

Food Insecurity and Rising Food Prices: What do we learn from experiential measures?

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Abstract: Throughout many countries in the world, the measurement of food security currently includes accounting for the importance of perception and anxiety about meeting basic food needs. Using panel data from Malawi, this paper shows that worrying about food security is linked to self-reports of having experienced food insecurity, and the analysis provides evidence that rapidly rising food prices is a causal source of the anxiety and experiences of food insecurity. This finding controls for individual-level fixed effects and changes in the economic wellbeing of the individual. A particularly revealing finding of the importance of accounting for anxiety in assessing food insecurity is that individuals report a significant increase in experiences of food insecurity in the presence of rapidly rising food prices even when dietary diversity and caloric intake is stable.

Keywords: Food security, food prices, anxiety, stability, LSMS, Malawi.

JEL Codes: Q18, I30, I32, E31

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1. Introduction

One of the initial definitions of food security, from the 1970s, was simply based on food availability, or more specifically whether aggregate food supply for a country was sufficient for their population.¹ Influenced in part by Sen (1981), and in recognition of the obvious inadequacies of this view, the concept was expanded over the next two decades to include considering whether individuals have resources to gain adequate access to food (FAO, 1983), whether individuals could properly utilize the nutrients in food (e.g. due to factors such as proper hygiene)², and also that the availability, access and utilization of food was stable over time (FAO, 1996).

As the conceptualization of food security broadened, so too did the measures. Much of the empirical analysis of food security has focused on measures of food supply (e.g. food balance sheets),³ food access (e.g. calories and dietary diversity) both at a given point in time and over time.⁴ Analysis based on change over time in the measures of food availability and access have been interpreted as measures of stability of food security.⁵ Stability though, has largely been interpreted as stability in realized outcomes such as food production, caloric intake, and dietary diversity.⁶

¹ First expressed at the 1974 World Food Summit as summarized by Ram et al. (1975).

² The concept of food utilization includes concerns of intra-household distribution of food, nutritional value of food, and nutrient absorption (Jones et al. 2013; Barrett 2010). Expanding the definition to include utilization acknowledges that two households, consuming the same amount of calories per capita, may actually look markedly different in terms of food security status.

³ For an overview, including discussion of food availability measures, see Jones et al. (2013).

⁴ World Bank (1986) was one of the earlier reports to measure the stability of availability and access to food (as measured by food supply and caloric intake) over time.

⁵ First differences in these measures have also been used to separate chronic from transitory food insecurity.

⁶ See for example, D'Souza and Jolliffe (2014), Jolliffe, Sharif, Gimenez (2013), Schmidhueber and Tubiello (2007), and Wheeler and von Braun (2013) as examples of examining the time stability of food availability and access as measured by food production, calories and dietary diversity.

In this paper, we examine a broader conceptualization of security that treats perceptions of security, and absence of anxiety about insecurity, as also being reflective measures of stability of food security. This notion of insecurity as being linked to anxiety and perceptions is neither new nor innovative. In the U.S., the distinction between someone who is identified as having “high food security” status and “marginal food security” status is most typically identified by whether the person reported experiencing anxiety over food sufficiency (or expected food sufficiency).⁷ The Food Insecurity and Experience Scale (FIES) is now used by the Food and Agriculture Organization (FAO) in nearly 150 countries covering 90 percent of the World’s population, and the first question in this instrument is whether the respondent worried whether they would have sufficient food to eat.

What we aim to illustrate in this paper is that stated anxiety about food security is closely linked to perceptions of food insecurity status (suggesting that worrying about food security can itself be viewed as insecurity or as reflecting a lack of stability in food security status). This supplements the evidence base that anxiety is a useful partial indicator of food insecurity. The analysis in this paper also reveals that stated experiences of food insecurity need not be associated with realized deprivations in food access as measured by calories and dietary diversity.⁸ Our inference from this finding is that experiential measures contain important signal about food insecurity status that is not conveyed in measures of access and availability (such as calories and dietary diversity). Another inference from our finding is that

⁷ In 2006, The U.S. Department of Agriculture revised their labels for different states of food security (e.g. high, marginal, low and very low food security) based on recommendation of the Committee on National Statistics (National Research Council, 2006) in order to distinguish the physiological state of hunger from other indicators of food security.

