Can household food security predict individual undernutrition? Evidence from Cambodia and Lao PDR

Bühler*[a], Dorothee; Hartje[a], Rebecca; and Ulrike Grote[a]

Hannover Economic Papers (HEP) No. 594

May 2017

Abstract

This paper uses a novel data set of marginalized households from Cambodia and Lao PDR to better understand different food security concepts. The multitude of indicators available raises the question how these indicators relate to each other and whether they are suitable to detect undernutrition of individuals. In the analysis we identify the causes of food insecurity in relation to a number of different food security concepts and examine the links between the food security status of households and individuals using anthropometric data of children under five. The regression results show that the different indicators of food security at the household level capture fundamentally different aspects of food security. In addition, household food insecurity only explains a small share of child undernutrition. We call for more research on intra-household allocation of food and stress the implications of our research for the design and targeting of food and nutrition support programs.

Keywords: Food Security, Undernutrition, Human Development, Poverty, Southeast Asia

JEL classifications: Q18, I15, O15

* Corresponding author, e-Mail: buehler@iuw.uni-hannover.de

[a] Leibniz University Hannover, Faculty of Economics and Management, Institute for Environmental Economics and World Trade, Königsworther Platz 1 30167 Hannover, Germany.

We acknowledge financial support by the Institute for Environmental Economics and World Trade and the Institute of Development and Agricultural Economics from Leibniz University of Hannover.

1. Introduction

Ensuring access to safe, nutritious and sufficient food is one of the major aims of the Sustainable Development Goals. Food insecurity and undernutrition constitute a major barrier to economic growth in developing countries (UN 2015; WB 2016b). Individuals who are not able to meet their dietary needs suffer from reduced productivity and are prone to diseases. As a result, academic achievements, earning opportunities, and livelihood outcomes are negatively affected (Glewwe et al. 2001; Smith & Haddad 2015; UN 2015). We study the relation between different food security indicators and causes of food insecurity to improve our understanding of the accuracy of different indicators (Headey & Ecker 2013; Maxwell et al. 2014). It will help to develop a cohesive understanding of food security and design better targeted and effective food policies.

Food security consists of four dimensions: (i) availability, (ii) access, (iii) use and utilization, and (iv) stability (FAO 1996). The first three dimensions are hierarchical in nature (Barrett 2010) and refer to the actual disposability of food (availability), the household's ability to acquire food in sufficient quality and quantity (access), and usage of food consisting of the individual's ability to absorb and metabolize the nutrients as well as health, hygienic, and behavioral components (use and utilization). The fourth dimension, stability, relates to the temporal aspect and calls for continuous food security throughout the seasons of the year. According to this definition, a household or individual is food secure if these four dimensions are satisfied.

Most studies focus either on availability and access (Carletto et al. 2013; De Haen et al. 2011; Rashid et al. 2011) or on individual undernutrition using anthropometrics which measure the use and utilization dimension (Black et al. 2013; Dercon & Singh 2012; Glewwe et al. 2001; Haddad et al. 2003; Headey 2013; Larrea & Kawachi 2005). Only few papers focus on different aspects of food security and study the relation between household level indicators and their ability to predict food security at the household level (De Haen et al. 2011; Headey & Ecker 2013; Maxwell et al. 2014; Smith et al. 2000). Data is scarce as health surveys are often not compatible with household surveys (Cafiero 2013; Carletto et al. 2013; De Haen et al. 2011). Our data set allows us to combine both aspects and enables us to use households and individual level information to discuss the causes of food insecurity.

To date, economists have studied the relation between income poverty and undernourishment extensively. However, evidence regarding the influence of other aspects of well-being on food insecurity as well as a comparative analysis of different indicators remains limited (Headey 2013; Klasen 2008). The analysis in this paper bridges the gap and enhances the understanding of food insecurity in several ways. First, we identify the associations between causes of food insecurity and food security indicators in Cambodia and Lao PDR. Second, to show the difference between household and individual food insecurity, we assess if household level indicators predict individual undernutrition. Third, to understand the dynamics of food insecurity we give a profound overview of the food security situation in our study area by combining household and individual level data on poverty, inequality, health, and education with food security.

Even though the Asian countries belong to the fastest growing economies worldwide, the continent exhibits a high incidence of poverty and is home to 60% of the world's undernourished (Rigg et al. 2012; WB 2016a; WB 2016c). Household consumption in Cambodia increased by about 40 percent in the past decade (WB 2014), yet, 25% of the population, are undernourished (Ecker & Diao 2011) and 14.2.% of the population suffer from food insecurity (FAO 2015). While Lao PDR experienced robust economic growth with 7% in 2016, inequality grew (WB 2016c) and 18.5% of the population face food insecurity (FAO 2015). Undernutrition rates for children under five of 32% and 44% (WB 2016a; WB 2016c) remain worrying and result in substantial long-term GDP losses, estimated around 2.4 to 2.5 percent per year in Cambodia and Lao PDR (Bagriansky & Voladet 2013; Bagriansky et al. 2014). Therefore, studying the causes of food insecurity in the region provides useful insights for the design of policy programs, which aim to increase food security.

