 points). Although we cannot ignore measurement error and the role of other factors in explaining these trends (the result in Turkey stands out as somewhat implausible), it is notable that many of the countries listed above did experience quite rapid food inflation. Indeed, the average rate of food inflation in these countries was approximately 4 points higher than the rest of the sample.

Table 10. **Changes in Self-Reported Food Insecurity from 2007 to 2008**

	Prevalence of food insecurity (%)	Population of food insecure (millions)
	48 developing countries (43.3% of developing world population)	
2007	29.33%	821.4
2008	29.28%	820.1
	−0.05 percentage points	−1.3 million
	47 developing countries excluding India (23.3% of developing world population)	
2007	31.51%	532.8
2008	34.04%	575.9
	2.53 percentage points	43.1 million

Source: Author's calculations from GWP data (Gallup 2011) .

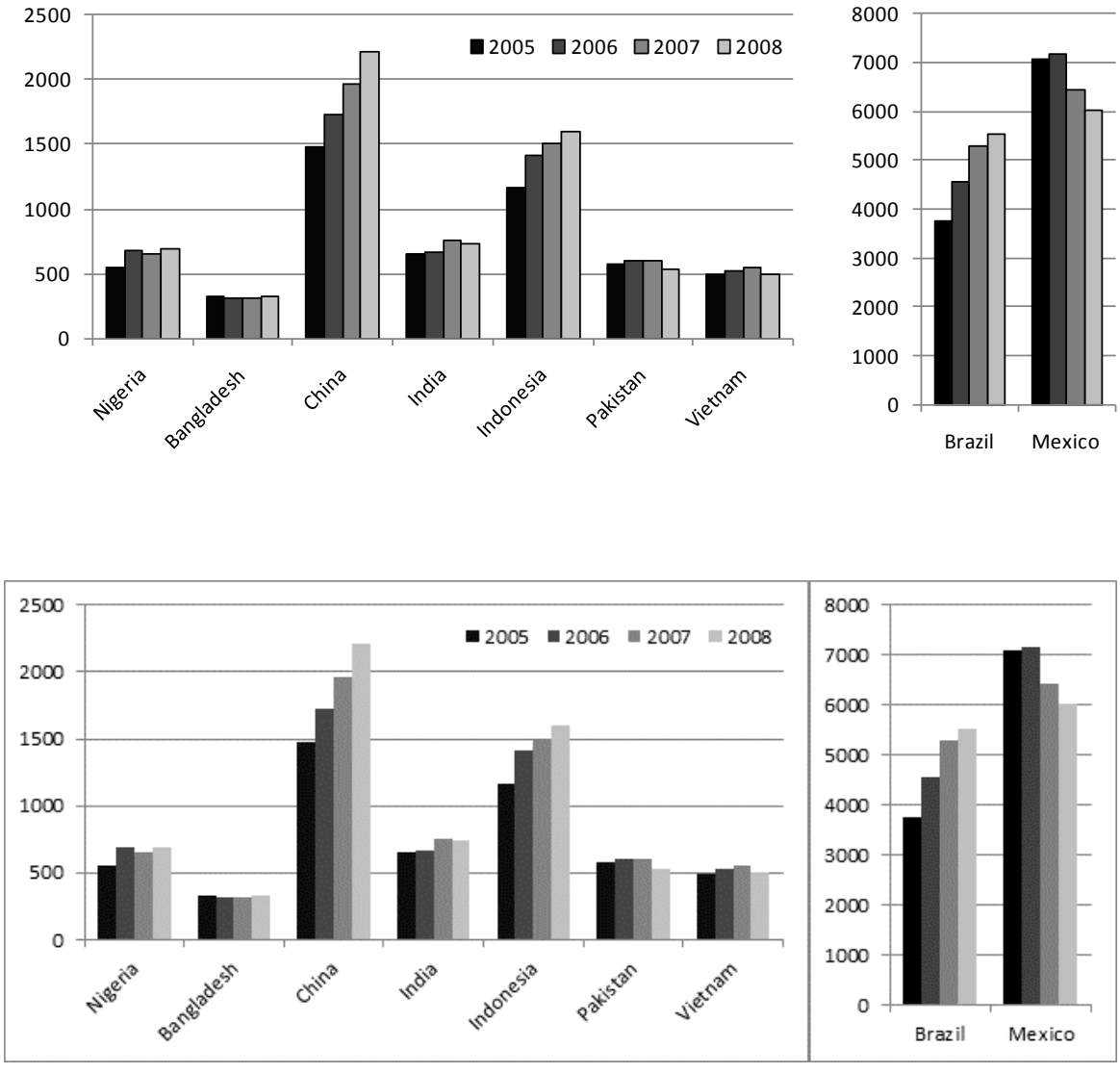
Although we have explored validity issues in previous sections, another relevant question is whether the GWP results are supported by any other survey evidence. One other reasonably large survey of developing countries that was conducted before and during the crisis is the Afrobarometer survey. A recent working paper by Verpoorten, Arora and Swinnen (2011) explores trends in an Afrobarometer indicator that pertains to a very similar question to the one asked in the GWP and finds a 3-percentage-point increase in food insecurity in urban Africa from 2005 to 2008 and a 2-percentage-point increase in rural Africa. Thus, the overall picture of some deterioration in food insecurity in Africa is common across both the GWP and Afrobarometer surveys. Second, and perhaps most important, the most recent World Bank estimates of poverty trends also suggest that global poverty fell between 2005 and 2008 on every continent (World Bank 2012). Third, the FAO (2012) has revised its estimates of large increases in global hunger in 2009. The most recent estimates show a relatively steady decline in global undernourishment, consistent with both the Gallup and World Bank poverty estimates.