⁸ This finding aligns with the literature on armed conflict, in which it is well recognized that various measures of safety and security do not correlate well with perceptions of safety and security, and are sensitive to the finding that statistical improvements in safety and security may not directly improve perceptions of safety and security (Rigterink, 2015).

rising food prices, whether or not they have direct adverse effects on calories and diet, lead to increased anxiety about meeting food needs. The next section of this paper proceeds by discussing the panel data used in this analysis and a descriptive profile of food security status in Malawi. Section 3 discusses the regression model used to examine the connection between rising food prices and the experiential measures of food security status, and section 4 provides some concluding discussion.

2. Data and Country Context

2.1. Data

This paper makes use of two waves of panel survey data, representative at national and subnational (rural/urban) levels. The first wave was carried out from March to November of 2010. This wave is a sub-sample of the Third Integrated Household Survey 3 (IHS3), which is part of the Living Standards Measurement Study - Integrated Surveys on Agriculture (LSMS-ISA) project in Malawi. The second wave was fielded from March to November of 2013 as part of the Integrated Household Panel Survey (IHPS). The panel element of the survey was designed such that individuals (not households) were followed between waves. Therefore, the IHPS sample includes 4,000 households that can be traced back to 3,104 baseline households from IHS3. After restricting to individuals for which all variables are non-missing, our final analysis is carried out on a sample of 10,907 individuals.

We construct three measures of access to food insecurity: daily per capita caloric intake, undernourishment, and the food consumption score (FCS)⁹, which captures dietary diversity¹⁰. Data on caloric intake comes from a 7-day recall module on household-level food consumption; undernourishment is a binary outcome indicating whether an individual consumes less than 2,100 calories/day. In addition to standard survey modules on household characteristics, assets, income, and consumption, the survey contains a module on experiential assessment of food security. This module includes several questions which ask whether households have experienced food insecurity at least once in the last 12 months (*In the last 12 months, have you been faced with a situation when you did not have enough food to feed the household? When did you experience this incident in the last 12 months?*) or worried about food in the last 7 days (*In the past 7 days, did you worry that your household would not have enough food?*).

To our core survey data, we merge in an external food price dataset that forms part of the Agricultural Market Information System (AMIS) collected by the Planning Department of Malawi's Ministry of Agriculture and Food Security (MoAFS). Price data is collected weekly from 72 markets located in Malawi's 26 districts, and aggregated to the monthly level. We focus on maize as the predominant crop (grown by approximately 98 percent of rural households) in Malawi. The IHS3 panel and IHPS households are geo-referenced allowing us

⁹ The FCS takes into account dietary diversity, frequency of food groups consumed, and relative nutritional value of each food group consumed in the last 7 days (FAO 2008). The potential score range is 140. The higher the FCS, the better the diversity of the household's food intake and, subsequently, the better the quality of the members' diets. In categorizing households, those with scores less than 21 are determined to have "poor" dietary diversity; those falling between 21 and 35 are said to be in a borderline range; and those with scores above 35 are considered to have acceptable levels of dietary diversity (Weismann and others 2009).

¹⁰ Dietary diversity is a concept that captures the degree to which households or individuals consume a variety of foods. Along with caloric intake and undernourishment, dietary diversity can help generate a greater understanding of a population's food insecurity (Ruel 2003). Research also suggests that dietary diversity can be used as a proxy for household income, household level access to food, macronutrient, and micronutrient intake (see Hatloy et al. 2000; Anzid et al. 2009; Hoddinott & Yohannes, 2002; Rah et al. 2010).

to map households to food prices found at the closest markets. In this way, we can measure changes on maize prices households faced in the 12 months leading up to their survey date.

2.2 Context

Malawi is among the poorest countries in the world, with limited resources and an economy relying heavily on single-crop maize agriculture. Maize is by far the most important staple crop, both in terms of the number of farm households cultivating this crop (approximately 96 percent of rural households) and in terms of total area harvested in the country (Dabalén and others, forthcoming 2016). Maize also accounts for more than 50 percent of the daily calorie intake in Malawi (Minot 2010).

The population amount to 17.2 million, and about 80 percent lives in rural areas. GNI Per capita (Atlas method) is US\$ 350 as of 2015¹¹ and 71 percent of the population lives on less than US\$ 1.90 per day (2011 PPP prices) as of 2010. Malawi is relatively small in size and densely populated, and has high population growth, which pose pressure on available land for smallholder farming and on the environment and the natural resource base. (World Development Indicators, accessed October 2016).

