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Generating evidence on individuals' experience of food insecurity and vulnerability

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ABSTRACT

Many indicators of food security and vulnerability are reported at the household level, preventing policymakers from identifying how differences among individuals within the household affect individual food security and vulnerability. Using examples from three recent studies from Uganda, Bangladesh, and Ethiopia, the paper illustrates how using individual – rather than household-level measures allows a better understanding of three dimensions of food security: agricultural productivity, impacts of development interventions on well-being, and coping mechanisms in response to shocks. It then discusses methods to elicit information on individual experiences of food security and vulnerability, including the use of measures of gender disaggregation that go beyond headship, the use of individual measures of well-being, and modifications of household level questions on coping mechanisms.

1. Introduction

Although hunger and deprivation are intrinsically experienced by *persons*, many indicators of food security and vulnerability are reported at the household level. While cost and complexity considerations may lead policymakers to use household-level indicators of hunger and food insecurity such as the Household Hunger Scale (Deitchler et al., 2011), the exclusive reliance on household-level indicators prevents a closer look at how differences among individuals within the household—whether due to sex, age, or status within the household—affect individual food security and vulnerability.

The debate regarding the usefulness of household vs. individual-level measures of food insecurity mirrors an earlier debate regarding the measurement of well-being. According to Haddad and Kanbur (1990), policymakers often argue that individual wellbeing can be equated with the average (or per adult equivalent) well-being of the household to which the individual belongs, based on the assumption that household resources are pooled, and then allocated according to need. The authors illustrate empirically that neglecting intrahousehold inequality substantially understates levels of inequality and poverty. Accumulating empirical evidence from developed and developing countries rejects the unitary model of the household, in which household resources are pooled, and household decision-makers share the same preferences. Instead, there is growing consensus that a collective model of the household is more relevant—a model in which individuals within households do not necessarily share the same preferences, pool resources, nor have equal bargaining power over their allocation to individual members (Behrman, 1997; Haddad et al., 1997). Yet, despite growing evidence in support of the collective model of household decision-making, the information base on food security—particularly on agricultural productivity and food production—still depends heavily on household-level indicators. This is not to say that data on individual (age and sex-specific) welfare outcomes do not exist. Indicators of human capital outcomes are routinely collected at the individual level, such as anthropometric indicators for nutrition surveillance and monitoring, enrollment data to track investments in human capital by age and sex, and mortality indicators, capturing the opposite extreme of well-being.[1] It is rare, however, that these individual-specific data on human capital outcomes are linked to production data for the same household.

This paper uses examples from three recent studies from Uganda, Bangladesh, and Ethiopia to illustrate how using individual—rather than household-level measures gives policymakers a better understanding of three dimensions of food security: agricultural productivity, impacts of development interventions on well-being, and coping mechanisms in response to shocks. In particular, the availability of individual-level data allows us to test hypotheses about the extent to which differences across individuals within the

[1] See, for example, Baird et al. (2011), who examined the impact of aggregate income shocks on infant mortality in developing countries. Showing a large negative association between per capita GDP and infant mortality, the authors also find that female infant mortality is more sensitive than male infant mortality to negative economic shocks.

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household affect food security outcomes. In Uganda, Peterman et al. (2011) show how using only a household-level indicator of gender differences (the sex of the household head) tends to underestimate gender differences in agricultural productivity. In Bangladesh, evidence from an evaluation of the long-term impact of agricultural technologies suggests that using individual health and nutrition outcomes as criteria for ranking anti-poverty interventions would lead to different conclusions compared to those based on household-level monetary indicators alone (Kumar and Quisumbing, 2011). In Ethiopia, Kumar and Quisumbing (2013) show how focusing only on household-level coping mechanisms may obscure differential impacts of shocks on household members by age and sex. The paper ends by discussing a variety of methods to elicit information on individual experiences of food security and vulnerability, ranging from the use of finer levels of gender disaggregation that go beyond headship, the standard use of individual measures of well-being (such as nutritional status), and modifications of household level questions on coping mechanisms to take into account differences that arise owing to age and sex within the household.