We use a novel panel data set which consists of 1,200 marginalized households from Stung Treng, a remote northern province of Cambodia, and Savannakhet, a southern province of Lao PDR. In addition, the data includes individual level data on 900 children below the age of five. We extend the UNICEF framework for the 'causes of child undernutrition and death' to incorporate the different dimensions of food security into the context of undernutrition. Although this concept has been applied in previous studies (Black et al. 2013; Carletto et al. 2013; Smith & Haddad 2015; Smith et al. 2000), it has not been used to analyze the relation between the causes of food insecurity and different food security dimensions. We apply Ordinary Least Squares (OLS) and conditional multivariate regression techniques in our analysis.

The remainder of the paper is organized as follows: section 2 introduces our conceptual framework of food insecurity and discusses relevant literature. Section 3 presents the data set and our empirical strategy. Section 4 reports and discusses the results and Section 5 concludes.

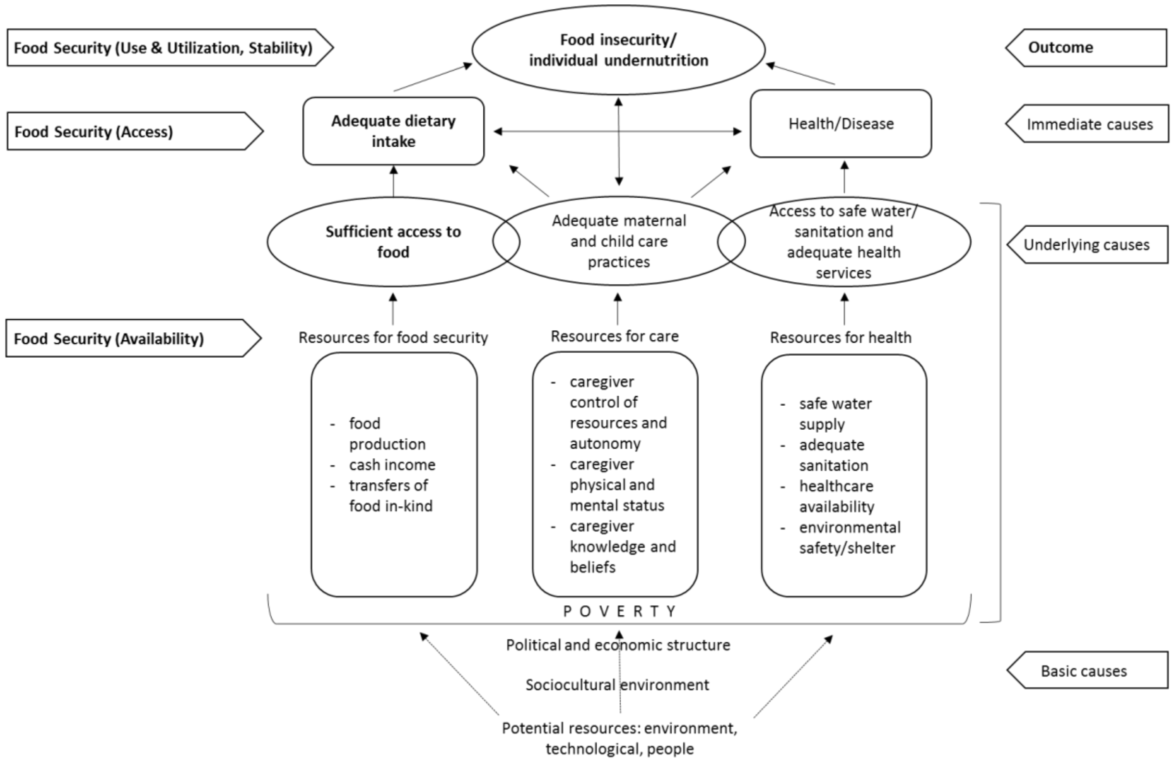
2. Literature review and conceptual framework

2.1 Causes of food insecurity

The causes of food insecurity are based on the UNICEF framework for the 'causes of child undernutrition and death' (see Figure 1). The concept is used in both, the undernutrition (Black et al. 2013; Smith & Haddad 2015) and the food security literature (Carletto et al. 2013; Smith et al. 2000) to identify causes of household food insecurity or individual undernutrition. It depicts the relationship between societal, community, household/family, and individual specific causes and the food security status. Along these lines, the causes of food insecurity are divided into three categories, basic, underlying, and immediate. Reflecting the hierarchical nature of the four food security dimensions, availability of food is part of the underlying causes, while access in terms of inadequate dietary intake belongs to the immediate causes of food insecurity. The availability dimension is generally related to the regional or national level. However, marginalized households in developing countries face imperfect markets and engage in the production of food as subsistence farmers (Di Falco et al. 2011; Lema et al. 2014). Therefore, the access dimension is interwoven with activities at the household level. Undernutrition and household food insecurity (including use and utilization and stability over time) belong to the outcome dimension.

