A Profile of Food Insecurity Dynamics in Rural and Small Town Ethiopia[1]

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Abstract

Using panel data from the Ethiopia Socioeconomic Survey (ESS), representative of all people living in rural and small-town areas, this paper describes changing patterns of food security between 2012 and 2014. We examine four measures of food security – two consumption based (calories and dietary diversity) and two experience based (whether food insecurity was experienced in any month, and whether any actions were taken in response).Over all four measures in both years, the share of the food insecure population was never less than 25 percent. Disentangling chronic from transitory food insecurity is important for policy design and for estimating the total food insecurity count over time. For example, the average rate of inadequate dietary diversity was approximately 30 percent in both 2012 and 2014, but the panel data reveal that 46 percent of the rural and small-town population had inadequately diverse diets at some point over the period. While the cross-sectional estimates suggest similar patterns in levels and trends of the measures, the panel data reveal that there is very little co-movement of the measures. For example, observing that someone has improved in terms of dietary diversity does not reveal information as to whether she or he has similarly improved in terms of the experiential-based measures.

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1. Introduction

Despite commendable achievements in reaching key Millennium Development Goals, food security in nations across Sub-Saharan Africa is still precarious (United Nations Economic Commission for Africa, African Union, African Development Bank Group, and United Nations Development Program, 2015). Even though Ethiopia in particular has made encouraging progress in reducing poverty and undernourishment, its malnutrition rates remain high (Food and Agricultural Organization [FAO], 2014; World Bank, 2014). For example, the FAO estimates that between 1990–1992 and 2012–2014, the share of the population who are undernourished fell from 75 to 35 percent, partially achieving Millennium Development Goal 1 (FAO, 2014).[4] Yet about 44 percent of children under 5 are stunted, 21 percent severely so, and about 10 percent of children under 5 suffer from wasting, 3 percent severely so (Ethiopia Central Statistical Agency and ICF International, 2012). Critical to nutrition for both children and adults are the three pillars of food security set out by the FAO – availability of, access to, and utilization of food – and their stability over time (FAO, 2006). Given its history of drought, conflict, and other shocks, in Ethiopia food security has been and continues to be a significant concern for large portions of the population, and therefore for government policy.

This paper documents the state of food insecurity in Ethiopia based on information from a large sample of households representative of all rural and small-town areas of Ethiopia. The data, which cover nearly 4,000 households, were collected in 2011/12 and 2013/14. We use the data to explore the nature of food insecurity, static and dynamic, in this vulnerable population: First, we use multiple measures to document the prevalence of food insecurity. Second, we document how the prevalence of food insecurity changed between survey waves and how measures of food security covary over time. Finally, we document the types of variation within and between geographic areas that drives changes in food security and what they say about whether food security is localized or widespread. Thus, using recent,

[4] Undernourishment is defined by per capita calorie consumption below a dietary threshold based on population demographics and activity levels.

representative panel data and multiple measures of food security, this paper complements previous studies of food security in rural Ethiopia.

While food security is typically defined by the three pillars listed above (food availability, access, utilization and the temporal stability of each of these); it is, however, an inherently multidimensional concept. In terms of one of its broadest definitions, "food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life"(FAO, 1996). Some indicators capture food safety and the cultural acceptability of the household diet in addition to standard indicators of availability (often at the country level), access (often at the household level), and utilization. More recently, experiential measures have received significant attention; these are designed to capture anxiety over food insecurity through psychological and behavioral questions about the severity of food insecurity. Two examples are the U.S. Department of Agriculture Household Food Security Scale (Bickel, Nord, Price, Hamilton, and Cook, 2000) and the FAO's Food Insecurity Experiential Scale (FIES; Ballard, Kepple, and Cafiero, 2013). The FIES is being used to estimate the prevalence of food insecurity in 147 countries through the Gallup World Poll (Nord, Cafiero, and Viviani, 2016). In its 2013 annual report *The State of Food Insecurity in the World: The Multiple Dimensions of Food Security*, the FAO sets out 30 indicators that capture various dimensions of food security (FAO, 2013).

In this paper we use four measures of food security—two related to household access and utilization of food (quantity and diversity) and two experiential. Identifying and describing the dynamics of food insecurity in vulnerable populations is critical to better targeting during crisis periods like droughts, and more generally to the design of safety net and insurance programs.

For centuries Ethiopia has experienced periods of extreme food insecurity, including famine, most recently in 1983–1985 (Taye, Mariam, and Murray, 2010). Given this history, and similar food crises caused by periods of conflict, there is an extensive literature related to food security, shocks, and

coping mechanisms, especially with regard to the role of food aid. It ranges from cross-sectional studies that draw on small samples from limited geographical areas to larger data sets and panel data studies, which are not always representative of any underlying population.

Hirvonen and Hoddinott (2014) use a large non-representative sample to look at the relationship between diversity in agricultural production and in children's diets. Yamano, Alderman, and Christiaensen (2005) use data from three separate nationally representative cross-sectional surveys conducted in 1995 and 1996 to look at how child nutrition then was affected by harvest failures and food aid.

Some studies have drawn on several waves of panel data and thus are better able to capture long-run dynamics. One rich data set many researchers use is that of the Ethiopian Rural Household Surveys (ERHS), 1989–2009.[5] In a series of papers, Dercon and coauthors use the data to examine the dynamics of poverty – which is closely related to food insecurity – in rural Ethiopia, specifically looking at the impact of various household- and village-level shocks (Dercon, 2004; Dercon, Hoddinott, and Woldehanna, 2006, 2012). These papers highlight how household characteristics may be linked to differences in experiencing or recovering from widespread covariate shocks (factors like drought that adversely affect an entire village) and household-specific idiosyncratic shocks (factors like death or illness that adversely affect only specific households). We examine sources of variation in changes in the food security measures available in our data by comparing the extent to which variation is occurring between or within villages. Changes that stem from between-village differences are more likely to be due to covariate factors; those that stem from within-village differences are more likely to be due to idiosyncratic factors. In either case, as previous studies note, differences in what is driving food insecurity necessitate different policy responses.

Maxwell, Vaitla, and Coates (2014), a study based on panel data from 300 households in rural Ethiopia, is closely related to this paper. They compare

[5] A description of the data is available at https://www.ifpri.org/publication/ethiopian-rural-household-surveys-erhs-1989-2009.

the prevalence of and changes in food security based on seven common measures (the data were tailored to measure food security). The authors find that although prevalence estimates vary by measure, they display similar trends and are reasonably correlated. Differences in the prevalence rates may be attributed to differences in cut-off points (e.g., for a poor diet base on a dietary diversity score); sensitivity of the measures to the severity of food insecurity (e.g., indicators that pick up mild vs. severe food insecurity); and the fact that the measures may be picking up different dimensions of food security.

Applying four food security measures, we find substantial differences both in prevalence rates and in their trends over time. The next section describes the survey data. Section three describes the measures of food security and other household characteristics. Section four presents estimates that provide a snapshot of food insecurity in rural Ethiopia, and section five discusses changes in the prevalence of food insecurity between the first and the second waves of the survey.

2. Survey data

The primary data are from the Ethiopia Socioeconomic Survey (ESS),[6] a panel survey conducted by the Central Statistics Agency of Ethiopia (CSA) in collaboration with the World Bank Living Standards Measurement Study team. Data were first collected from 3,969 households between September 2011 and March 2012.[7] The first wave (ESS1) used two-stage probability sampling and is representative of rural and small-town areas throughout Ethiopia.[8] In the first stage, 290 enumeration areas with probability proportionate to estimated population were selected from rural areas and 43 from small-town areas within five strata based on the administrative divisions

[6] The first wave was initially referred to as the Ethiopia Rural Socioeconomic Survey (ERSS), but this name was changed with wave 2 when the panel was supplemented by an urban subsample. Now the survey is referred to as ESS and each wave is numbered, so ESS1 refers to the first wave of the ESS.

[7] The response rate was 99.3 percent.

[8] The ESS rural sample is a subsample of the Annual Agricultural Sample Survey (AgSS) conducted by the CSA.

in Ethiopia.[9] In the second stage, within each enumeration area 12 households were randomly selected (fixed interval, systematic random sampling).

The second wave of data (ESS2) was collected between September 2013 and April 2014 and covered 5,262 households – 3,776 panel households and 1,486 new urban households.[10] Although ESS2 is representative of the entire country, for this paper we limit our analysis to the households that were interviewed in both waves. Using sample weights, the estimates provide inferences to the populations of rural and small-town areas of Ethiopia.

The household questionnaires cover demographics, education, health, labor, time use, income and assistance, nonfood spending, food consumption and spending, food security, shocks and coping mechanisms, housing, assets, and credit. The community questionnaires cover infrastructure, resources, and significant events, such as drought. This analysis is primarily concerned with the food security, food consumption, and expenditure modules. It is important to note that because food data were collected postharvest, they are likely to reflect seasonal periods of relative food security. This is a particularly important caution because due to Ethiopia's reliance on rain-fed agriculture, there is strong seasonality in its consumption patterns (World Bank, 2014).

3. Measures of food security

We construct four measures of food security: daily calories per adult equivalent (AE); the Food Consumption Score (FCS); actions taken to relieve food insecurity in the past week; and months of food insecurity in the past year. While each of these is measured at the household level, we report estimates of the percent of people who live in households that are food

[9] The strata consist of four regions (Amhara; Oromia; Southern Nations, Nationalities, and Peoples' Region; and Tigray) with a fifth combining data for the remaining administrative regions.