2. Individual vs. household indicators of agricultural productivity in Uganda

There is marked interest in the sources and consequences of agricultural productivity differences between male and female farmers, particularly in sub-Saharan Africa (SSA), with female farmers consistently showing lower yields. In the absence of data on inputs and outputs at the plot level, one could surmise that women are less efficient than men in agricultural production. However, reviews of the microeconomic empirical evidence on male–female differences in agricultural productivity (Quisumbing, 1996; Peterman et al., 2010) have found that productivity differences can partially be explained by lower input application on women's vs. men's plots. While one solution might be to increase input application, this is clearly a simplistic solution, because we still do not fully understand why inputs are lower on women's plots, given that farmers do choose the type and amount of inputs to apply, how inputs can realistically be increased, since women typically have greater difficulty obtaining access to credit, and how cultural and contextual factors affect the division of labor and resource allocation to men's and women's plots. Most empirical studies (with notable exceptions) also focus on one crop, thereby neglecting multi-crop farming systems in much of SSA; use sex of household head as the indicator for capturing gender differences, neglecting crop cultivation by males and females within the same household; and have relatively small sample sizes. Finally, because good quality data at the plot level are rare, studies are difficult to replicate.

The use of a household level indicator such as sex of the household head as a proxy for gender differences within the household is typical of this literature, and with few exceptions, studies do not undertake sensitivity analyses regarding the choice of gender indicator. One exception is a paper by Doss and Morris (2001) which points out that using the sex of the farmer allows for examination of female farmers in both male- and female-headed households. This is significant because, as Bourdillon et al. (2002) point out, even in female-headed households of rural Zimbabwe, men (such as adult sons) are expected to make agricultural decisions. Moreover, even among female-headed households, the reason that one became female-headed—whether due to widowhood, or whether the husband is a migrant—may have significant implications for decisionmaking ability as well as levels of well-being. Because sex of household head is not always a perfect indicator of female control over resources or decision-making, there is a need for more studies that conduct sensitivity analysis between measures of female management and female headship.

Peterman et al. (2011) provide new estimates of gender differences in agricultural productivity using household survey data from Uganda (2003) covering 2700 plots in 851 households, collected by the International Food Policy Research Institute (IFPRI). In addition to information about the sex of the household head, the data also include the sex of the owner of each plot, by crop, and also allows for mixed ownership. The authors use multivariate tobit models to model productivity differences, controlling for socioeconomic indicators, agricultural inputs, crop choice, access to markets, and biophysical plot characteristics. The authors also conduct robustness checks for alternative definitions of the variables, such as the percentage of land managed by women, and excluding polygamous households. Similar to previous studies, the authors find that productivity is lower for female-managed crops when all crops are pooled, and also lower for sweet potato and sorghum (but not for other crops). They also find that estimates of productivity differences are sensitive to the choice of gender indicator: the extent of the estimated productivity differential is *smaller* when headship is used as stratifying variable.[2]

Further results from the Uganda analysis suggest that, controlling for other factors plot-level productivity is lowest among crops with mixed gender ownership, suggesting the presence of household bargaining difficulties between men, women, and children. However, when they control for household fixed effects, they find that productivity on female-owned plots is lower but that the mixed ownership indicator is no longer significant, possibly because the mixed ownership classification captures the impact of unobserved household characteristics. Thus, to better measure agricultural productivity, and to ascertain the causes behind gender differences therein, one needs to use more disaggregated indicators such as sex of plot manager. Such data collection efforts are being encouraged by FAO's support to the agricultural censuses, but such sex-disaggregated data need to be analyzed and used more to inform policy. The availability of individual-specific data will also enable us to examine whether impacts of interventions vary at the individual vs. the household level.