The basic causes of food insecurity depict the economic, social, environmental, and cultural context. They relate mainly to the national, regional or global level and capture average income, inequality, and political and environmental stability. Evidence suggests that poverty is both a cause and an outcome of food insecurity (Bhattacharya et al. 2004). As one of the key variables, income affects food insecurity at the household level and through overall GDP levels (Smith & Haddad 2015). At the household level, higher income enables families to invest more into avoiding underlying causes including poor sanitation or access to safe drinking water. On a broader scale, higher GDP improves public service provision including education and access to health services. Political, legal and cultural factors shape households' decisions related to income earning strategies and consumption (Black et al. 2013; Smith & Haddad 2015). Women's rights and their role in society determine female bargaining power and are important factors of food security as women are typically in charge of preparing meals (Tibesigwa & Viesser 2016).

Figure 1: Conceptual Framework - Causes of Food Insecurity. Sources: Adapted from Carletto et al.(2013), Smith & Haddad (2015), Smith et al.(2000), and UNICEF(1998).



The underlying causes of food insecurity are split into three areas (UNICEF 1998) including (i) adequate access to food in the household, (ii) adequate care for children and women, and (iii) sufficient health services and a healthy environment. The causes relate to household and community level variables. First, access to food at the household level is concerned with availability of food from own production or local markets and sufficient funds to produce or buy food (Di Falco et al. 2011; Lema et al. 2014). Second, caring practices are related to knowledge, ability, and believes (Smith & Haddad 2015). As women are the primary caretakers of children, higher female education is associated with food security and lower undernutrition rates (Black et al. 2013; Haddad et al. 2003; Headey 2013; Hong & Mishra 2006; Larrea & Kawachi 2005; Rashid et al. 2011; Smith & Haddad 2015; Vollmer et al. 2014). Third, elements of health and a healthy environment include access to health facilities, such as hospitals (Larrea & Kawachi 2005; Smith & Haddad 2015), safe drinking water, and access to sanitation and waste disposal (Black et al. 2013; Haddad et al. 2003; Headey 2013; Hong & Mishra 2006; Larrea & Kawachi 2005; Smith & Haddad 2015).

The immediate causes of food insecurity relate to individual dietary intake and individual health. Both factors are interdependent and reinforce each other. Previous research has found a strong relation between health impairment and dietary intake in terms of quality and quantity (Dixon et al. 2001).

2.2 Food security and undernutrition indicators in the literature

Table 1 presents a synthesis of indicators that have been developed to measure the four food security dimensions. Following Maxwell et al. (2014) and De Haen et al. (2011), we categorize the most commonly used food security indicators into five groups: (i) calorie intake, (ii) dietary diversity and food frequency measures, (iii) consumption behavior measures, (iv) experimental measures, and (v) anthropometrics.

Table 1: Food security indicators and their determinants

Category	Indicators	What it measures	Source for indicator	Dimension of food security
Calorie intake	FAO undernourishment indicator	Calorie consumption, energy intake, and probability of sufficient caloric consumption at different levels (national, household, individual); uses context specific calorie tables for specific food items	(Wanner et al. 2014; FAO 2002)	availability
	Calorie consumption		(Svedberg 2002)	availability, access
Dietary diversity and food frequency	Food Consumption Score (FCS)	Number of different food groups consumed, frequency, food groups typically weighted according to scale which accounts for nutritional importance of respective food groups	(Ruel 2006; Swindale & Bilinsky 2006; Wiesmann et al. 2009)	availability, access
	Household Dietary Diversity Score (HDDS)			availability, access
Consumption behavior	Coping Strategies Index (CSI)	Indirect measure of food security which takes into account the consumption behavior at the household level, frequency and severity of behavior used if people face food or income shortage are captured	(Maxwell & Caldwell 2008)	availability, access, use & utilization
	reduced Coping Strategies Index (rCSI)			availability, access, use & utilization
Experimental Methods	Household Food Insecurity Access Scale (HFIAS)	Combine different behavioral and psychological dimensions with severity of food insecurity	(Coates et al. 2007)	availability, access, use & utilization
	Household Hunger Scale (HHS)		(Ballard et al. 2011)	availability, access, use & utilization
Anthropometrics	Wasting	Nutritional outcomes at individual level --> usually measured for children < 5 years	(Vollmer et al. 2014; WHO 1986)	availability, access, use & utilization, stability
	Stunting			
	Underweight			

Belonging to the category of calorie intake indicators, the FAO undernourishment indicator measures the general availability of food produced in a region or country (Carletto et al. 2013). Other caloric consumption related indicators, dietary diversity, and food frequency scores, such as the Food Consumption Score (FCS) capture availability, access, and to a small extent use and utilization. Indicators related to consumption behavior, experimental measures, and anthropometrics give information about use and utilization. If observed across several periods, the food security indicators can also reveal stability over time. The anthropometrics in children under five can detect availability, access, use and utilization of food across time. Stunting (height-for-age) is a long-term measure, which captures deprivation or illnesses in the past, especially for older children. Wasting and underweight are short- and medium-run measures of the nutrition status because child weight changes fast and therewith captures short-run fluctuations in food intake and utilization (Ashworth 1969; Duflo 2003).