[10] The response rate was 96.2 percent. For households that split, the remaining core household was interviewed.

insecure. This distinction matters when household size and food security status are correlated, which is frequently the case.

Daily calories per AE, a common measure for nutritional analysis, is conceptually linked to the FAO food access pillar. The calories estimate is based on a 7-day recall of 25 broadly defined and commonly consumed foods and beverages. The enumerator solicited information on quantities consumed from purchases, home production, and gifts and other sources from the individual primarily responsible for preparing food. To link food quantities to calories and other nutritional information, we use the 1998 Food Composition Tables developed by the Ethiopian Health and Nutrition Research Institute (EHNRI, now part of the Ethiopian Public Health Institute) and the FAO.[11,12] We then calculate the total AE for each household based on the age and sex composition of members,[13] using equivalence scales developed by the CSA (Ethiopia Central Statistical Agency, 2012). The survey asks about meals served to guests; we incorporate information on the AE of these guests into the total household AE in order to capture accurately the count of individuals sharing in food consumed over the past week.[1415] Finally, we divide total daily household

[11] We obtained hard copies of the tables from EHNRI. General information on FAO food composition tables is available at http://www.fao.org/docrep/017/ap796e/ap796e.pdf. For foods that were not available in the Ethiopia database, we used the USDA National Nutrient Database for Standard Reference, http://ndb.nal.usda.gov/ndb/doc/index. For kocho, a standard and popular Ethiopian bread, we use nutritional information from Shank and Ertiro (1996), http://www.africa.upenn.edu/eue_web/enset96.htm).

[12] We trim daily per capita food quantity data at the 97th percentile in wave 1, and the 99th in wave 2, which we based on biologically feasible amounts.

[13] Adult equivalence scales capture household composition to account for the varying dietary requirements of individuals of different ages and sexes, as well as economies of scale in consumption (Deaton, 2000).

[14] Ideally we would want to account for meals household members ate away from home, but because the data were not collected in wave 1, we do not incorporate it into our calculations. In wave 2, we have information only on whether any member ate meals away from home and the approximate value of the meals; we do not have the number of meals eaten away from home. Given the growing importance of food away from home in developing countries, this is a shortcoming of the survey.

[15] We top-coded calories at 7,000 per AE for both waves; 7,000 is approximately 94.7 percentile in wave 1 and 96.2 in wave 2.

calories by the household AE (with guests) to get the final measure of daily calories per AE (denoted as calories).

There are two primary concerns related to the calorie estimate: The first is that 25 items is a short list of food items for a consumption survey, and Beegle *et al.* (2012) provide evidence that the number of food items (in addition to recall period and method of collection) greatly influences estimates of consumption. With a short list, the survey may be missing a non-negligible portion of food consumption. However, in mitigation of this concern we note that in rural and small-town Ethiopia, the share of staple food consumption is estimated to be very high, which means that a few food items cover a substantial portion of total calories.

A second concern is that the food items in the survey are relatively broad categories, and Jolliffe (2001) provides evidence that asking about the consumption of food in terms of categories (e.g., meat) produces substantially lower estimates than asking about specific types (e.g., chicken, beef, and goat). This concern is particularly relevant to obtaining the right level of total calories (i.e., the cross-sectional estimate), but much of our analysis is mainly concerned with changes in calories across the waves (the first-difference estimate), and since the food items list was essentially the same in both waves, there is no reason to expect that the bias in levels necessarily contaminates the bias in first differences. Nonetheless, we take these concerns seriously and interpret the calorie data results with caution.

The FCS, developed by the World Food Programme, measures dietary diversity and is often interpreted as a partial measure of dietary quality; it has been used in food security assessments throughout the world and validated against nutritional measures for adults and children (Arimond and Ruel, 2004; Nguyen et al., 2013). The measure is conceptually linked to both the access and utilization pillars of food security. Because we use information on the frequency with which households had consumed foods from 16 foods and food groups over the past week, the measure is not derived from the same data used for the calorie estimates but is from a different section of the questionnaire that follows the standard FCS definition. The FCS is the

weighted sum of the frequencies with which in the previous week a household has consumed foods within eight groups: grains, pulses, vegetables, fruit, meat and fish, milk/dairy, sugar, and oil/fat. The weights are based on the nutrient density of each group.[16] Lower scores indicate a less varied diet, with less potential for micronutrient intake. Low scores are often associated with a large share of calories derived from staple foods (and in many poor countries, oil and fat).

The third measure relates to a household's experience with food access, which is gauged through eight questions based on the number of days in the past week the household (1) relied on less preferred foods, (2) limited the variety of foods eaten, (3) limited portion size at mealtimes, (4) ate fewer meals in a day, (5) restricted adult consumption to benefit small children, (6) borrowed food or relied on help from a friend or relative, (7) had no food of any kind in the household, and (8) went a whole day and night without eating anything. We create a count variable based on these actions against food insecurity (labeled *actions)*; the larger the number, the greater the food insecurity, or the more limited the access to food. All the actions are linked to food-based rather than non-food-based coping strategies, such as selling off assets—households may be sacrificing in other areas that this measure does not capture.

Finally, we create a variable for total months of food insecurity based on the household's response to the question, "In the last 12 months, have you been faced with a situation when you did not have enough food to feed the household" (labeled *months*). These last two measures are experience-based; they complement the calorie and diversity measures, which do not directly reflect a household's actions or subjective feelings about food insecurity.

We also inventory household demographic characteristics: household size, age of household head, and indicators for female head, married head, and heads who have completed primary education. And we create several variables that capture household livelihood, including real annual household consumption,

[16] The food groups and weights (in parentheses) are as follows: starches (2), pulses (3), vegetables (1), fruit (1), meat (4), dairy (4), fats (0.5), and sugars (0.05).

the sum of food and nonfood consumption. The value of food consumption is the sum of the value of food purchased outside the home and the value of food produced at home and gifts.[17] The value of nonfood consumption is the sum of all reported expenditures on nonfood items. All values are in 2013 Ethiopian birr. They have been spatially adjusted for each wave and temporally adjusted based on price indices provided by the CSA. We also create an indicator for access to agricultural land (farm households) and indicators for households that receive assistance through the Productive Safety Net Programme (PSNP), free food assistance programs, and food or cash for work programs.

4. A profile of household food security in rural Ethiopia

Table 1 presents population-weighted summary statistics of key variables by wave, with p-values to denote the statistical significance of differences in means between the two waves. For wave 1 estimates we use wave 1 sample weights, and for wave 2 estimates, wave 2 weights. The weighted sample estimates thereby providing inferences to the population of rural and small-town areas of Ethiopia in 2011/12 and 2013/14, respectively.[18] The effective size of the sample for our analysis is 3,266 panel households.[19] Households have about 5 members and most are headed by males. (Mean values of adult equivalents are 4.2 in both waves; the numbers are slightly larger when guests are taken into account.) In wave 1, the household heads were about 45 years old, and about 13 percent of them had completed primary school. On average, as estimated in the ESS measure of total consumption, about 80 to 90 percent of total expenditures is for food. We observe a decline between

[17] Food produced at home and gifts use median unit-value prices taken from the nearest geographical area in a minimum of 10 unit-price observations

[18] The weighted-estimates provide inferences to the population of households for household size, age of household head, and the indicators for whether the household is: a farm household, female-headed, has a married head, headed by someone who has completed primary education. For all other variables, including in particular the food security measures, the weighted estimates provide inferences to the population of individuals.

[19] We dropped 510 panel households due to missing data on consumption, household demographics and relationships, and housing characteristics.

waves in the mean of real annual total consumption per AE, driven by a decrease in real annual food consumption.[20]

Table 1: Summary Statistics

	Wave 1		Wave 2		P-value of mean difference
	Mean	***S.E.***	***Mean***	***S.E.***	
Household size	5.17	(0.06)	5.13	(0.06)	0.487
Indicator (Female headed household)	0.20	(0.01)	0.22	(0.01)	0.000***
Age of household head	44.59	(0.40)	46.11	(0.39)	0.000***
Indicator (Head married)	0.77	(0.01)	0.75	(0.01)	0.126
Indicator (Head completed primary education)	0.15	(0.01)	0.16	(0.01)	0.158
Indicator (Farm household)	0.89	(0.02)	0.97	(0.01)	0.000***
Real Annual Total Consumption per AE	5957	(405)	4917	(143)	0.001**
Real Annual Food Consumption per AE	4668	(339)	3654	(122)	0.000***
Real Annual Nonfood Consumption per AE	871	(46)	983	(41)	0.018**
Daily calories per AE	2894	(91.98)	2774	(84.95)	0.101
Food consumption score (FCS)	42.64	(0.90)	44.32	(0.85)	0.089*
Actions against food insecurity	3.60	(0.48)	2.14	(0.23)	0.000***
Actions against food insecurity (if actions>0)	10.19	(0.67)	7.80	(0.42)	0.000***
Months of food insecurity	0.97	(0.08)	1.07	(0.09)	0.389

Notes: Population-weighted means and deciles. Calories refer to daily calories per adult equivalent. Diversity refers to the food consumption score. Actions refers to the number of reported actions taken against food insecurity. Months refers to the number of reported months of food insecurity. Number of observations: 3,266. AE = adult equivalents.

Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

[20] A potential concern with this estimated decline is that the consumer price index measure of inflation may overstate price changes as observed by households in rural and small-town areas. Indeed, when we examine changes in unit values (i.e., expenditure per food item divided by household quantity of food item, which can be viewed as reflecting quality and price changes of food items), their rate of increase is about half the rate found by the CPI measure of inflation.

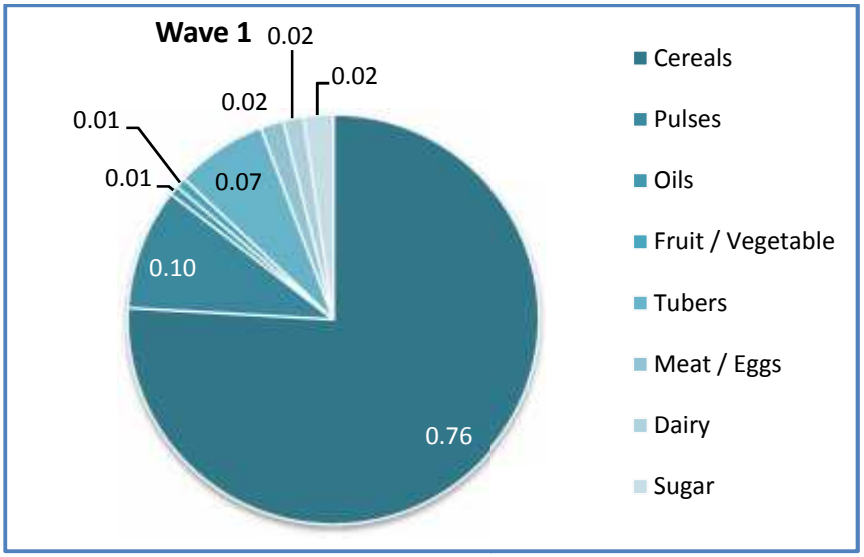
We also observe that the standard error of the estimated mean of total consumption is twice as large in wave 1 than in wave 2.[21] One possible explanation for this decline in the standard error (and the coefficient of variation) is that the enumerators and field protocols improved between waves 1 and 2, which would reduce error and, most likely, reduce observed dispersion. Most households in rural Ethiopia have access to agricultural land; a share of these households sells some of the harvest. Very few households report receiving any form of assistance and there are no observable differences between waves in assistance received.[22] Appendix Figure A1 shows the percent of individuals living in households that report receiving various forms of assistance by wave and consumption quintile. There is marked heterogeneity; somewhat surprisingly, poorer households do not always report more assistance.

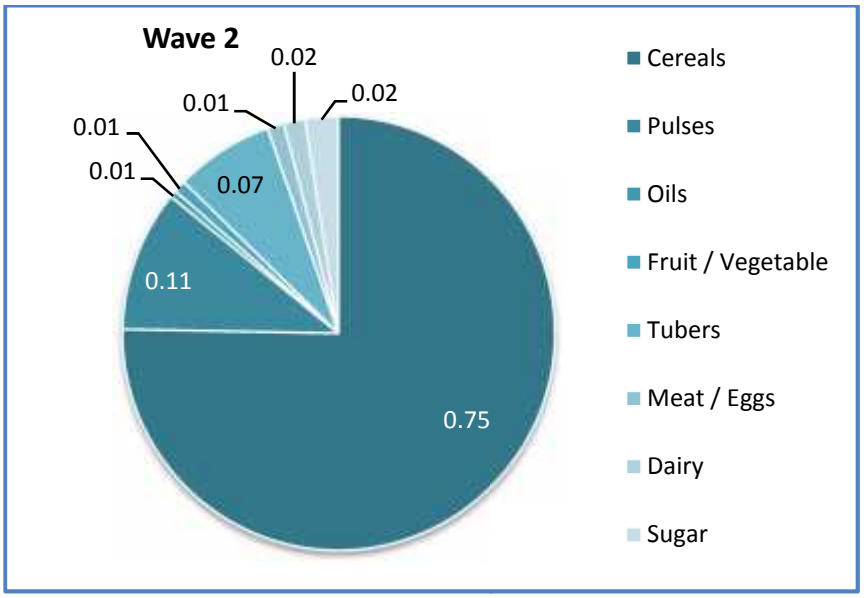
The Ethiopian diet depends largely on cereals (mainly teff, wheat, barley, rice, and sorghum) with both waves of data indicating that on average, 75 percent of calories are from cereals(figure 1). Average food shares for the seven other food categories, such as pulses and oils, were also constant when both waves were treated as cross-sectional data. Figure 2 shows the cumulative consumption frequencies by major food group; the food consumption score reflects these (weighted) frequencies. Most households report eating staple foods (cereals) and oil and fat every day. As households become richer, they are able to diversify their diets, incorporating pulses, vegetables, meat and fish, and dairy. (Berhane, Paulos, Tafere, and Tamru (2011) give a detailed analysis of dietary patterns in Ethiopia.)

[21] The scale-independent coefficient of variation also declines substantially.

[22] We do not include assistance from input for work programs because less than 1 percent of households report receiving such aid.

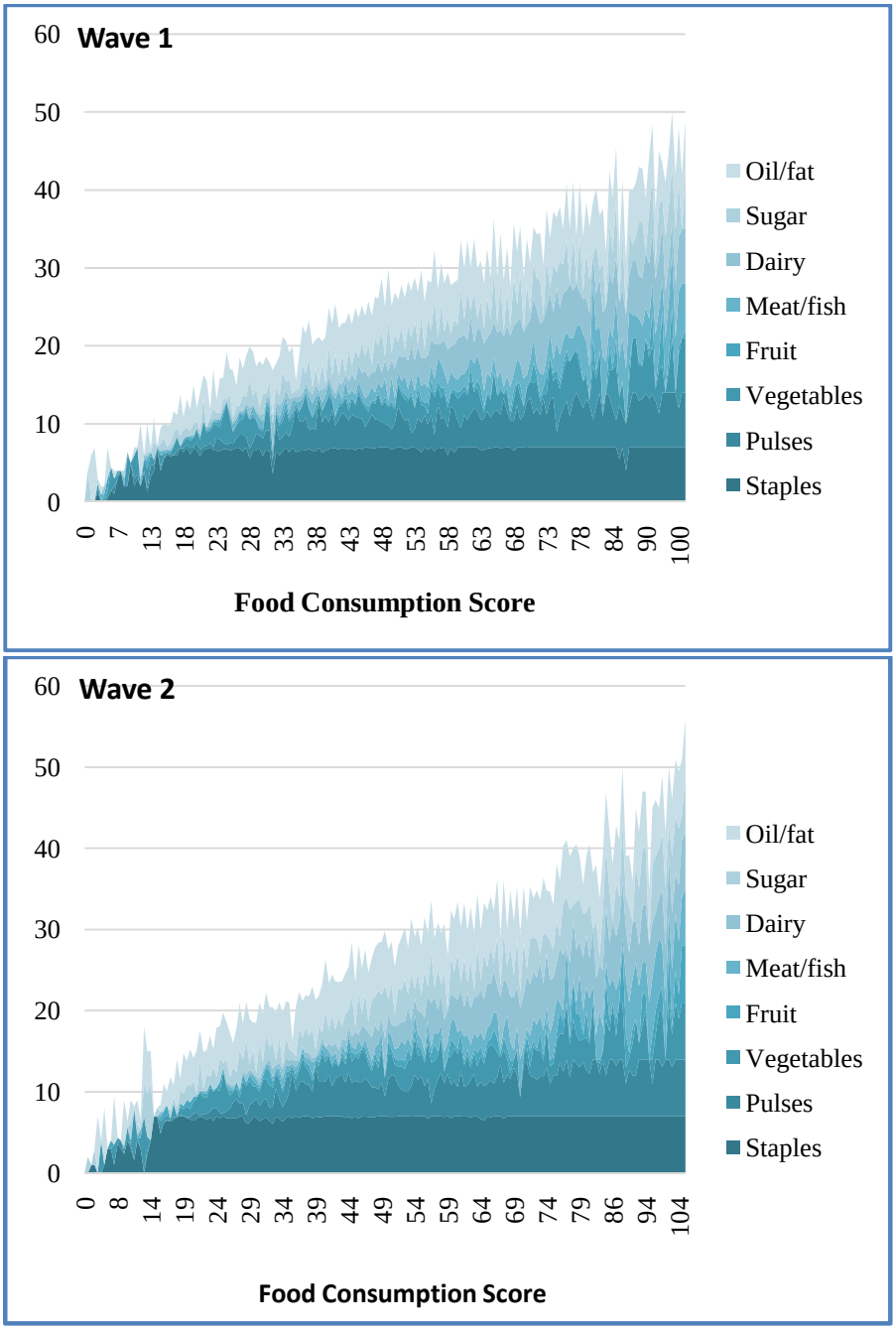
Figure 1: Calorie Shares by Wave





Notes: Population-weighted estimates. Number of observations: 3,266.
Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

Figure 2: Cumulative Consumption Frequencies by Wave



Notes: Population-weighted estimates. Number of observations: 3,266.
Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

The mean daily calories per AE was 2,894 in wave 1 and 2,774 in wave 2.[23] The mean FCS was 43 in wave 1 and 44 in wave 2.[24] Table 1 also reveals that the standard errors of both FCSs and calories are essentially unchanged between waves, unlike the standard errors for the expenditure measures. The standard error would be expected to change if the underlying population distribution of FCSs or calories had changed significantly in two years, or if there were significant changes in the quality of the data (e.g., due to measurement error). Thus one possible inference of the stable error message is that there were no significant changes in data quality between the two waves.