3. Comparing individual and household impacts of new agricultural technologies in Bangladesh

A study evaluating the long-term impact of agricultural technologies in Bangladesh provides another example of differences in conclusions about the effectiveness of new technologies when one uses individual vs. household-level indicators of food security (Kumar and Quisumbing, 2011). In 1996–1997, the IFPRI and Data Analysis and Technical Assistance Ltd. (DATA) conducted an initial series of surveys to evaluate the impacts of improved vegetable and polyculture fish management technologies on household resource allocation, income, and nutrition. Households were surveyed in three sites in rural Bangladesh where nongovernmental organizations (NGOs) and specialized extension programs disseminated new vegetable and fish technologies. These new technologies were: (1) improved vegetable varieties, disseminated in Saturia by a local NGO to women's group members who grow vegetables on small plots on or near the household compound; (2) polyculture fish technologies, disseminated by a medium-sized local NGO in Jessore, which arranged

[2] Headship also blurs distinctions between male- and female decisionmaking if, for example, adult sons assume decisionmaking in female-headed households.

long-term leases of ponds managed by groups of women (ranging in number from 5 to 20) who received credit and training in polyculture fish production methods; and (3) polyculture fish technologies, disseminated by a specialized extension agency to households in Mymensingh that already owned or managed a pond, or shared pond ownership with other households.

Four surveys of 955 households were conducted at four-month intervals beginning in June 1996, and covered one complete agricultural cycle. Survey data were supplemented with qualitative research on factors affecting intrahousehold bargaining power, which fed into formulation of questions in the last survey round on dowries, assets brought to marriage, and bargaining power (Bouis et al., 1998). The data collected enabled the construction of household-level consumption, income, and asset aggregates, as well as individual-level measures of assets (male, female, and joint assets), food intake (using 24-h recall methods), anthropometry, and hemoglobin levels (for children age 0 to 5 years and women aged 15–49 years). Ten years later, a follow-up study in 2006–07 to analyze the determinants and consequences of chronic poverty provided the opportunity to revisit the study sites and evaluate the long-term impacts of the technologies. Using difference-in-difference analysis and a statistical comparison group of early adopters and late adopters of the technology, Kumar and Quisumbing (2011) found that improvements in household-level indicators across the three programs were quite different from the pattern of improvement in individual-level indicators. The biggest gains to early adoption of the technology were in the individual fishpond sites, where significant positive impacts on household level consumption, household assets, and per capita calorie availability were observed. In contrast, the short-term positive impacts of adopting the vegetable technology were dissipated in the longer run, and late adopters did better than early adopters. The authors hypothesize that, in the individual fishponds case, the quasi-rents from adopting a technology with high up-front costs were maintained. In contrast, because the vegetable technology was divisible and easy to adopt, quasi-rents were dissipated over the long run, reducing the advantage of early adopters. The short-term positive impact of group fishponds was also diluted over the long run because income gains had to be shared by many families.

Patterns of improvement are quite different when individual-level indicators are compared, indicating that short-term profits at the household level may not be a good predictor of long-term changes in individual nutritional status. When individual-level indicators of nutritional status are examined, the improved vegetable sites did best, and the individual fishpond sites, the worst. In both the individual and group fishpond sites, stunting rates for girls increased more for early adopters. In contrast, in the homestead vegetables sites, despite small income gains, for early adopters, stunting rates of girls decreased, and women's BMI increased. The stunting for boys decreased in all sites, though these impacts were not statistically significant. In trying to explain the divergence between the individual and household-level results, Kumar and Quisumbing (2011) posit that the emphasis on vegetables (iron- and vitamin-A rich food) and targeting to women improved nutrition (particularly of girls) even if income gains were small in the vegetables sites. Quisumbing et al., 2011 also argue that perhaps because of the particular dynamics of gender relations in Bangladesh, group-based approaches that involved women had favorable impacts on individual nutritional status, particularly of children, even if their impacts on monetary indicators appeared low. This nuanced analysis of the long-term impact of these interventions would not have been possible without individual-specific data. Because poverty and well-being are multidimensional concepts, adopting a single measure of impact at the household level would not allow policymakers to assess tradeoffs between competing development objectives, with all the difficulties of welfare ranking and weighting that such trade-offs imply (Quisumbing et al., 2011: 169).