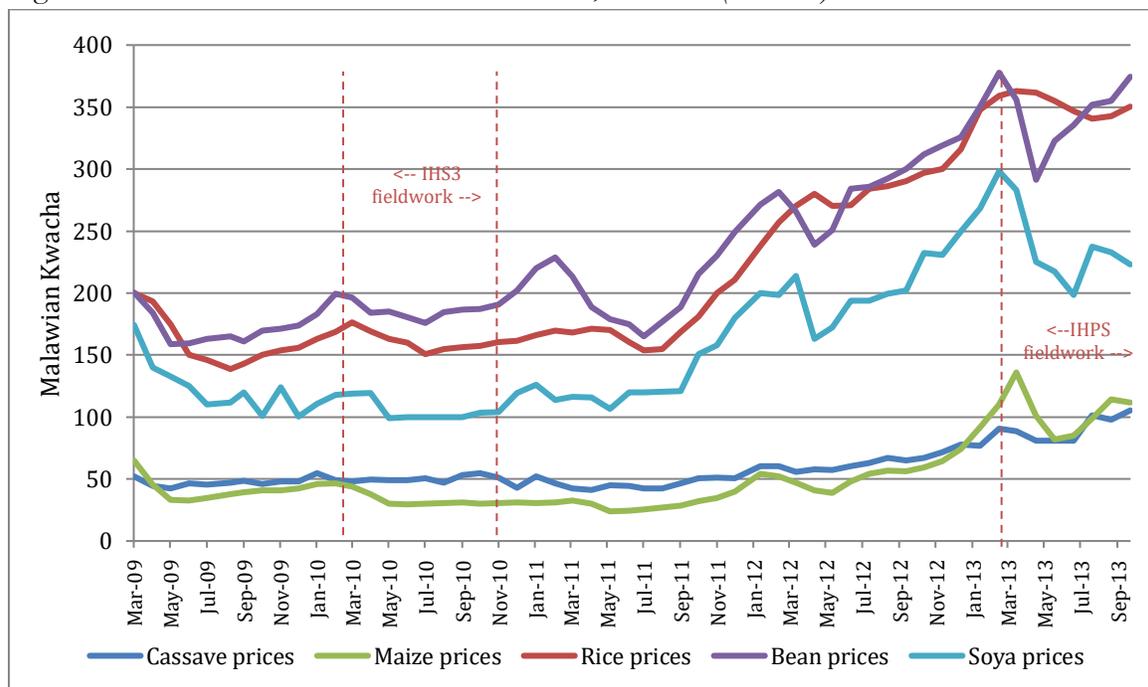
Such precarious conditions are compounded by the country's high and recurrent exposure to drought, floods and food price shocks. Compared to other SSA countries, food prices in Malawi are highly variable and subject to spikes, with maize prices being the most variable (see Christiaensen and others 2015). Between 2000 and 2014, the inflation rate in Malawi (15.4 percent) was 2.5 times higher than the Sub-Saharan Africa regional average (6.1 percent).

The latest episode of a food price surge in Malawi took place between late 2012 and

¹¹ WDI; Current US\$, 2015

2013. Figure 1 presents monthly price data from 2009 to 2013 for staple foods from 72 markets across Malawi. The price of maize hovered at approximately 40 Kwacha/kg–50 Kwacha/kg between May 2009 and November 2011. Beginning in 2012, the price of maize began to climb slowly. Then, between November 2012 and March 2013, the unit price more than doubled, jumping from 64.3 Kwacha/kg to 136 Kwacha/kg. Other food staples experienced similar spikes in the market. From March 2009 to July 2011, the price of beans vacillated between 165 Kwacha/kg and 228 Kwacha/kg. However, over the next 21 months, the price slowly rose to peak at 377.7 Kwacha in March 2013.

Figure 1. Rise in Median Food Prices in Malawi, 2009–13 (*Kwacha*)



Source: Authors based on the Agricultural Market Information System (AMIS) from the Ministry of Agriculture and Food Security

Palacios-Lopez et al. (2016) estimate that at least 50 percent of households in Malawi are net-buyers of food (of which approximately 54 percent of the poorest households are net-

buyers of food), suggesting adverse food-price effects for many people in Malawi. However, the extent to which food price increases may affect people's access to food¹² depends on a larger number of factors beyond the distribution of net sellers and net buyers of food staples. These include the rate at which national prices are passed through to local economies, the specific commodities for which prices increase, the ability of consumers to substitute into other less expensive food items, the coping strategies available to households, and the policy responses by governments.