In terms of the experiential measures, less than a third of the population live in households who report taking any action against food insecurity (Figure 3). Over the entire survey sample, people lived in households that took about 3.6 actions on average in response to food insecurity in wave 1, and about 2.1 actions in wave 2. This decline is statistically significant. When we subsampled the households that did take actions against food insecurity, there was a statistically significant decline between waves in the number taken. On average, people lived in households that report about one month of food insecurity in both survey rounds.

Table 2 displays averages of the food security measures for each decile of the relevant distribution by wave. For example, during wave 1, people in the top decile for actions were in households that undertook on average 13 actions to alleviate food insecurity; in wave 2, those in that decile undertook on average 5 fewer actions than in wave 1. Across the distribution, changes in FCSs across people are quite uniform but changes in calories are larger for people at the top of the distribution. The patterns for the experiential measures reflect the fact that few people live in households that report positive actions or months.

[23] This is comparable to calorie estimates from the most recent WFP report (WFP and Ethiopia Central Statistical Agency, 2014).

[24] These estimates are weighted to produce average calories and FCS for individuals. For example for the FCS, each individual is assigned the value of FCS for their household, and then weights are used to allow for inference to the population of individuals.

Table 2: Household Food Security Distributions

	Calories		Diversity		Actions		Months	
	Wave 1	**Wave 2**	**Wave 1**	**Wave 2**	**Wave 1**	**Wave 2**	**Wave 1**	**Wave 2**
Mean	2894	2774	42.6	44.3	3.6	2.1	1.0	1.1
10th	1239	1163	19.5	21.5	0	0	0	0
20th	1636	1539	27.0	29.5	0	0	0	0
30th	1919	1865	35.0	36.0	0	0	0	0
40th	2234	2138	38.5	39.5	0	0	0	0
50th	2585	2426	42.0	43.0	0	0	0	0
60th	2993	2823	45.5	47.0	0	0	0	0
70th	3409	3226	50.0	52.5	3.0	0	1.0	2.0
80th	3984	3801	57.5	58.5	7.0	3.0	2.0	3.0
90th	5122	4900	66.5	68.0	13.0	8.0	3.0	3.0

Notes: Population-weighted means and deciles. Calories refers to daily calories per adult equivalent. Diversity refers to the food consumption score. Actions refers to the number of reported actions taken against food insecurity. Months refers to the number of reported months of food insecurity. Number of observations: 3,266. AE = adult equivalents.
Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

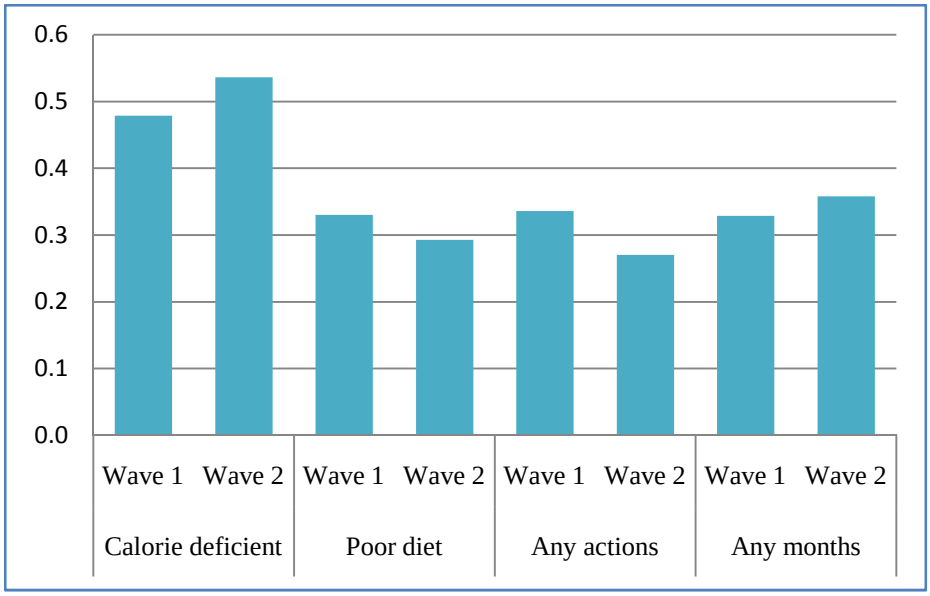
These numbers underscore the importance of exploring changes in food security across people rather than relying on changes in the average values. For example, D'Souza and Jolliffe (2014) show that the impact of food-price increases differs significantly for people across the distribution of food security measures in Afghanistan. And for urban Ethiopians, Alem and Soderbom (2011) show that households with fewer assets and with members who are casual laborers are harder hit by higher food prices.

To estimate the prevalence of food insecurity and to identify the most vulnerable people in rural Ethiopia, we create indicators of food insecurity using cut-off points for the four measures. While there are inherent difficulties in choosing cut-offs, operationally such indicators are typically useful for targeting, monitoring, and evaluation, and so we use them here in providing descriptive information.

We create indicators of calorie deficiency and poor diet based on thresholds set by the World Food Programme (WFP) in its food security assessment of Ethiopia (WFP and CSA, 2014): *Calorie-deficient* households are those with fewer than 2,550 daily calories per AE. *Poor-diet* households are those with an FCS less than 35 (the WFP threshold for poor or borderline versus acceptable diets). We also define indicators for the experiential measures: households that report any action against food insecurity over the past week (labeled "*any action*") and those that report any month of food insecurity over past year (labeled "*any month*").

Figure 3 shows that more than 25 percent of rural and small-town Ethiopians are food-insecure by any measure – though the prevalence rate using calories is markedly higher than rates using the other indicators. These findings are consistent with the high prevalence of poverty and undernourishment found in recent assessments of food security in Ethiopia (FAO, 2015; Rosen, Meade, and Murray, 2015; World Bank, 2014). The most recent WFP food security assessment found that about 74 percent of rural Ethiopians have acceptable diets (WFP and CSA, 2014) and the ESS2 found that about 70 percent of those in rural and small towns had acceptable FCS diets.

Figure 3: Food Insecurity by Wave

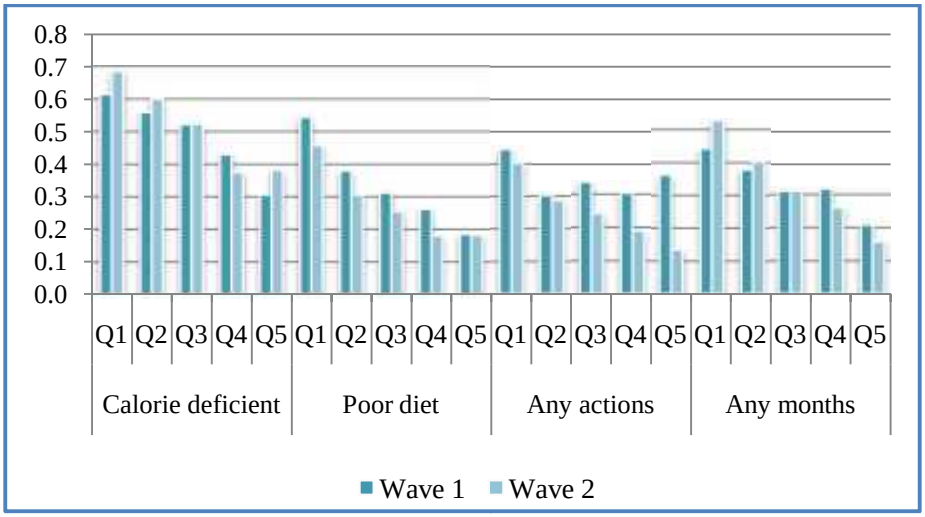


Notes: Population-weighted estimates. Number of observations: 3,266.
Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

While prevalence rates are similar in both waves and across data sources, they mask large differences in food security based on household economic status. Examining people by consumption quintiles (based on real nonfood monthly consumption per AE), we see that, as expected, people in poorer households have significantly worse food insecurity status relative to people in richer households. This is the case for all measures in both waves except for the any-action indicator in wave 1 (Figure 4).[60] In fact, in the bottom consumption quintile, over half of rural Ethiopians do not meet the minimum daily calorie requirements of 2,550 per AE, and about half have poor diets.

[60] As a proxy for income and livelihood, we use the log of the real value of nonfood consumption per adult equivalent; we do not include food consumption since it is drawn from the same data as the food security measures, so that including it could result in spurious correlations.