3. Study design

3.1 Data

The data set used is part of a novel two-period household survey collected in May 2013 and 2014 in the northern Cambodian province of Stung Treng and the southern Laotian province of Savannakhet (see Figure 3 in appendix). With 95,000 rural inhabitants, Stung Treng is a sparsely populated province of Cambodia, 500 kilometers away from the nation's capital, Phnom Penh. The majority of households are engaged in small-scale farming and about 16% are estimated to be food insecure (WFP 2008). Savannakhet is the largest Laotian province with a total rural population of 754,469 (LSB 2015), which is situated about 400 kilometers south of the capital Vientiane. Roughly 11% of the rural population face food insecurity but up to 74% of households are at risk to become food insecure in the future (WFP 2007).

The initial survey contains 1,200 rural households which were sampled according to a multi-stage sampling procedure based on Hardeweg et al. (2013) and UN (2005). Sampling in Savannakhet consisted of three stages accounting for the different agro-ecological zones and the heterogeneity in village size. In addition, stratification took population density and the presence of ethnic minorities into account. The province was stratified into three regions, the Mekong region in the west, the Lowland region in the middle, and the Mountain region in the east. Since the mountainous area is less densely populated, the stratum was oversampled to ensure sufficient coverage. The cluster size was set to 15 households per village in the Mekong and Lowland region and, due to smaller village size, to 10 in the Mountain region. Weights were calculated to reflect the probability of inclusion for each household in the respective province.

In Stung Treng, agro-ecological conditions and village size are homogenous. Therefore, a two-stage sampling procedure was applied. In the first step 30 villages were selected from the list of all 129 rural villages in the province with probabilities proportional to their size measured as the number of households. In the second step, 20 households were randomly chosen from each village's household list. This results in equal probability for each household in the province to be part of the sample[1].

The survey consists of two modules: (i) a household questionnaire covering individual and household level data; and (ii) a village questionnaire capturing village level characteristics such as employment opportunities, population size, and access to general services (education, banking, etc.). The household head or a representative gave responses to the household questionnaire while the village head or deputy answered the latter. The individual questions cover information on education, health, anthropometrics, and occupations. The household level questions capture income and consumption components, agricultural production, shocks, assets, food security, and housing conditions with a one-year reference period.

3.2 Identification of dependent variables

We use four different measures to capture food security according to different dimensions and categories, including: (i) the Food Consumption Score (FCS) – a measure of dietary diversity, (ii) the reduced Coping Strategies Index (rCSI) – which captures coping strategies employed by households when facing food shortage, (iii) the Household Food Insecurity Access Scale (HFIAS) – related to food availability and household behavior, and (iv) child anthropometrics – undernutrition indicators for children under five. Therewith, we cover the dimensions of access, use and utilization, and stability as outcomes in our analysis. Availability is not included as an outcome variable since according to the underlying conceptual framework it belongs to the causes of food insecurity. It is, however, included in the immediate causes as daily per capita kilocalorie intake.

The construction of the FCS is based on the technical report issued by the World Food Program (2008) and involves five steps. Accordingly, household-level values of dietary diversity and food frequency are calculated from the seven-day recall data provided by the households. The

[1] More information on the Cambodian dataset can be found in Buehler et al. (2015) and Nguyen et al. (2015).

values are weighted to account for the respective nutrient density of the food groups and thus the FCS is related to caloric intake measures (Carletto et al. 2013; Maxwell et al. 2014; Wiesmann et al. 2009; WFP 2008). We use the adjusted scales, proposed by the World Food Program (WFP 2008), to classify households' food security status since the majority of households consume oil and sugar. Based on the respective scale, households are classified as being food secure, mildly or severely food insecure (see Table 2).