Nationally, average per capita caloric intake remained largely unchanged between 2010 and 2013, at 2,260 and 2,314 calories per day, respectively (see table 1). The prevalence of undernourishment (as measured by calorie deficiency) also remained intact during this period (in fact it fell slightly, but the decline was not statistically significant). While we observe no change in food security as measured through calorie-based indicators, we find slight improvements in individuals' dietary diversity between 2010 and 2013. Table 2 shows there was a slight increase in the raw value of the FCS from 48.6 in 2010 to 50.5 in 2013. The data also reveal an improvement in the distribution of FCS between waves. At the national level, the prevalence of 'poor' or 'borderline' FCS decreased from 26 to 19 percent; this same statistically significant trend is found separately in urban and rural areas.

¹² Typically, food access is measured using caloric intake; 2,100 calories per capita is widely accepted as the threshold for sufficient daily intake (World Food Programme 2005).

Table 1. Trends in caloric intake and undernourishment

	Round 1 – 2010	Round 2- 2013
Panel A: Daily per capita caloric intake		
<i>National</i>	2,260 (33.8)	2,314 (37.4)
<i>Urban</i>	2,531 (82.6)	2,530 (85.2)
<i>Rural</i>	2,211 (37.5)	2,273 (41.4)
Panel B: Undernourished prevalence		
<i>National</i>	0.535 (0.025)	0.510 (0.016)
<i>Urban</i>	0.435 (0.028)	0.421 (0.034)
<i>Rural</i>	0.554 (0.017)	0.527 (0.017)

Note: Standard errors in parentheses corrected for two-stage sampling design. None of the changes in the prevalence of undernourishment between two waves is statistically significant.

Table 2. Trends in dietary diversity

	Round 1 – 2010 (SE)	Round 2- 2013 (SE)
Panel A: Raw food security score (FCS)		
<i>National</i>	48.59 (0.69)	50.52*** (0.59)
<i>Urban</i>	61.59 (1.84)	63.71 (1.22)
<i>Rural</i>	46.27 (0.72)	48.01*** (0.62)
Panel B: Poor or borderline FCS		
<i>National</i>	0.263 (0.015)	0.188*** (0.014)
<i>Urban</i>	0.096 (0.024)	0.039*** (0.008)
<i>Rural</i>	0.293 (0.016)	0.216*** (0.016)

Notes: Standard errors in parentheses corrected for two-stage sampling design. Asterisks on the round 2 estimates indicate that the change in prevalence of undernourishment between two waves is statistically significant (*p<0.10, ** p<0.05, ***p<0.01).

The absence of an impact from high food prices on conventional measures of food security does not necessarily mean the absence of a problem. Despite no change in calories and a small improvement in dietary diversity between 2010 and 2013, trends in experiential measures paint a picture of significant decline in food security. Household respondents were asked whether they experienced food insecurity at least once in the previous 12 months (Table 3, Panel A) and, if so, they provide a count of months during which they experienced this insecurity (Table 3, Panel B). Nationally, experiential food insecurity increased 27 percent, going from 52 percent in 2010 to 66 percent in 2013. This increase is found in both rural and urban areas, and is particularly pronounced in urban areas, where the proportion of households reporting food insecurity increased approximately 50 percent. The duration of experiential food insecurity also increased between 2010 and 2013: The average number of food insecure months rose from 1.6 to 2.2 at the national level. The increase in both prevalence and duration of experiential food insecurity from 2010 to 2013 suggests that, despite modest improvement in measures of access to food, people state that they are more food insecure.

Table 3. Trends in experiential measures of food security

	Round 1 – 2010	Round 2- 2013
<i>Panel A: Self-reported food insecurity, last 12 months</i>		
<i>National</i>	0.518 (0.015)	0.664*** (0.014)
<i>Urban</i>	0.353 (1.84)	0.526*** (0.030)
<i>Rural</i>	0.548 (0.017)	0.690*** (0.016)
<i>Panel B: Number of months food insecure, last 12 months</i>		
<i>National</i>	1.55 (0.07)	2.17*** (0.07)
<i>Urban</i>	0.81 (0.08)	1.44*** (0.10)
<i>Rural</i>	1.69 (0.08)	02.30*** (0.08)

Notes: Standard errors in parentheses corrected for two-stage sampling design. Asterisks on the round 2 estimates indicate that the change in prevalence of undernourishment between two waves is statistically significant (* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$).