Figure 4: Food Insecurity by Consumption Quintile and by Wave



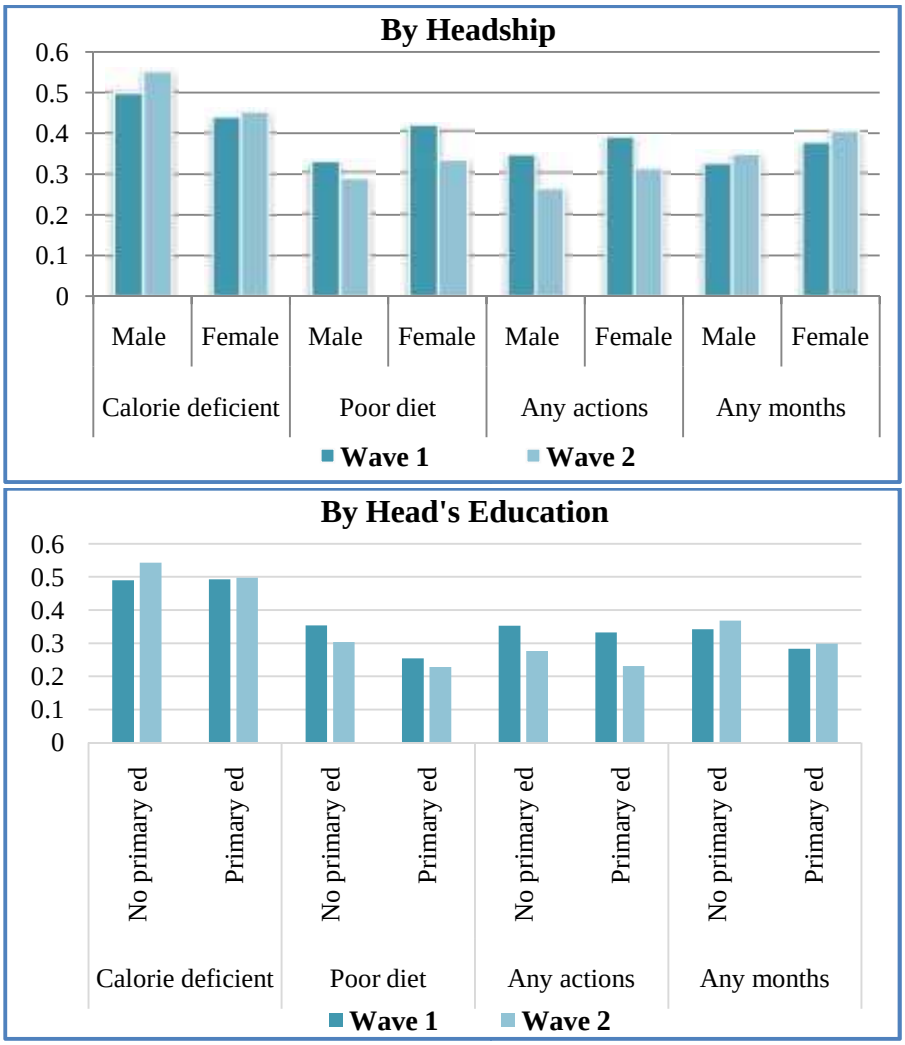
Notes: Population-weighted estimates. Q = quintile. Consumption quintile is based on real per adult equivalent nonfood monthly consumption. Number of observations: 3,266.

Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

Figure 5 shows the prevalence of food insecurity by education and sex of the household head. While the differences are fairly modest, male-headed households have slightly better outcomes, but the differences in terms of whether the head has had primary education are more marked. People in households headed by someone who has some primary education are significantly less likely to have poor diets, to be calorie deficient, or to have experienced any months of food insecurity. Figure 6 explores the prevalence of food insecurity by region. The survey design allows for disaggregated estimates for four regions (Tigray, Amhara, Oromia, and the Southern Nations, Nationalities, and Peoples' [SNNP] Region); the other six administrative regions are grouped together as the Others Region. There are both noticeable regional variations in food insecurity and differential changes in food security over time (Figure 6). This may not be surprising given the topographical diversity within the country and the related differences in seasonal income and consumption patterns (WFP and CSA, 2014). For all indicators except calorie deficiency, the prevalence of food insecurity is highest in the SNNP region; Amhara and the Other Regions

category have the highest prevalence of calorie deficiency. Based on the experiential indicators, Tigray and Amhara display a relatively low prevalence of food insecurity in wave 1, though the situation worsens considerably in wave 2.

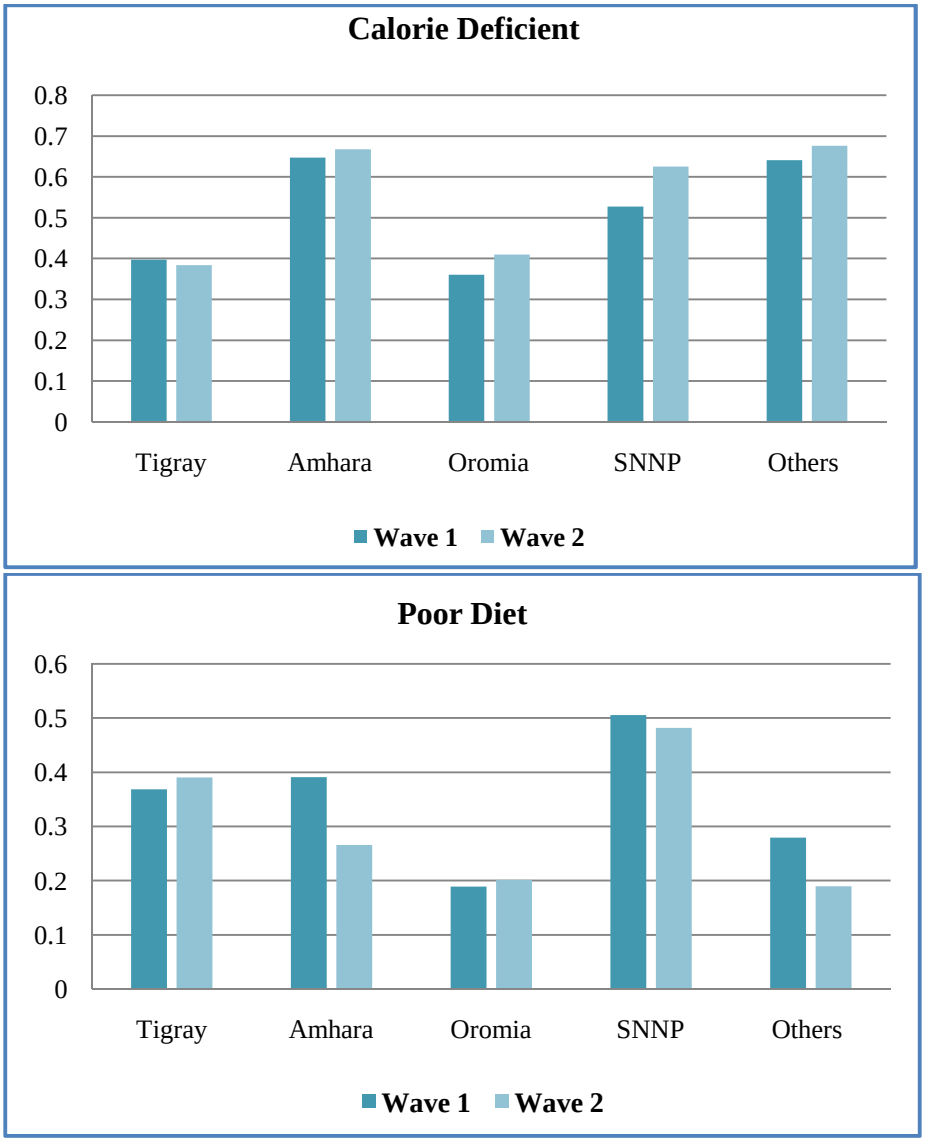
Figure 5: Food Insecurity by Headship and Head's Education and by Wave