Finally, it is worth exploring why the GWP results (and the new World Bank and FAO numbers) tell a positive story at the global level. One clear pattern is that events in the largest developing countries heavily influence any appraisal of global trends, not only because of the obvious influence of their sheer size on global trends, but also because many large countries are characterized by limited food inflation, rapid economic growth, or both. The first of these is not surprising. Large countries are very reluctant to rely heavily on significant food imports and are more likely to impose export restrictions and set aside significant food reserves. For example, China, India, Indonesia, and Vietnam all imposed some restrictions on grain exports in 2007 or 2008, and Nigeria abolished a 100 percent tariff on rice imports (Headey and Fan 2010). Of course, the effect of these attempts to insulate domestic markets on global poverty is ambiguous given that effective trade restrictions by large countries may protect their own poor but may hurt the rest of the world's poor by spurring further international food inflation. Another domestic policy factor that may explain the apparent reduction of food insecurity in some of the larger developing countries is the spread of major social safety net programs in these countries, particularly India's National Rural Employment Guarantee Scheme. However, in addition to these factors, strong economic growth in most of the world's largest developing countries clearly provides a plausible explanation for the largely favorable trends in self-assessed data in these countries.

To examine disposable income issues more explicitly, we deflate nominal economic growth in recent years by changes in the food CPI rather than by an overall price index (as we did in some of the regressions in tables 6 and 7). This indicator is clearly an imperfect indicator of food security because poor people also spend money on nonfood items (but not much on fuel, which is the major source of nonfood inflation) and because mean GDP growth is often not

representative of the income growth of lower income groups. Nevertheless, this crude indicator of "food-disposable mean income" at least indicates whether mean nominal income growth outpaced food inflation.

Figure 2. Nominal average per capita GDP deflated by the food CPI, 2005 to 2008.



Source: The indicator above is nominal GDP per capita between 2005–06 and 2007–08 from the IMF (2011) deflated by food CPI data from the ILO (2011).

Figure 2 plots this indicator for the nine largest developing countries from 2005 to 2008, with Brazilian and Mexican incomes measured on a separate axis because of scaling issues. The results are quite striking. “Mean food-disposable income” rose by over USD 700 per capita in China, over USD 1,800 in Brazil, and over USD 400 in Indonesia. In India, the increase was surprisingly modest (USD 80), but the increase was notably large in Nigeria (USD 240). In Mexico, however, the results are completely reversed, with food-disposable incomes declining sharply in 2007 and especially in 2008, during the so-called “tortilla crisis.” In the other countries, the data show much more modest trends and some general declines in 2008 as food prices rose substantially in Bangladesh, Vietnam, and Pakistan. Although there are variations among these nine countries, it is clear that nominal income growth generally outpaced food inflation in most country-year observations by a large margin in the four most populous countries (China, India, Indonesia, and Brazil).