This surge in experiential food insecurity was accompanied by an increase in self-reported exposure to food price shocks. Interviewed households were asked to indicate the presence of food price shocks in the 12 months leading up to the survey. While only 26 percent of households in 2010 reported facing a significant increase in food prices during the previous 12 months, a staggering 83 percent of households reported facing this shock in 2013. In the urban South, approximately 93 percent of households reported experienced a food price shock, more than 6 times the percentage of households in 2010.

In summary, the descriptive statistics indicate that despite escalating food prices in late 2012-2013, Malawian households appear to be food secure in all measures of availability, access, and utilization over the study period and yet, they report both worrying more about food security and state that they are experiencing food insecurity more frequently. The next section explores in more detail the association between food price surges and the increased

worries and anxiety of households to meet their food needs. The primary hypothesis examined is that the dramatic increases in food prices make households feel as though their food security is unstable, despite no change in their actual levels of consumption.

3. Methodology and Results

3.1. Model specification

The descriptive statistics suggest a story of food prices creating anxiety about food security for individuals and this anxiety is reflected in more frequent experiences of food insecurity. But the descriptive statistics are primarily formed by comparing the cross-sectional trends observed in the averages (and, in some cases, the mass in lower tails) of objective and experiential measures of food insecurity from 2010 to 2013. It is of course possible that the skewness of these distributions are changing in such a way that mean changes of the overall distributions are not reflective of average changes experienced by individuals. Similarly, as with all bivariate comparisons, it is also possible that there are important confounding factors that are omitted from the descriptive discussion.

To address these concerns, we leverage the panel aspect of the IHS to examine change over time at the individual level (rather than changes in the overall distribution). We also control for potential, key confounding factors that are observable and sweep away essentially all time-invariant individual-level factors with the fixed-effects estimator.¹³ As dependent variables in our model specifications, we estimate change in the binary indicators for worrying about food in the last 7 days, experiencing food insecurity in the last 12 months, and also for the count of these months.

¹³ We considered a random-effects estimator, but results from a Hausman test led us to reject an assumption of independence between the omitted variables and those in the model, suggesting that for this model specification, a random-effects estimator is biased.

There are many idiosyncratic reasons that two individuals who look the same with respect to objective measures of food security (that is, they have similar levels of dietary diversity and caloric intake), may provide different responses to an experiential question on food security. For example, some individuals are inherently more nervous or risk-averse and are therefore more inclined to self-identify as food insecure. The fixed-effects estimator controls for these types unobserved factors that are unique to individuals (thus reducing concerns of omitted variable bias).

The fixed-effects regression can be expressed as follows:

$$Y_{it} = \beta_{0i} + \beta_1 X_{it} + \varepsilon_{itc}$$

where Y_{it} is the set of experiential food security measures for individual i in time period t described above, X_{it} is a vector of independent variables containing time-varying controls and measures of price variability and/or price shifts occurring in the last 12 months, β_1 represents the marginal effects of each independent variable on food insecurity, and ε_{itc} is the error term clustered (indicated by c) at the level of the enumeration area (EA).

We are interested in examining the hypothesis that increasing food prices alone increase anxiety about food security and reported exposure to food insecurity. To assess this, we include in our set of controls in X_{it} objective measures of food security status (ie. FCS and daily per capita caloric intake). If anxiety is due to these factors alone, then food prices should have no additional effect. Throughout the analysis, we use maize prices as our proxy for food prices. Maize accounts for more than 50 percent of households' caloric consumption and so fluctuations in maize prices directly affect the majority of the

population (Minot 2010). Panel weights are used to make the results representative of the national population of Malawi.

3.2 Results

Table 4 shows the model estimates from predicting our three outcomes of experiential food insecurity: a dichotomous indicator of food insecurity in the last 12 months, a count of the number of months experiencing food insecurity in the last 12 months, and a dichotomous measure of worrying about food in the last 7 days. For all models, we present the fixed-effect OLS estimates. For the binary outcome models, we also present fixed-effects logit estimates and for the count model, we report estimates from a fixed-effects Poisson estimator. The Logit estimator has the advantageous attribute that it bounds the fitted values between zero and one, and the Poisson estimator similarly is meant to better account for the clumping associated with count variables.