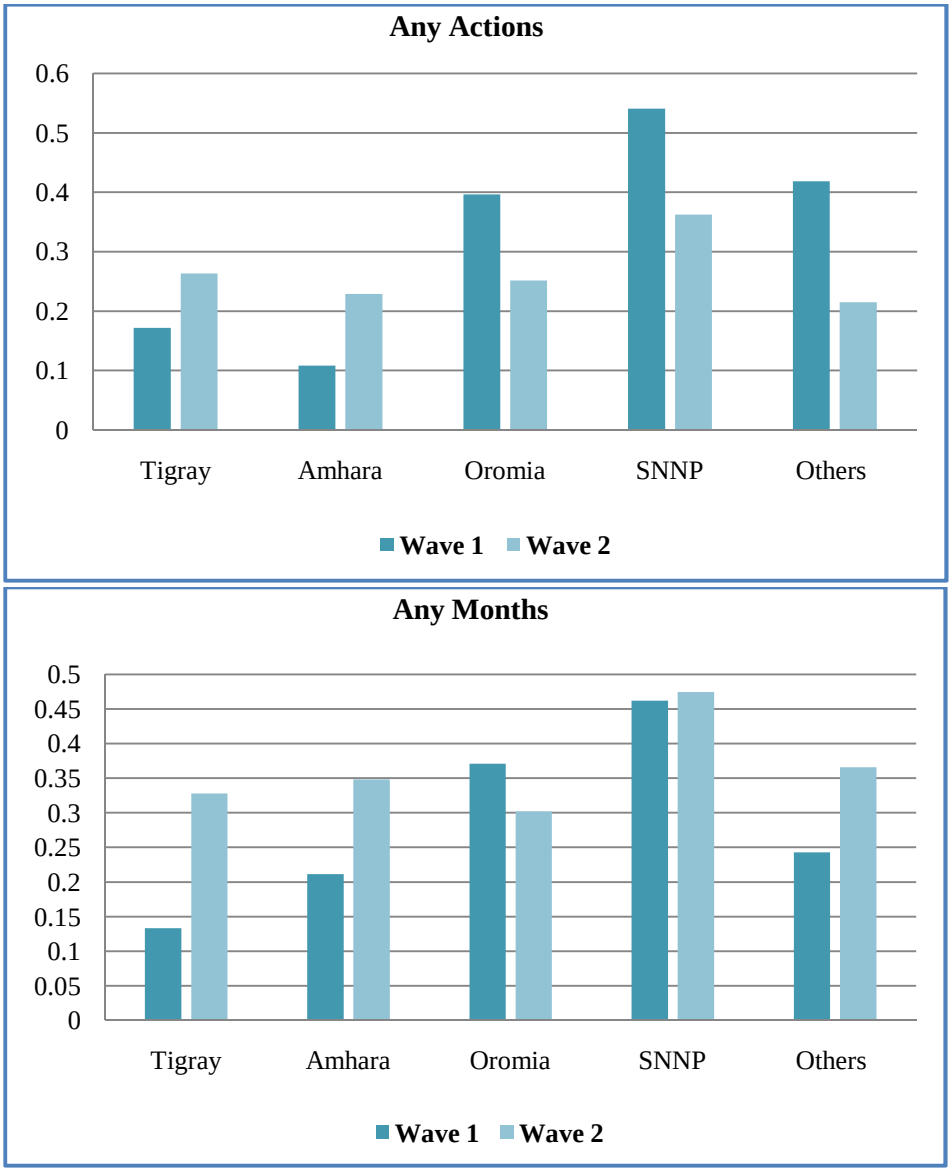


Notes: Population-weighted estimates. ed = education Number of observations: 3,266.

Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

Figure 6: Food Insecurity by Region and Wave





Notes: Population-weighted estimates. SNNP = is Southern Nations, Nationalities, and Peoples' Region; Others includes all other administrative regions. Number of observations: 3,266.

Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

5. Transitions in household food security in rural Ethiopia

The results shown for the two waves provide cross-sectional snapshots of the precarious nature of food security for rural and small-town Ethiopians. These snapshots tell us that between 2012 and 2014, more people are calorie-deficient while fewer have poor diets (Figure 3), but they cannot tell us how likely a person is to become food insecure, or how many have transitioned into or out of food insecurity. A major benefit of panel data is the ability to identify the latter, and to help understand what drives these transitions.

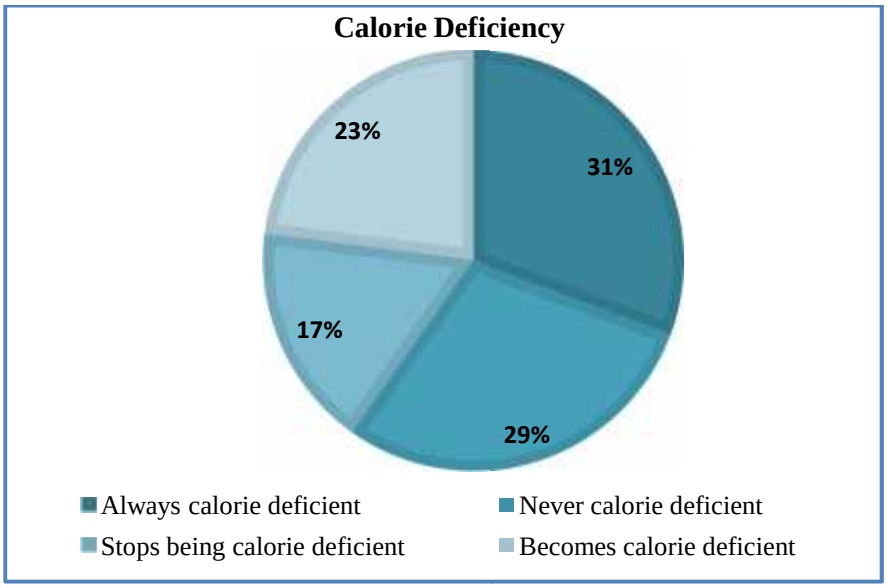
Figures 7 and 8 present transitions in and out of food insecurity, identifying both the chronically insecure and the percent of people whose food security status improves or deteriorates.[61] About 17 percent of people live in households that transition out of calorie deficiency between waves 1 and 2; and similarly, 17 percent transition to an adequately diverse diet. Approximately 19 percent of the people who lived in households that took actions to mitigate food insecurity in wave 1, reported in wave 2 that they did not need to do so. Similarly, 15 percent who reported being food insecure for at least one month in wave 1, reported no months of food insecurity in wave 2.

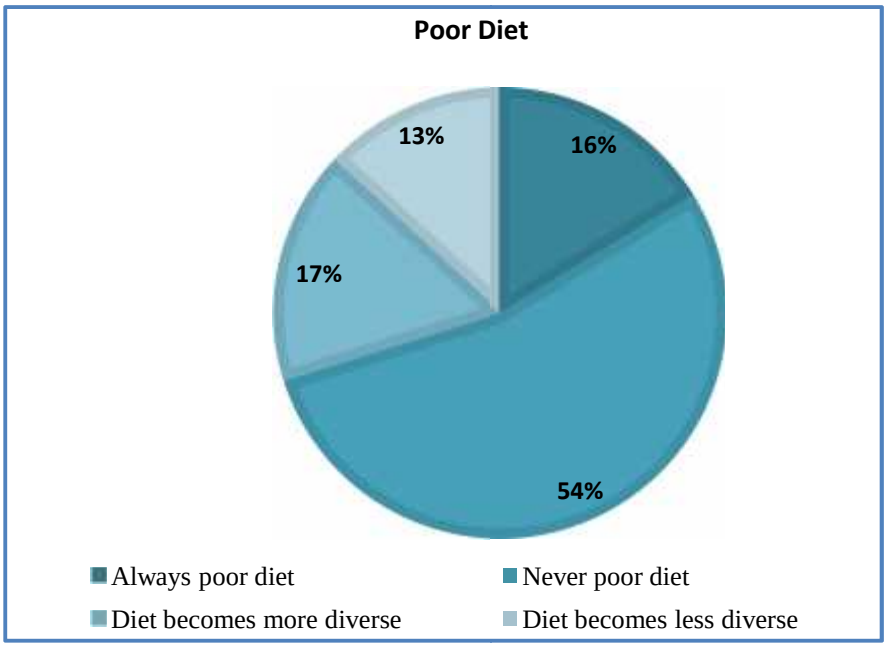
While substantial portions of the population thus indicated improvement over time, there are also many Ethiopians who saw their food security status worsen between waves. Twenty-three percent of the rural and small-town population transitioned from having adequate calories in wave 1 to being calorie-deficient in wave 2. Similarly, 13 percent transitioned into poor dietary diversity status. The pattern of the experiential measure – months of reported food insecurity and any actions taken to relieve food insecurity – is similar to the poor diet indicator: 13 percent of the population took no actions in wave 1, but then started taking actions in wave 2; while 18 percent of the population reported zero months of food insecurity in wave 1, but then in wave 2 experienced at least one month of food insecurity. The proportions whose status deteriorates over time are somewhat smaller than those whose

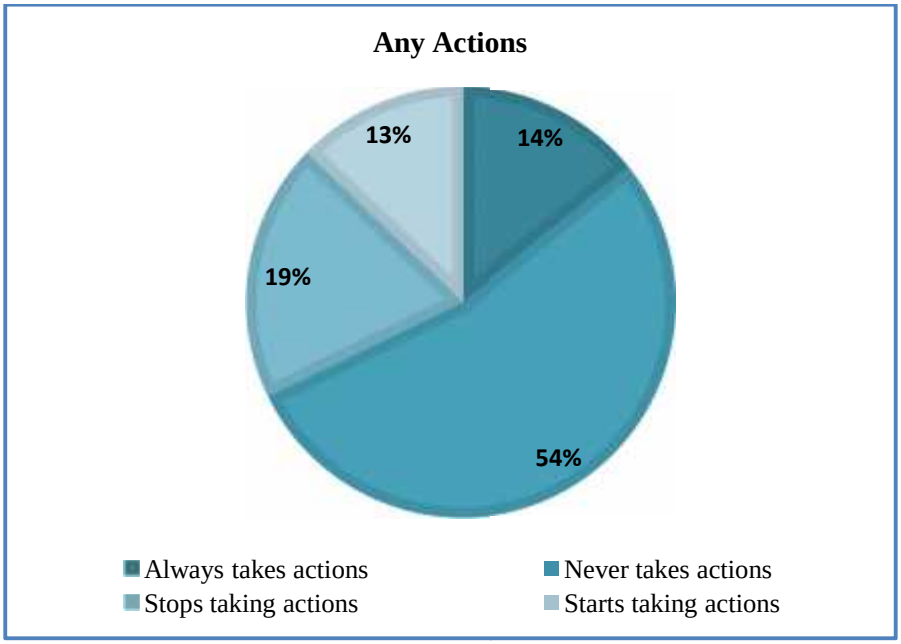
[61] In this section where we examine differences across the two waves, or transitions between the waves, we use the wave 2 weights.