These results apply to the largest countries, but we can also experiment with predicting changes in self-assessed food security for the entire sample of developing countries based on our regression results. Specifically, we use the growth and inflation coefficients derived in regressions 2 and 4 in table 7 in conjunction with actual growth and inflation rates to predict changes in self-assessed food insecurity over 2006–08. From these regressions, it is clear that economic growth reduces self-assessed food insecurity, whereas the total inflation rate increases it. For the most part, the results in table 7 suggest that these two effects cancel each other out over 2006–08. In one estimate, global food insecurity decreases by 25 million people, and in the other, it increases by 6 million. In other words, the econometric predictions lead to a conclusion that is qualitatively similar to the raw descriptive statistics: a decrease in global self-assessed food insecurity or little or no change overall.

Table 11. Econometrically Predicted Changes in Self-Assessed Food Insecurity over 2006–2008 (Millions of People)

	Predicted change in food insecurity using regression 2 in table 7	Predicted change in food insecurity using regression 4 in table 7
Total predicted change in self-reported food insecurity	−104.5	−152.8
Change due to economic growth	79.4	158.8
Change due to total inflation	−25.1	6.0

Source: Author's calculations based on the GWP (Gallup 2011)
Note: Changes in self-reported food insecurity are estimated by multiplying the coefficients from table 7 by changes in GDP per capita and changes in the total CPI from 2006 to 2008.

<<A>>V. CONCLUSIONS

The innovation of this study is its use of survey-based evidence, rather than simulations, to assess the impact of the food crisis on global and regional food insecurity. We find no evidence that global food insecurity was higher in 2008 than it was in previous years, although it affected many regions, particularly a number of countries in Africa and Latin America. Though qualified by measurement issues, these results are broadly corroborated by recent World Bank estimates of a declining global poverty trend over 2005–08. Our results also cast doubt on the usefulness of simulation approaches in predicting global poverty trends, although the more sophisticated of these approaches are still useful for exploring the mechanisms and distributional impacts of food price impacts in an experimental setting.

Finally, our results raise the question of whether self-assessed indicators might be a useful addition to existing food security metrics. Further research is needed in this regard. As we noted in section 2, self-assessed indicators are susceptible to a number of biases. Nevertheless, these

weaknesses must be traded off against the fact that such indicators are easily, quickly, and cheaply measured relative to household expenditure or consumption data. There are also some potentially significant ways to improve self-reported data. For example, a more disaggregated ordering of self-assessed food security (such as using scales of 0 to 5) might reduce measurement errors. King et al. (2004) also argue for anchoring vignettes to make measurements more comparable across different socioeconomic groups. Another approach might be to ask households to report the frequency of consumption across different groups rather than asking about more subjective feelings of deprivation. Such dietary diversity or food consumption scores have been shown to be strong predictors of household calorie consumption and individual anthropometric outcomes (Wiesmann et al. 2009; Arimond and Ruel 2006) and might capture the fact that reducing dietary diversity is a common means of coping with higher staple food prices (Block et al. 2004). Others have argued for the use of sentinel sites to collect higher frequency measurements of food security and nutrition outcomes (Barrett 2010).

Regardless of the path that is pursued, there are strong grounds for making a large push to improve the measurement of food security. The global food crisis of 2007–08 revealed some significant deficiencies in our capacity to monitor coping strategies and welfare impacts in an acceptable timeframe. Moreover, if strong economic growth had not been prevalent in substantial parts of the developing world prior to and during the food crisis, the impacts of higher food prices might have been far more disastrous. Indeed, predictions of higher food prices and continued price volatility in the next decade or beyond (Headey and Fan 2010) would seem to justify greater investment and experimentation in food security measurement in the near future.