Marginal effects are only presented for the OLS regressions and thus coefficients for a given covariate and outcome are only across the OLS specifications. For the other models though, the signs and significance of each coefficient can be compared.¹⁴ Daily per capita caloric intake and annual per capita expenditure have no significant effect on experiential food security, i.e. an increase in caloric intake does not make one feel more food secure, and vice versa. Logically, FCS is negatively predictive of experiential food insecurity, though the magnitude of the effect is miniscule; a one-unit increase in FCS reduces the probability of experiencing food insecurity in the last 12 months by less than 1 percent. Maize price levels also have a significant, but minimal impact on experiential food security.

¹⁴ Although the logit and Poisson models are better fits for our outcomes of interest, we cannot estimate marginal effects using these models when controlling for individual fixed effects. Therefore, we estimate marginal effects from OLS regression outputs in order to assist in interpreting the coefficients.

The greatest predictor of experiencing food insecurity, in any of the three dimensions, is facing an increase in the inflation rate of maize prices over the last 12 months. A one-unit increase in the inflation rate of maize prices increases the probability of experiencing food insecurity over the last 12 months, or of worrying about food in the last 7 days, by 8 and 6 percent, respectively. Individuals who face a one-unit increase in the rate of inflation of maize prices experience an additional 0.4 months of food insecurity, on average. While a one-unit increase in the inflation rate of maize between waves may seem large, it is precisely the magnitude of change experienced on average (see Table A1 in the Appendix). At the national level, the inflation rate of maize prices increased from -9.0 percent in 2010 to 98.7 percent in 2013 – this is a first difference increase of 1.077.

Table 5 presents results by rural and urban status. This disaggregation shows that while changes in FCS and base maize price levels are predictive of experiential food insecurity in rural areas, the same is not true in urban areas. However, while increases in the inflation of maize prices are significant predictors of all three outcomes in both urban and rural areas, the magnitude of the effect is substantially higher in urban areas. For example, a one-unit increase in the maize inflation rate increases the likelihood of worrying about food in the last 7 days by 5.3 percent in rural areas; in urban areas, the likelihood is increased by 14 percent.

Table 4. Food-price inflation and experiential food insecurity, controlling for individual-level fixed effects

	Food insecure in the last 12 months		Months of food insecurity in the last 12 months		Worried about food in the last 7 days	
	Logit	OLS	Poisson	OLS	Logit	OLS
Maize price 12 months ago (month 1)	0.021*** (0.006)	0.004*** (0.001)	0.010*** (0.003)	0.016*** (0.005)	0.022*** (0.008)	0.004*** (0.001)
Change in inflation rate of maize (past 12 months)	0.455*** (0.118)	0.082*** (0.016)	0.226*** (0.041)	0.378*** (0.075)	0.332** (0.149)	0.060*** (0.021)
Dietary diversity (Food Consumption Score)	-0.013* (0.007)	-0.002** (0.001)	-0.011*** (0.003)	-0.018*** (0.004)	-0.019*** (0.006)	-0.004*** (0.001)
Daily per capita calorie consumption (thousands)	-0.068 (0.099)	-0.019 (0.013)	0.066* (0.040)	0.039 (0.047)	-0.011 (0.075)	-0.009 (0.011)
Annual per capita expenditure (Kwacha)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Number of observations	6,904	17,734	12,988	17,734	6,780	17,734
Adjusted R ²	0.126	0.067	na	0.073	0.100	0.055

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

Notes: All models control for individual fixed effects and observations are weighted to be representative of the population. Standard errors are presented in parentheses. The models in columns (i) and (v) are estimated using a fixed-effects logit estimator, the model in column (iii) is estimated using a fixed-effects Poisson estimator; and the models in columns (ii), (iv), and (vi), are estimated using fixed-effects OLS. The magnitudes of the coefficients for a given indicator and outcome are not directly comparable across models as marginal effects are only presented for fixed-effect OLS. Panel sampling weights were rescaled to sum to the number of observations in the data and are treated as importance weights in Stata. Standard errors in columns (i), (iii), and (v) are calculated using the jackknife method, clustered at the EA level. Standard errors in columns (ii), (iv), and (vi) are clustered at the EA level.