4. Individual vs. household coping mechanisms in response to food price shocks in Ethiopia

Despite the voluminous evidence that the 2007–08 food price crisis was detrimental to the welfare of the poor all over the world (Headey and Fan, 2008, 2010), evidence on gender and intrahousehold impacts remains scarce, even if many conjectures were made that the crisis would have had detrimental impacts on women. For example, Espey and Harper (2009) argue that "harmful household coping strategies and compounding vulnerabilities threaten to push many, particularly many women and their dependents, into chronic poverty." However, most of the conjectures about differential impacts were based on newspaper accounts (King Dejardin and Owens, 2009) or small qualitative studies (for example, Hossain et al., 2009). Although quantitative analyses of gendered impacts have been undertaken, they typically identify at-risk groups based on existing (pre-crisis) data sets (see King Dejardin and Owens, 2009) and simulations based on pre-crisis data sets (Zezza et al., 2008; Friedman and Schady, 2009), or, where pre- and post-crisis data are available, do not disaggregate impacts by age and sex (D'Souza and Jolliffe, 2010).[3]

Shocks are defined as "realizations of the state of the world whose risk may or may not have been recognized beforehand" (Dercon, 2010). Shocks are typically classified into covariate shocks (those that affect a large number of households in a given locality at a given time) and idiosyncratic shocks (those that affect a few individuals or households at a given time), and are often defined as unanticipated events, whether positive or negative. Data on shocks may be obtained from self-reports or from "objective" sources (such as price series or rainfall data). Analyzing the probability of experiencing a self-reported shock is useful for policymakers because it helps to identify those households and individuals who are more likely to be vulnerable to those shocks.

For example, the same covariate event—a global increase in food prices—may have different impacts on men and women, and on boys and girls within households. While many individuals may experience the same phenomenon, for some the impact is negative, for others negligible, and for others, even positive.[4] Kumar and Quisumbing (2013) take advantage of a panel data set on 1400 households from rural Ethiopia that were initially surveyed before the onset of the crisis, in 1994–95, 1997, and 2004, and after food prices spiked, in 2009 to investigate whether female-headed households are more likely to report experiencing a food price shock, and whether female-headed households experiencing a shock are more (or less) likely to adopt certain coping strategies that might have a greater detrimental impact on specific groups within the household (men, women, boys and girls). The authors control for the characteristics of households that are correlated with experiencing a food price shock by estimating a linear probability model with "having experienced a food price shock in the last two years" as the dependent variable, with household demographic characteristics, including age, sex, and schooling of the household head in 2009, asset holdings, networks, membership in local burial societies (*iddir*), access to credit, and relative wealth in the village, and being a net

[3] An exception is Jensen and Miller (2008).

[4] The food price increases, for example, tended to favor net producers of food.

buyer of food as regressors. With the exception of household demographic characteristics, which refer to the current round, lagged household characteristics are used because current household characteristics (for example, asset holdings) could be correlated with the experience of a food price shock if households disposed of assets to finance consumption. The regression is estimated with and without village fixed effects. Only the coefficients on the sex of the household head, land owned, and its quality remain robust to the inclusion of village fixed effects—female-headed households are more likely to report experiencing a food price shock, while the size of land owned and more fertile land is protective against the food price shock.

Because a household's self-report of a food price shock may be affected by household characteristics, Kumar and Quisumbing (2013) use instrumental variables regression to estimate the impact of the self-reported food price shock on the food gap and coping strategies used by households, treating whether the household reported experiencing a food price shock and its interaction with the variable for a female-headed household as endogenous.[5] The dependent variables are the *change* in the number of meals served in good and bad months and *changes* in consumption habits and quantities served to household members (adult men, adult women, boys, and girls). They find that female-headed households that experience a food price shock increase their food gap—the number of months that they are unable to meet their food needs—by 2.28 months more on average than male-headed households (Table 1). The number of meals eaten in bad months, whether by adults or children, is not affected by the food price shock, nor by female-headed households' experience of the food price shock. However, while both adults and children in female-headed households eat fewer meals during good months, those female-headed households *that reported a food price shock* increased the number of meals served to adults in good months. This may occur because female-headed households that experienced a shock may "play catch up" during good months to compensate for shortfalls during lean months.