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SUPPLEMENTAL APPENDICES

Contents

SUPPLEMENTAL APPENDIX S1. ADDITIONAL STATISTICS AND ECONOMETRIC RESULTS

Table S1.1—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 S1.2—Estimates of changes in self-reported food insecurity with outliers included

Regression No.	1	2	3	4	5	6
Type of deflator	GDP deflator	Total CPI	Food CPI	GDP deflator	Total CPI	Food CPI
Outliers removed?	Yes	Yes	Yes	Yes	Yes	Yes
Regressor	OLS	OLS	OLS	Fixed effects	Fixed effects	Fixed effects
Economic growth	-0.16**	-0.09*	-0.09*	-0.321***	-0.174*	-0.146
Number of observations	291	275	271	291	275	271
Number of countries	120	112	111	120	112	111
R-square	0.02	0.01	0.01	0.047	0.036	0.025

Sources: Dependent variables are from the Gallup World Poll (Gallup 2011). Economic growth data are from the IMF (2010), and food and total CPI data are from the International Labour Organization ILO (2011).

Notes: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively, and # indicates marginal insignificance at the 10% level. The robust regressions are estimated using the *rreg* command in stata, with default settings. For fixed effects regressions standard errors are adjusted for country clusters. *Economic growth* is the percent change in GDP per capita between the two years in which the GWP surveys were conducted.

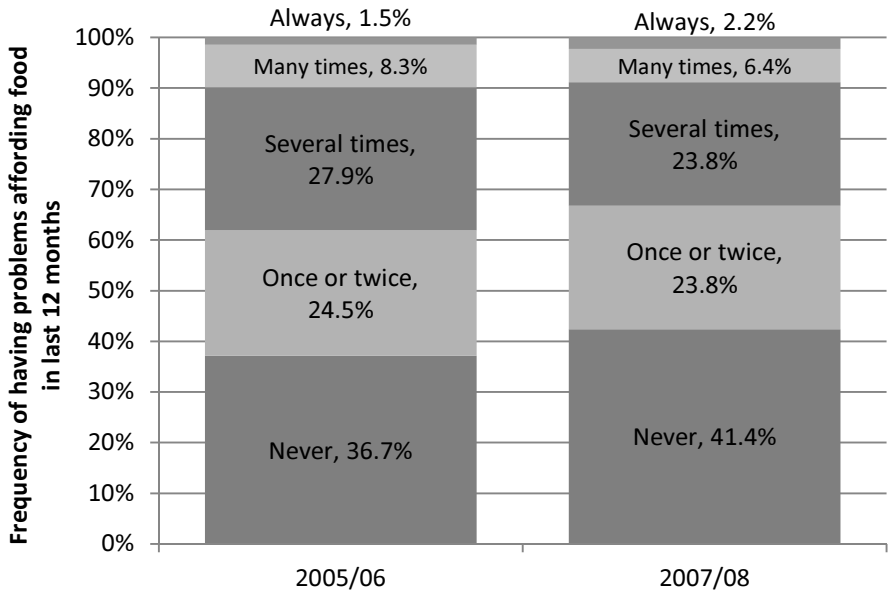
Table S1.3—Countries excluded from the "global" estimates and likely impacts of the 2007/08 food crisis on their food insecurity

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.

Figure S1.1—Population-weighted estimates of changes in the frequency of self-reported food insecurity problems in sub-Saharan Africa: 2005/06 and 2007/08



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

Notes: This figure reports population weighted changes in self-reported food insecurity for 19 sub-Saharan African countries, excluding South Africa. The question is similar to the main question posed in the text, but asks how often there have been difficulties in affording enough food for you or your family to eat over the last 12 months.

SUPPLEMENTAL APPENDIX S2: RAW GALLUP DATA

Table S2.1—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 S2.1—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 S2.1—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 S2.1—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 S2.1—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 S2.1—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 S2.1—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 S2.1—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 S2.1—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 S2.1—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).

SUPPLEMENTAL APPENDIX S3: GALLUP DETAILS

Table S3.1—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 S3.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	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 S3.1—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 S3.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	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 S3.1—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 S3.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	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 S3.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	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 S3.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	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 S3.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	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 S3.1—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 S3.1—Continued

Country	Collection Dates	# of Interviews	Design Effect[a]	Margin of Error[b]	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.