Table 5. Food-price inflation and experiential food insecurity by area, controlling for fixed effects

	Food insecure in the last 12 months (se)		Months of food insecurity in the last 12 months (se)		Worried about food in the last 7 days (se)	
	Urban	Rural	Urban	Rural	Urban	Rural
Maize price 12 months ago (month 1)	0.003 (0.004)	0.003*** (0.001)	0.008 (0.008)	0.017*** (0.005)	0.005** (0.003)	0.004*** (0.001)
Change in inflation rate of maize (past 12 months)	0.124 (0.078)	0.079*** (0.016)	0.495*** (0.164)	0.371*** (0.077)	0.140*** (0.051)	0.053** (0.022)
FCS	0.003 (0.003)	-0.003*** (0.001)	-0.002 (0.005)	-0.019*** (0.005)	-0.001 (0.001)	-0.004*** (0.001)
Daily per capita calorie consumption (thousands)	-0.061*** (0.020)	-0.006 (0.016)	-0.037 (0.034)	0.083 (0.062)	-0.002 (0.021)	-0.010 (0.014)
Annual per capita expenditure (Kwacha)	0.000 (0.000)	-0.000* (0.000)	0.000 (0.000)	-0.000* (0.000)	0.000 (0.000)	-0.000 (0.000)
Number of observations	4,609	16,788	3,174	16,788	4,609	16,788
Adjusted R2	0.104	0.066	0.094	0.074	0.154	0.048

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

Notes: All models control for individual fixed effects and are estimated using OLS regressions. Observations are weighted to be representative of urban and rural areas. Standard errors (in parentheses) are clustered at the EA level.

4. Conclusion

The perceptions that maize inflation may compromise the ability of households to meet their food needs matter in their own right. Being exposed to food price surges is welfare-damaging per se, as it unsettles people's 'peace of mind'. There is an important strand of literature on subjective wellbeing in developing countries that recognizes that household's livelihoods have interlocking dimensions of subjective and objective welfare. Narayan et al. (2002) suggest that "From poor people's perspectives, ill-being or bad quality of life is much more than just material poverty [...] It is compounded by insecurity in the sense of lacking both protection and peace of mind."¹⁵ Qualitative research in 17 countries between 2008-2011 on the impact of the food price crisis (along with the fuel and financial crises) found high levels of stress, anxiety, and even trauma resulting from inability to provide adequate food for the family reported nearly in all interviewed communities (Heltberg and others 2012).¹⁶

In addition to capturing psychological dimensions, the experiential indicators of food insecurity can reveal shifting household behaviors in responses to food price shocks. Those that feel insecure with increasing food prices, despite no decline in food consumption or caloric intake, may be revealing information about their coping strategies. But these coping strategies may put them at increased risk for future bouts of food insecurity. This is because, the coping strategies employed by the poor (selling productive assets like land or implements) are typically put them at an even greater disadvantage in the future (Barrett 2002).

15 Narayan, Deepa, Raj Pattel, Kai Schafft, Anne Rademacher, and Sarah Koch-Schulte. 2002. "Voices of the Poor. Can Anyone Hear Us?" Oxford: Oxford University Press.

16 Heltberg, R., N. Hossain and A. Reva. 2012. "Living Through Crises. How the Food, Fuel and Financial Shocks Affect the Poor." World Bank. Washington, DC

Having worries and anxiety over food needs can also have negative implications on health. Ample evidence exists that psychological stress is associated with increased cardiovascular risk factors, such as hypertension and insulin resistance, and with outcomes such as ischaemia, arrhythmia, and pump failure (Rozanski and others 1999, Brotman and others 2007).¹⁷

The analysis of food security often adopts food consumption scores and daily caloric intake as the measures by which food security is assessed. However, this paper finds good reasons to broaden the measure of food security to encapsulate people's perceptions when facing food needs. Increasing food prices were found to heighten people's worries to meet their food needs. Often times the association between household food consumption scores and daily caloric intake and personal perceptions obtained when characterizing food security is weak. Because of a poor self-perceived food security status, many households in Malawi considered less likely to experience food insecurity between 2010 and 2013 under common metric standards instead expressed much higher levels of vulnerability. In other words, episodes of experiential food insecurity were not relieved by a stable performance in daily caloric intake.