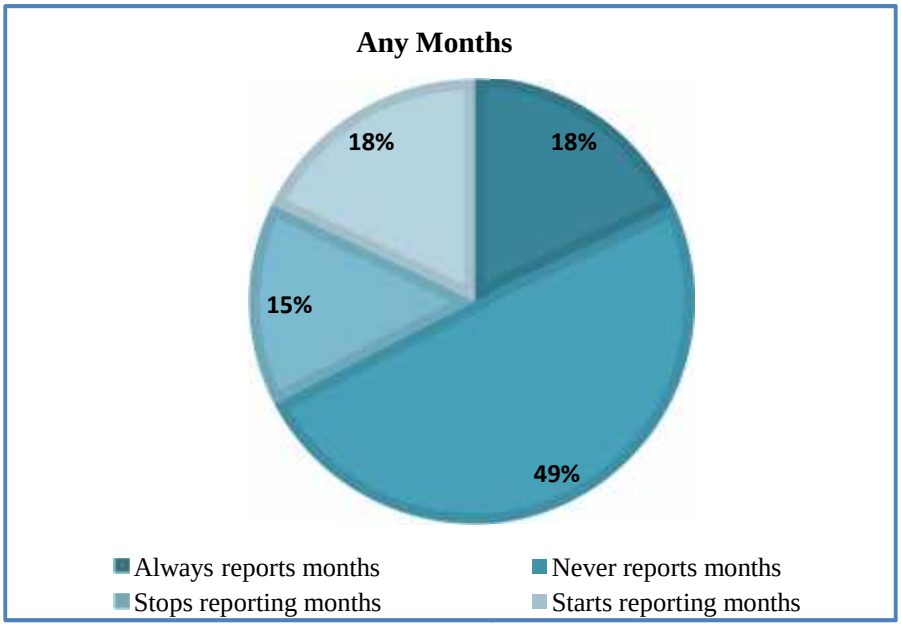
status improves, but what is particularly noteworthy is the large number of individuals whose food insecurity status transitions over time.

Figure 7: Food Insecurity over Time



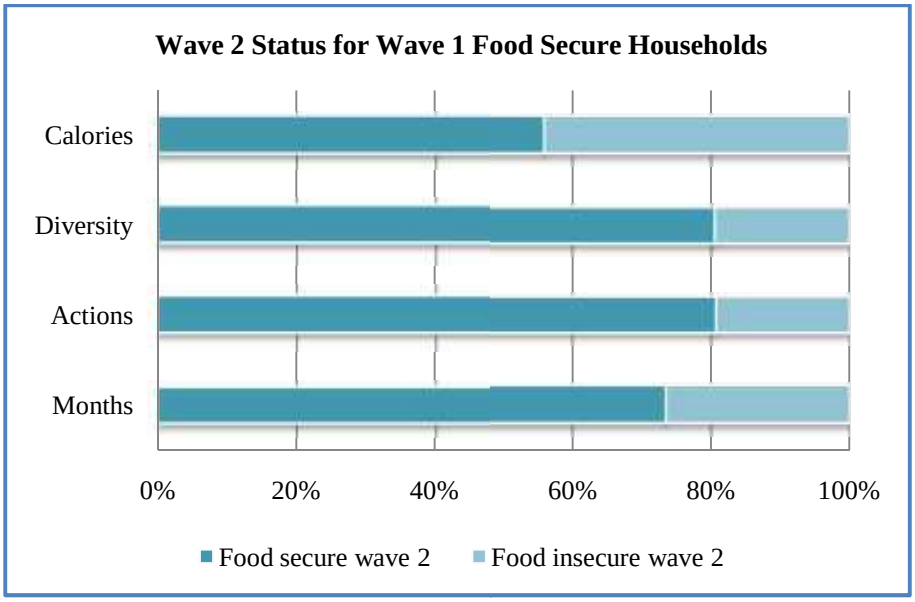


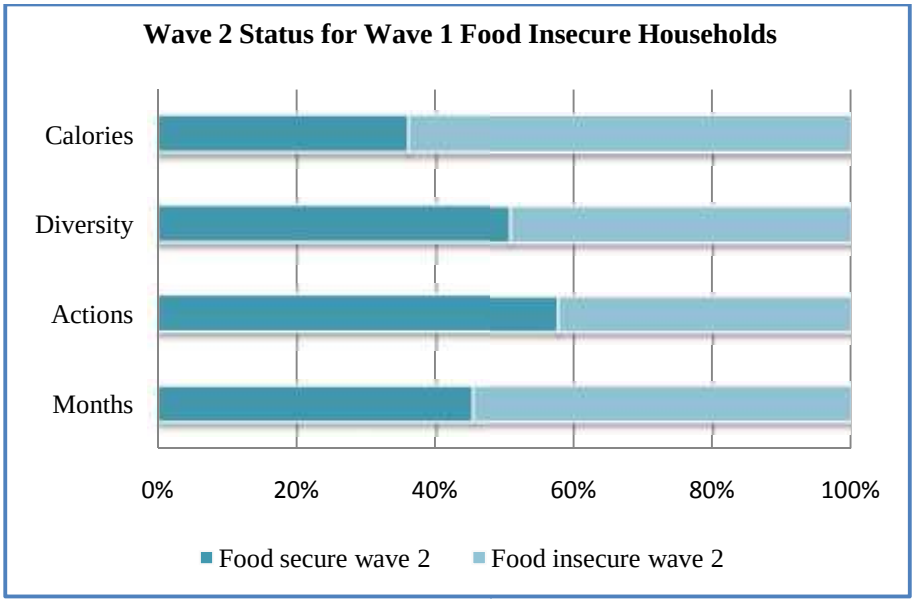




Notes: Population-weighted estimates. Number of observations: 3,266.
Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

Figure 8: Transitions in Food Insecurity by Measure

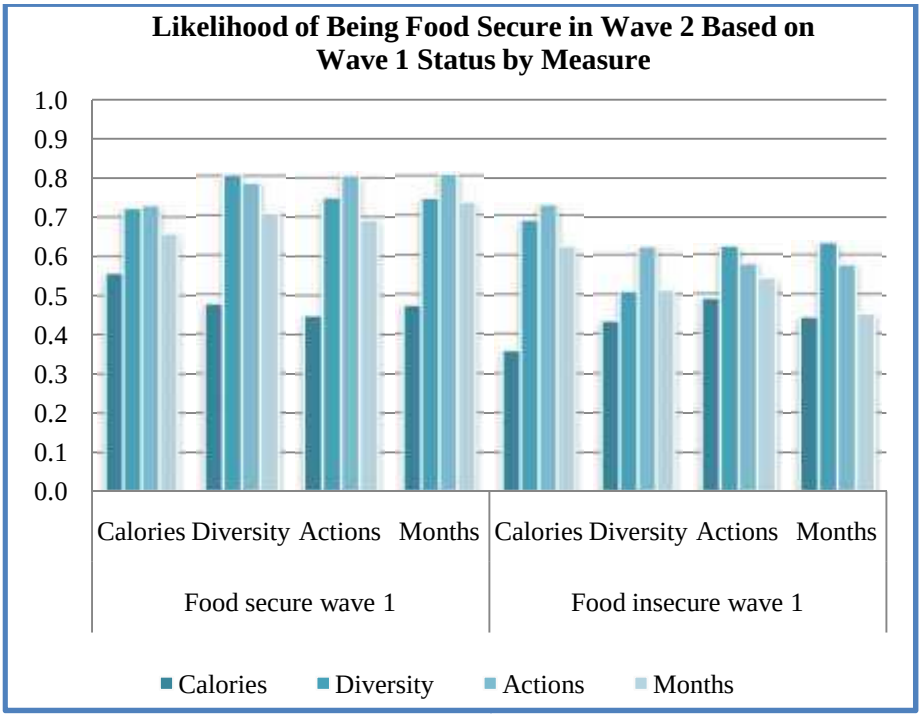


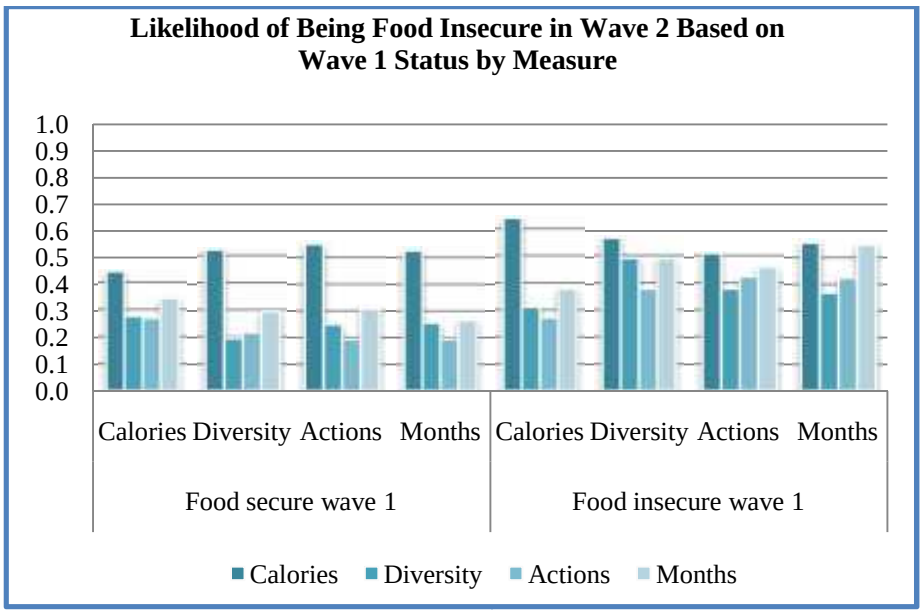


Notes: Population-weighted estimates. Number of observations: 3,266.
Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

To further explore these transitions, for each food security measure figure 9 reports the likelihood of being food secure or insecure in wave 2 based on whether the person was food secure (top panel) or insecure (bottom panel) in wave 1. Depending on the indicator, people who are food secure in wave 1 are likely to be food secure – to varying degrees – in wave 2. The persistence is greater with dietary diversity and the experiential measures than with calories. The food security status of many Ethiopians does, however, worsen. For people who were food insecure in wave 1, the likelihood that they remain food insecure varies by indicator. Those who were calorie-deficient are more likely than not to continue to be calorie-deficient; however, those with poor diets or any reported months of food insecurity are about equally likely to become food secure as to stay insecure. Households that took actions against food insecurity in wave 1 are less likely to do so in wave 2.