Table 2: Classifications of food security by indicators

Indicator	Categories	Description	Range (internal to indicator)
FCS	1	Severely food insecure	0 - 28
	2	Borderline food insecure	29 - 42
	3	Acceptable (food secure)	>42 (maximum: 112)
rCSI	1	Severely food insecure	>18 (maximum:
	2	Mildly and moderately food insecure	4 -18
	3	Food secure	0 - 3
HFIAS	1	Severely food insecure	N/A, algorithmic
	2	Mildly and moderately food insecure	classification process)
	3	Food secure	
Underweight	0	Normal	Std. >= -2
	1	Underweight	-2> Std. <-3
	2	Severely underweight	Std. <-3
Stunting	0	Normal	Std. >= -2
	1	Stunted	-2> Std. <-3
	2	Severely stunted	Std. <-3
Wasting	0	Normal	Std. >= -2
	1	Wasted	-2> Std. <-3
	2	Severely wasted	Std. <-3

Source: based on (Coates et al. 2007; Maxwell & Caldwell 2008; WFP 2008; WHO 1986)

While the HFIAS and the rCSI both measure food security in terms of use and utilization, their underlying concepts differ. Using a reference period of four weeks, the HFIAS is derived from a set of questions related to food availability and household behavior (Coates et al. 2007). The rCSI measures behavior or coping strategies employed by people who do not have access to sufficient amounts of food. The indicator is based on a set of questions that ask how frequently the household used a certain strategy in the past year (e.g. go to bed hungry, borrow from a friend) (Maxwell & Caldwell 2008).The calculation of the HFIAS and the rCSI are based on the technical reports from Coates et al. (2007) and Maxwell & Caldwell (2008). For convenience, we use the reversed score of the HFIAS and the rCSI.

We use all three indicators of child undernutrition, including: (i) underweight – as weight-for-age, (ii) stunting – in terms of height-for-age, and (iii) wasting – in terms of weight-for-height. All three indicators are based on child age, height, and weight measured by the enumerators during the survey. We use standard deviation scores (z-scores) which compare the children to the international reference population established by the World Health Organization (WHO 1986). The z-scores are calculated as the individually observed value minus the age and sex specific median from the WHO reference population, divided by the standard deviation for this group from the reference population (Borghi et al. 2006). The values are restricted to the biologically plausible values[2] (Vollmer et al. 2014). We define the cut-offs of moderate and severe undernutrition based on the standards promoted by the WHO (De Onis & Bloessner 1997). In addition, we define a binary variable indicating undernutrition if the z-score is smaller than -2.

As indicated, the reference periods of the indicators vary. Therefore, their ability to measure stability over time differs. Given that the FCS is based on food intake in the past week it gives a snapshot of food security at one particular point in time. Similarly, the underweight indicator refers to the current nutrition status of children. The HFIAS and the wasting indicator capture food security in the medium run. The rCSI and especially the stunting indicator are able to detect food insecurity across a longer time horizon. Since our data spans across two waves of household data it does not allow us to detect general food security trends or seasonality throughout the year.

3.3 Identification of independent variables

We derive our independent variables from the framework presented in Section 2. In contrast to other recent studies of food insecurity and child undernutrition (Black et al. 2013; Maxwell et al. 2014; Smith & Haddad 2015; Vollmer et al. 2014) our data combines household characteristics with food insecurity and individual undernutrition. This allows us to use causes that are measured at the household and the individual level in our analysis. Following the three different causes of food insecurity from the framework, we have three different sets of independent variables.

The first set of variables reflects the individual level of food insecurity and relates to individual health and food intake. In the regressions related to household food insecurity, we use a health shock dummy to capture diseases experienced by household members in the past year. Dietary intake is reflected by kilocalorie intake per capita per day (Larrea & Kawachi 2005). While these two variables are measured at the household level, we include a number of child and

---

[2] According to this z-scores > |6| for height-for-age, <-6 and >5 for weight-for-age, and >|5| for height-for-weight are excluded.

mother specific characteristics to account for individual health condition and nutrition intake in the set of individual regressions. To account for individual child characteristics, we include the age in months, the sex of the child, and the birth order (Nguyen et al. 2013). Furthermore, we use different dummies to identify the child's health status (Black et al. 2013), indicating whether the child had diarrhea in the past four weeks or had a serious illness in the past year. As the physical constitution and health status of the mother have a strong effect on the child's nutrition status we include the mother's BMI. In addition, we capture the mother's age and education measured in years.

The second set, representing underlying causes of food insecurity, accounts for village and household level characteristics related to food insecurity. Based on the framework, three areas are influential, including food, care, and health resources. We include remittances (log), the home consumption value of fish and meat (log), and the value of in-kind food transfer received (log) to capture the food resources available, specifically proteins (Headey 2013). To account for the quality of income sources we include the number of low-skilled wage workers. Caretaking is reflected by the highest education in the household and the experience of the household head by age in years. As female-headed households have been found to be at higher risk of food insecurity (Klasen et al. 2015) we include a dummy indicating the sex of the household head. The third area includes resources for health. Following Black et al. (2013), Haddad et al. (2003), and Larrea & Kawachi (2005), we construct a dummy indicating access to safe drinking water. Similarly, access to sanitation is a dummy variable indicating access to a shared or private sanitation facility. A waste and an electricity dummy identify households who have access to electricity and public waste disposal to capture additional differences in environmental safety. The availability of healthcare is reflected by the distance to the next hospital measured at the village level. While the variables related to food resources might have a more direct impact on food security in terms of access and availability, we expect care and health variables to be more important for the use and utilization dimension of food security as well as children's nutrition status.