Food insecurity stems not only from having low daily caloric intake and poor access to food, but also from the fear of being unable to feed one's children or the insecurity from not knowing where the next meal will come given an over-exposure to high food prices. Such worries can plunge families further into physical illbeing or further deprivation, as

17 Alan Rozanski, James A. Blumenthal and Jay Kaplan. 1999. "Impact of Psychological Factors on the Pathogenesis of Cardiovascular Disease and Implications for Therapy." *Journal of the American Heart Association*. Daniel J Brotman, Sherita H Golden, Ilan S Wittstein. 2007. The Cardiovascular Toll of Stress. *The Lancet*: Vol. 370: 1089–100.

families usually end up using their few assets to cope with them. In addition, being exposed to risk is welfare-damaging per se, as it unsettles their 'peace of mind'. Acknowledging experience-based measures in the conceptualisation and measurement of food security is therefore important for practical and intrinsic reasons.

Rather than reinforcing caloric intake as the main measure of food security, emphasis should be placed on a wider vector of outcomes, including households' self-assessment of their ability to secure food needs, potentially susceptible to damage when struck by food price shocks. Acknowledging experience-based measures that can capture the psychological dimension of food insecurity relating to worries and anxiety over food needs and anticipate erosive coping strategies is therefore important for practical and intrinsic reasons.

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APPENDIX

Table A1. Descriptive stats for panel sample

	Round 1 – 2010 (SE)	Round 2- 2013 (SE)
Food insecure in last 12 months	0.524 (0.020)	0.663 (0.020)
Months of food insecurity in last 12 months	1.544 (0.088)	2.185 (0.106)
Worried about food in last 7 days	0.271 (0.019)	0.374 (0.021)
Maize price twelve months ago	41.046 (1.166)	53.442 (1.084)
Inflation rate of maize prices over last 12 months	-0.090 (0.028)	0.985 (0.061)
Food consumption score	47.203 (0.960)	49.112 (0.908)
Daily per capita calorie consumption (thousands)	2.233 (0.045)	2.315 (0.048)
Annual per capita expenditure (Kwacha)	130,349 (6,888)	135,557 (5,622)
Observations	8,835	8,835

Notes: Descriptive statistics provided for panel sample included in fixed effects OLS regressions presented in Table 4. This includes individuals interviewed in both waves for which none of the variables included in the regression are missing. Observations are weighted to be representative at the national level. Standard errors are clustered at the EA level.

Table A2. Descriptive stats for panel sample, rural and urban

	Urban in both rounds		Rural in both rounds	
	Round 1 (SE)	Round 2- (SE)	Round 1 (SE)	Round 2- (SE)
Food insecure in last 12 months	0.365 (0.046)	0.517 (0.050)	0.549 (0.022)	0.680 (0.022)
Months of food insecurity in last 12 months	0.767 (0.101)	0.118 (0.118)	1.659 (0.095)	2.294 (0.118)
Worried about food in last 7 days	0.139 (0.025)	0.366 (0.035)	0.287 (0.021)	0.373 (0.023)
Maize price twelve months ago	40.414 (0.722)	60.285 (1.794)	41.115 (1.330)	52.323 (1.170)
Inflation rate of maize prices over last 12 months	-0.074 (0.069)	0.719 (0.059)	-0.094 (0.031)	1.033 (0.068)
Food consumption score	59.265 (1.494)	62.517 (2.255)	45.431 (0.937)	47.104 (0.883)
Daily per capita calorie consumption (thousands)	2.487 (0.168)	2.541 (0.219)	2.189 (0.046)	2.274 (0.049)
Annual per capita expenditure (Kwacha)	249,586 (49,643)	199,283 (37,622)	114,161 (4,497)	124,586 (4,430)
Observations	1,576	1,576	6,942	6,942

Notes: Descriptive statistics provided for panel sample included in fixed effects OLS regressions presented in Table 4. This includes individuals interviewed in both waves for which none of the variables included in the regression are missing. Additionally, ‘urban’ and ‘rural’ subsamples are restricted to individuals who are either urban or rural in both rounds; individuals who change urban/rural status between rounds are excluded. Observations are weighted to be representative at the urban and rural levels. Standard errors are clustered at the EA level.

Figure A. Duration of subjective food insecurity