Cutting back quantities served is another coping mechanism used by households. While female-headed households are less likely to cut back on quantities served to adults or children, female-headed households *that experience a food price shock* are more likely to cut back on quantities served to their members, indicating that they are more vulnerable than other types of households.

To test the sensitivity of these results to the use of self-reported shock indicators, the authors estimated a reduced form equation in which the prices of teff and coffee, percentage *changes* in these prices, and their interaction with the female-head dummy are included as regressors (Kumar and Quisumbing, 2013). Price data at the village level are arguably a more objective measure of price changes compared to the self-reported experience of a shock. The results are broadly consistent with the IV estimates, although fewer coefficients are statistically significant. Female-headed households have larger food gaps and are also more likely to reduce quantities served to boys. Increases in teff prices (the staple food) tend to reduce meals served to adults in good months, while a rise in coffee prices increases meals served to adults in good months. Improvements in the export market (as revealed by increases in coffee prices) seems to benefit both adults and girls; a higher percentage increase in coffee prices decreases the likelihood of cutting back quantities served to adult females and girls. Likewise, higher coffee prices are associated with lower probabilities of female-headed households cutting back the number of meals for adult males, boys, and girls.

The above results—using self-reported indicators of a food price shock as well as objective indicators of food price increases—suggest that female-headed households who experience a food price shock are more likely to adopt coping mechanisms that can worsen nutritional status, particularly of children. This implies that not only female-headed households should continue to be an important target for social protection mechanisms, but also that it is important to ascertain whether there are vulnerable groups within households, regardless of the sex of the household head. Questions that ask only whether the household adopted different types of coping behaviors in response to a crisis would not be able to discern whether adults or children fared worse, or whether boys or girls (or men or women) were at greater risk because of such coping mechanisms. In this case, very simple modifications of standard questions regarding coping mechanisms were implemented to obtain information on individual-level impacts of the food price crisis.

5. Methods for eliciting individual experience of food insecurity and vulnerability: the way forward

The above discussion illustrates the gains from using individual indicators of agricultural productivity, nutritional status, and impacts of coping mechanisms. What can be done to improve systems for data collection and monitoring? The first step is a change in perspective: if household-level measures tend to underestimate poverty and inequality (Haddad and Kanbur, 1990) and gender differences in agricultural productivity (Peterman et al., 2011); lead to lack of appreciation for interventions that yield improvements in nutritional status, even if income gains are small (Kumar and Quisumbing, 2011); or gloss over differential impacts of coping mechanisms on household members (Kumar and Quisumbing, 2013), increased efforts should be directed towards obtaining indicators of food security inputs and outcomes at the individual level.

In the area of measuring agricultural production, statistical systems should increasingly strive to obtain individual-level, not simply household-level data. A starting point should be obtaining basic information on the plot manager, not just the household head, in studies of agricultural productivity. This would include such basic demographic information as age and sex, but could also include relationship to the household head (an indicator of status within the household) and years of schooling or highest grade attained. Such efforts are already being supported by FAO for the agricultural censuses (once every 10 years) as well as by the Living Standards Measurement Studies-Integrated Surveys of Agriculture (LSMS-ISA) in sub-Saharan Africa. Going forward, a more nuanced approach to gender indicators would be desirable. For example, what types of decisions are taken by women vs. men? To what extent do women and men make decisions jointly or individually in agriculture? What is the pattern of asset ownership within the household? The US Government's Feed the Future Initiative, for example, has recently adopted a Women's Empowerment in Agriculture Index developed by the US Agency for International Development (USAID), the International Food Policy Research Institute (IFPRI), and the Oxford Poverty and Human Development Initiative (OPHI) that is based on interviews of women and men within the same household, instead of aggregate data, to examine the extent to which its interventions promote inclusive agricultural growth (USAID, IFPRI, and OPHI 2012). A joint project of IFPRI and the International Livestock Research Institute has released an online toolkit