Finally, the third set of variables, accounting for the basic causes of food insecurity, includes socioeconomic and political factors. Smith & Haddad (2015) and Vollmer et al. (2014) use macroeconomic factors to capture the basic societal or economic situation across countries. Since our study region covers two provinces we include district and village fixed effects to account for regional differences (Knueppel et al. 2009). As consumption per capita is very likely endogenous to our model (Rashid et al. 2011), the influence of income inequality and poverty is captured by consumption quintiles (Hong & Mishra 2006; Vollmer et al. 2014). Household wealth is approximated through asset and land values. Given that they are highly correlated we perform a principal component analysis to create a factor variable which jointly captures wealth (Filmer & Pritchett 2001; McKenzie 2005). Finally, as household composition influences food security, we additionally control for household size and the age structure of the household (Haddad et al. 2003).

3.4 Specification of econometric models

In the analysis, we use three different sets of regressions. The first specification uses ordinary least squares (OLS) and compares the influence of household level characteristics on different measures of food security representing the dimensions of access and use and utilization. This allows understanding which household characteristics correlate with the individual indicators. The regression takes the following form:

$$Y_{it} = \alpha_0 + \beta_1 ID_{it} + \beta_2 UD_{it} + \beta_3 BD_{it} + \gamma_1 HS_{it} + \mu_1 v_i + \mu_2 t_t + \varepsilon_{it}, \quad (1)$$

where i identifies the household and t the time period. The outcome variable (Y_{it}) changes and includes the standardized FCS, the rCSI, or the HFIAS score of each household respectively. ID_{it} is a vector of immediate causes including dietary intake and a health shock dummy. As the food security indicators are measured at the household level, the dietary intake and the presence of health shocks are measured at the household level. UD_{it} includes all variables related to the underlying causes of food insecurity. It is comprised of the household head characteristics (sex, age), access to food (home consumption value of fish and meat, remittances, in-kind food transfers), care for children and women (highest education in the household in years and the gender of the person who is responsible for the major financial decisions), and access to health and safe environment (access to safe drinking water, sanitation). BD_{it} is a vector of basic causes and includes consumption quintiles, the asset factor, and the ethnicity dummy. HS_{it} is a vector of the household structure (household size, share of household members from a particular age group). v_i, and t_t are village and time fixed effects. To account for unobserved household characteristics and spatial correlation, we add a second version with household fixed effects.

In the second specification, we apply an ordered probit regression to analyze the probability of households to be classified as food secure, mildly/moderately food insecure and severely food insecure. The regression can be expressed as follows:

$$y_{it}^* = \alpha_0 + \beta_1 ID_{it} + \beta_2 UD_{it} + \beta_3 BD_{it} + \gamma_1 HS_{it} + \mu_1 d_i + \mu_2 t_t + \varepsilon_{it}, \qquad (2)$$

with
$$y_{it} = \begin{cases} 1 \; if \; y_{it}^* \leq 0, \\ 2 \; if \; 0 > y_{it}^* \leq \mu_1, \\ 3 \; if \; \mu_1 < \; y_{it}^*. \end{cases}$$

where i identifies the respective household and t the time period. The households status of food security is based on the cut-offs of the respective indicator. We include a vector of household controls (HS_{it}), district (d_i) and time fixed effects (t_t). ID_{it}, UD_{it}, and BD_{it} are the vectors of the variables related to immediate, underlying and basic causes of food insecurity. Since we do not control for village and household fixed effects in this regression we include distance to town as part of the immediate causes and access to public waste disposal and distance to hospital in the vector of the underlying causes.

In the third specification, we use a probit model to estimate if the household's food security status can predict individual undernutrition in children under five. The regression takes the following form:

$$\Pr(y_{jit} = 1) = \alpha_0 + \beta_1 FSI_{it} + \beta_2 IDc_{jit} + \beta_3 IDm_{jit} + \gamma_1 HS_{it} + \mu_1 d_i + \mu_2 t_t + \varepsilon_{ji}, \qquad (3)$$

where j identifies each child below five years, i the respective household, and t the time period. FSI_{it} identifies the household's food security status according to the respective household food security indicator (FCS, rCSI and HFIAS). In addition, this regression includes a vector of child- (IDc_{jit}) and mother-specific (IDm_{jit}) characteristics to test in how far these are decisive. The former includes the child's gender and the age in months. The latter includes the mother's age, BMI, and years of education. Household controls, district and time fixed effects are included as control variables.

Finally, we perform a series of robustness checks to account for other variables which affect individual undernutrition, deal with the issue of omitted variable bias, and address potential measurement errors. Examining the residuals and their leverage, the regressions in the first specification appear to be well behaved according to Cox D and studentized residuals (Greene 2012). The overall F tests (Wooldridge 2010) reveal that the coefficients are jointly significant. The variance inflation factor indicates that multicollinearity is not present. For the z-scores the second model including child- and mother-specific characteristics performs significantly better according to the Akaike and Bayesian Information Criterion (Greene 2012). We use heteroscedasticity robust standard errors for all models. To account for stratification of the data we use weights in all regressions and descriptive statistics displayed.