Figure 9: Transitions in Food Insecurity by and Across Measures





Notes: Population-weighted estimates. Number of observations: 3,266.
Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

In addition to comparing food security status over time based on a single measure, we examine the co-movement of food insecurity indicators over time. Table 3, which shows whether food security worsens, is constant, or improves over time for combinations of indicators helps answer the question of whether improvement in one indicator of food security suggests similar improvement in other indicators. It also helps identify whether indicators are dependent on or independent of each other. For most combinations, observing improvement in one measure of food security for an individual appears to tell an observer very little about whether the person has similarly improved in another measure.

For example, the (sample design-corrected) Pearson test of independence between changes in food security as measured by changes in FCS and in the reported number of months experiencing food insecurity has a p-value of 0.27. This suggests a failure to reject the null hypothesis of independence, which means that an improvement in FCS tells us nothing about whether the count of food-insecure months is improving or worsening. Similarly, the p-value of the test of independence for changes in FCS and in the number of

actions taken in response to food insecurity is 0.65, which also means that the first difference in FCS is independent of the first difference in the number of actions taken to alleviate food insecurity.

Table 3: Comovements in Food Insecurity Status

		Worsened	*Constant*	*Improved*	*Total*
		Poor diet status			
Calorie deficiency status	Worsened	0.03	0.17	0.03	0.23
	Constant	0.08	0.42	0.11	0.60
	Improved	0.02	0.12	0.04	0.17
	Total	0.13	0.70	0.17	1.00
		Any actions status			
Calorie deficiency status	Worsened	0.03	0.16	0.04	0.23
	Constant	0.07	0.40	0.12	0.60
	Improved	0.02	0.12	0.04	0.17
	Total	0.13	0.68	0.19	1.00
		Any months status			
Calorie deficiency status	Worsened	0.05	0.15	0.03	0.23
	Constant	0.10	0.41	0.09	0.60
	Improved	0.04	0.11	0.03	0.17
	Total	0.18	0.67	0.15	1.00
		Any months status			
Poor diet status	Worsened	0.03	0.08	0.02	0.13
	Constant	0.11	0.49	0.10	0.70
	Improved	0.04	0.10	0.03	0.17
	Total	0.18	0.67	0.15	1.00
		Any actions status			
Poor diet status	Worsened	0.01	0.09	0.02	0.13
	Constant	0.09	0.47	0.14	0.70
	Improved	0.02	0.12	0.03	0.17
	Total	0.13	0.68	0.19	1.00
		Any actions status			
Any months status	Worsened	0.05	0.12	0.01	0.18
	Constant	0.07	0.48	0.13	0.67
	Improved	0.01	0.08	0.06	0.15
	Total	0.13	0.68	0.19	1.00

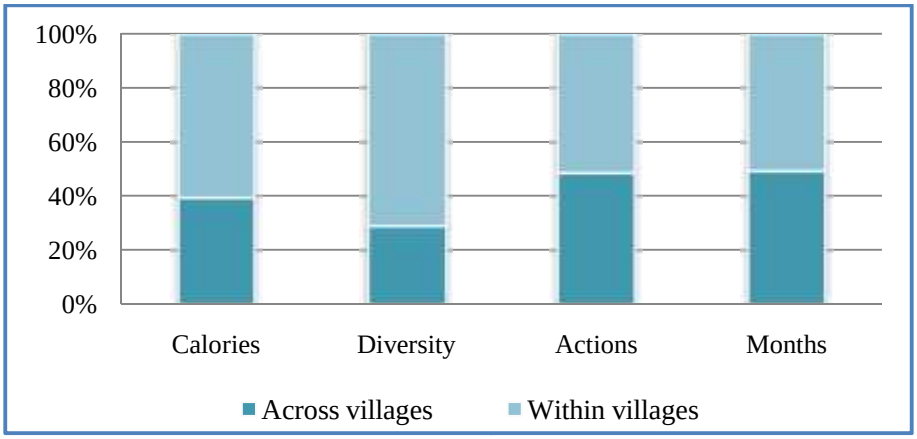
Notes: Population-weighted estimates. Number of observations: 3,266.
Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

An important exception to this finding is that there is statistical dependence in the first difference of the experiential measures. For example, a decline in the reported number of months experiencing food insecurity is correlated with a decline in the reported number of actions taken to counter food insecurity, suggesting that these measures may be picking up some common dimension of food insecurity.

Finally, we examine the geographic sources of variation of changes (in first differences) for our food security measures: calories, FCS, and the two experiential measures. For each measure, the figure 10 presents the proportion of the variance that is occurring within villages and the proportion occurring between villages. A lack of variation in first-difference measures within villages suggests that all food security shocks are (like droughts) covariate: if someone in a village has a marked decline in FCS, everyone in that village has the same decline. Similarly, if all of the variation is within a village and none between villages, then all change appears to be idiosyncratic or not shared at all by neighbors within villages. One possible example of an idiosyncratic shock would be death of a household member.

From Figure 10 it appears that the majority of variation is occurring within villages; for calories and FCS, more than 60 percent of the variation is within-village. For the two experiential measures, the within-village variation explains a slightly smaller proportion of total variation but it is still the main source of the variation. As a whole, the results suggest that drivers of changes in food insecurity appear to be both covariate and idiosyncratic, with the idiosyncratic component significantly more important. Other research, such as Dercon *et al.* (2006), has found that households in rural Ethiopia typically experience both covariate and idiosyncratic shocks that affect current consumption and in some cases have long-lasting effects. Additionally, Yilma *et al.* (2014), who examine how coping mechanisms relate to the nature of a shock in rural Ethiopia, find that when confronted with covariate shocks households reduce food consumption and draw on savings; however, confronted with idiosyncratic health shocks, they draw on savings and borrow.

Figure 10: Variations of Changes in Food Security



Notes: Population-weighted estimates. Number of observations: 3,266.
Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.

6. Conclusion

In this paper, we use data from the ESS, a panel survey that is representative of rural and small towns in Ethiopia, to examine patterns of food security over time and across households. Understanding the drivers of food insecurity is crucial in Ethiopia, where much of the population either lives with or is vulnerable to food insecurity and poverty. We found, using multiple measures, that a large share of the rural Ethiopian population is food insecure, and that this share was much larger when viewed over a 2-year period since there is considerable movement into and out of food insecurity. We also found that the changes in food security are driven by differences both between and within villages, with the latter being more important in terms of calories and nutritional diversity. Finally, we found little co-movement in food insecurity status. The measures may have been picking up different dimensions of food security or may suffer from measurement error.

Our results underscore the importance of research that carefully examines the measurement of the multidimensional concept of food security, such as Maxwell *et al.* (2014) specifically for Ethiopia, and Carletto, Zezza, and Banerjee (2013) more generally. Such research is crucial for identifying public and private solutions to both transitory and chronic food insecurity.

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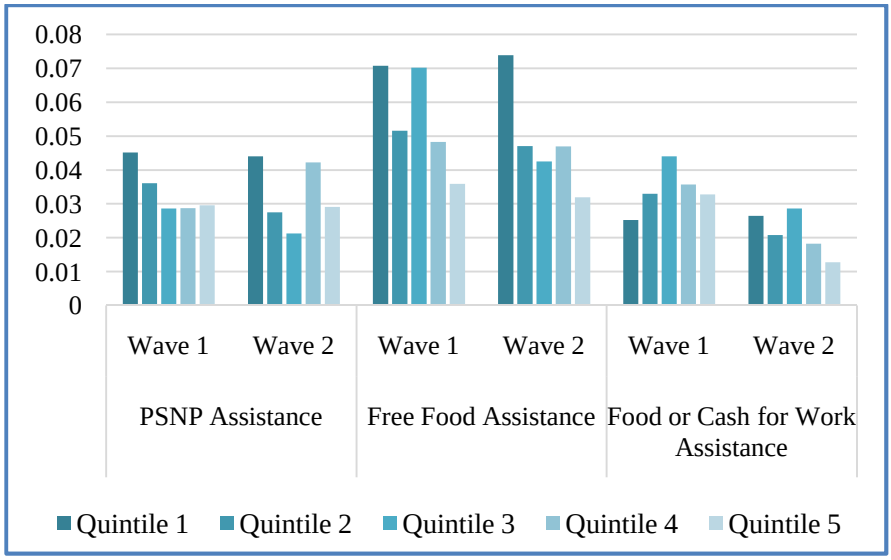
Appendix Figure 1: Assistance by Quintile and by Wave



Notes: Population-weighted estimates. Quintiles are based on real nonfood monthly consumption per AE. Number of observations: 3,266.

Source: Ethiopia Rural Socioeconomic Surveys, 2011/12, 2013/14.