[5] The instruments are the price of teff and coffee in 2004, the percentage change in teff and coffee prices between 2004 and 2009, and the interaction of the percentage change in price variables with the female-headed household and spouse dummy. We use teff prices because teff is an important food staple in Ethiopia and coffee prices because coffee is a major exportable commodity.

Table 1
Impact of self-reported food price shock on the change in the food gap, meals, and quantitites served, Ethiopia.
Source: Tables 4 and 5, Kumar and Quisumbing, forthcoming.

Outcome	Coefficients from regressions using self-reported shocks		
	Female head	Food price shock (instrumented)	Food price shock × female head (instrumented)
Food gap (in months)	−1.395 (1.056)	0.577 (1.848)	2.280[a] (1.276)
No. of meals in good months, adults	−0.700[b] (0.281)	0.280[b] (0.096)	0.667[a] (0.342)
No. of meals in good months, children	−1.188[a] (0.605)	−0.096 (0.224)	1.243 (0.747)
No. of meals in bad months, adults	−0.501 (0.319)	0.234 (0.224)	0.556 (0.398)
No. of meals in bad months, children	−0.562 (0.537)	−0.199 (0.246)	0.532 (0.614)
Cut back quantities served, adult males	−0.233 [b] (0.096)	0.141[c] (0.040)	0.282[b] (0.110)
Cut back quantities served, adult females	−0.116 [a] (0.057)	0.133[c] (0.038)	0.169[b] (0.060)
Cut back quantities served, boys	−0.352 [c] (0.099)	0.107 (0.082)	0.496[c] (0.102)
Cut back quantities served, girls	−0.273 [a] (0.130)	0.106 (0.088)	0.407[c] (0.096)

Notes: regressions include demographic characteristics as of 2009, asset holdings, networks, *iddir* membership, access to credit and relative wealth in the village as of 2004, and village fixed effects. Instruments consist of the prices of teff and coffee in 2004, the percentage change in teff and coffee prices between 2004 and 2009, and the interaction of the percentage change in price variables with the female-headed household dummy.
[a] $p < 0.1$. Robust standard errors clustered at village level in parentheses.
[b] $p < 0.05$.
[c] $p < 0.01$.

using quantitative and qualitative methods for measuring individual asset ownership (http://gaap.ifpri.info/files/2010/12/GAAP_Toolkit_Feb_14.pdf).

Policymakers seeking to evaluate agricultural development programs would do well do use individual-level indicators of well-being, not just money-metric indicators at the household level. In their comparison of the long-term impacts and cost-effectiveness of educational transfers and agricultural technology interventions, Quisumbing et al. (2011) find that while some interventions may do well in terms of increasing per capita expenditures or assets, they may do poorly in improving nutritional status. While one option would be to assess the extent to which interventions meet their stated development objectives, it is often the case that food security and anti-poverty programs have a range of objectives, and spillover effects are present. Because poverty, well-being, and food security are multidimensional concepts, it is usually difficult—and probably unwise—to adopt a single measure of impact. Using a suite of individual as well as household-level indicators of food security may help policymakers arrive at more informed judgments in order to prioritize policy interventions.

One argument often raised against collecting individual level indicators is that they are expensive or too complicated. However, sometimes only simple modifications are needed to get at individual-level impacts. For example, instead of asking "did you cut back quantities served in response to the crisis?" one could ask this question separately for adult men, women, boys, and girls. Qualitative work could help refine questions so that only the most relevant questions in a specific cultural context are asked. Perhaps the question should not be the cost of collecting these individual indicators, but rather, what is the cost of *not* collecting individual-level indicators of food security in order to obtain a more accurate picture of hunger and vulnerability.

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