As our results might be subject to omitted variable bias and potential measurement error, we deal with both issues explicitly in our robustness checks. First, we use the Altonji ratio to assess the extent to which our results are driven by omitted variable bias. This strategy was pioneered by Altonji, Elder and Taber (2000) and allows to compute how large the influence from unobservables has to be to make the results from the observables invalid. The outcomes, as reported in the Appendix, suggest that our model is robust to the selection on unobservables.

Second, we address potential measurement error in our anthropometric data. Due to the layout of the survey, not all children under five were at home during the time of the survey. Thus, for some children we have only estimates regarding their weight and height. To test if there are statistically significant differences between measured versus estimated z-scores we run a set of regressions that exploit the variation present at the household and village level. The results (see appendix) suggest that there is no significant difference between measured and estimated z-scores.

Third, we use BMI in older children and adults to verify our results for the broader household. Since we only have estimated weight and height to calculate the BMI these results might suffer from measurement bias. Therefore, we abstain from drawing conclusions from these results but rather see them as a cross check.

4. Results and discussion

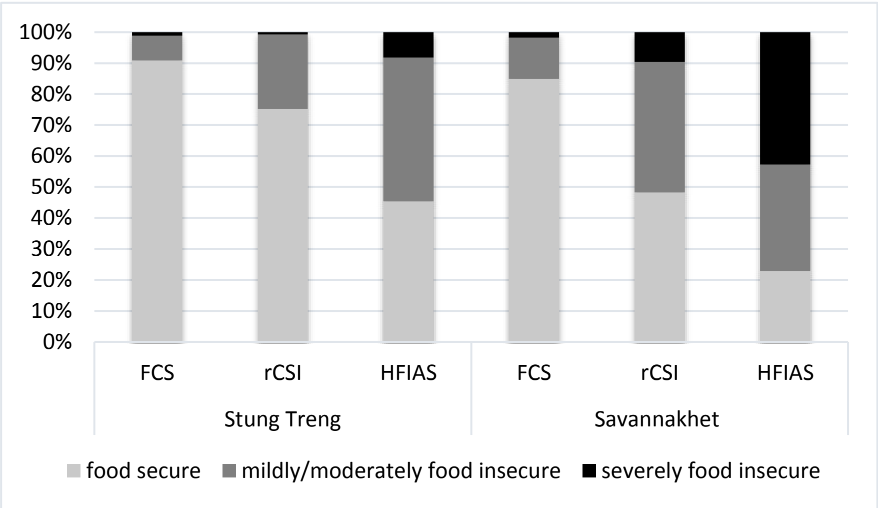
4.1 Food secure household with undernourished children

Our descriptive analysis confirms previous findings showing that the four indicators capture different aspects of food security (see Figure 2). While 85-91% of the households appear to be food secure according to the FCS, the rCSI and the HFIAS show a different picture. According to the HFIAS, only 45% of the households in Stung Treng and 23% of the households in Savannakhet are food secure. These findings are in line with findings from Maxwell et al. (2014) for Ethiopia. Based on the results for the FCS, food availability and access do not seem to be problematic for rural households in our study area. The classifications of the HFIAS and rCSI point towards substantial problems in the dimension of use and utilization. In addition, our results suggest that food insecurity is more problematic for households in Savannakhet compared to households in Stung Treng because more households are categorized as severely food insecure across all three indicators in Savannakhet.

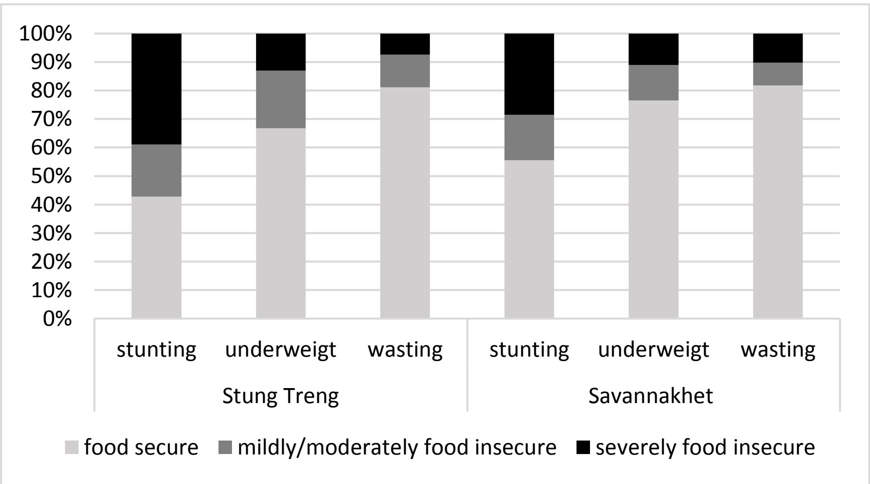
Turning to the estimates of anthropometrics for children under five, displayed in Figure 2b, it is evident that especially stunting is widespread in both provinces. Even though households have access to food, as the FCS results suggest, the anthropometric measures show that intra-household allocation of food resources and health related issues remain challenging. This is in line with the low correlation coefficients between the household food security and the individual undernutrition indicators.

Figure 2: Food security classifications for different indicators by country, in percent

a) Household food security by indicator



b) Individual food security for children under five



Note: Total sample from two periods included and accounting for sampling weights.

Source: own calculations

Finding undernourished children in households who have access to sufficient amounts of food highlights the importance of the use and utilization dimension. Studying feeding practices in Takeo, a southeastern province of Cambodia, Jacobs & Roberts (2004) report that mothers typically start breast feeding two or three days after the delivery. Therewith, the start of breastfeeding is comparatively[3] late (Black et al. 2013). Evidence suggests that breastfeeding is a simple intervention that reduces neonatal mortality and morbidity in babies (Debes et al. 2013). In addition, mothers supplement their children's diet with a rice, salt, sugar mixture from 3-4 months of age (Jacobs & Roberts 2004). Other foods, including vegetables and fruits, are introduced much later. This concentration of food intake on rice persists also for adults. In our sample, 70% of the daily calorie intake stem from rice.

Table 3: Sample summary statistics

		Wave 1		Wave 2	
Causes	Variable	Mean	Std. Dev.	Mean	Std. Dev.
Immediate	Food consumption (kcal pc/day)	1843.37	1100.86	2032.17	1340.21
	Health shock dummy (1=shock)	0.35	0.48	0.37	0.48
	Distance to town (in minutes, village level)	56.57	45.28	58.62	47.48
Underlying	Remittances (PPP USD)	713.28	2172.93	436.01	1030.78
	Home consumption fish (PPP USD)	173.86	350.04	175.54	451.15
	Home consumption meat (PPP USD)	31.31	107.60	48.74	237.33
	Transfer food (PPP USD)	9.20	67.64	4.77	36.70
	Blue collar wage worker (number)	0.15	0.58	0.15	0.58
	Gender dummy household head (female=1)	0.16	0.37	0.17	0.37
	Age of household head (years)	49.40	13.71	49.90	13.32
	Highest education of head (years)	6.21	4.23	6.43	4.20
	Access to safe drinking water dummy (1=safe)	0.48	0.50	0.48	0.50
	Access to sanitation facility (1=access)	0.51	0.50	0.52	0.50
	Waste dummy (1=yes, village level)	0.08	0.28	0.08	0.27
	Distance to hospital (km, village level)	13.84	13.54	15.24	15.54
	Electricity dummy (1=yes)	0.54	0.50	0.68	0.47
Basic	Consumption (PPP USD)	1185.94	1417.13	1170.46	1316.78
	land (in ha)	2.20	3.30	2.35	2.77
	Ethnicity dummy (1=majority)	0.55	0.50	0.55	0.50
Indicators	FCS (score)	70.75	18.60	56.65	17.67
	rCSI (score)	49.29	5.70	44.10	9.13
	HFIAS (score)	20.93	6.51	14.37	6.00
	Observations	1077		1082	

Note: Sampling weights are applied

Source: own calculations

[3] From a health perspective, immediate breastfeeding within the first hour is essential. In Latin America the share of immediate breastfeed is high with a share of 58%, in Africa and Asia it is intermediate (50%) and in Eastern Europe it is considered low (36%).

The overall sample characteristics (see Table 3) show that the average individual consumes about 1,850 kilocalories per day. This is 16% below the average calorie requirement in Southeast Asia and just fulfills the minimum calorie requirement (Svedberg 2002). In addition, health shocks are frequent, with one third of the sample reporting health shocks in each of the two periods. Home consumption values of fish are considerably larger compared to meat indicating that fish is the preferred source of protein.

Roughly one-half of the households in the sample have access to safe drinking water, sanitation facilities, and electricity while only a minority of households (8%) have access to a waste disposal system. Households spend on average 3.25 $PPP per capita per day and about 16 to 18% of the households live below the absolute poverty line. As most households are engaged in subsistence farming land holding are small, ranging between 2.2 to 2.35 hectare per household.

4.2 Influence of socio-economic characteristics on food security indicators

The results of the first set of regression models on the relation of socioeconomic characteristics on different food security indicators are presented in Table 4. The first three columns show results with controls for time and village fixed effects. In columns (4) to (6) the outcomes with household fixed effects are reported. The models explain 32-51% of the variation in the dependent variables.

The FCS results are displayed in columns 1 and 4. The immediate causes, per capita kilocalorie consumption and health shocks, have a statistically significant effect on the FCS score. While the presence of a health shock decreases the FCS, each additional kilocalorie consumed is associated with a higher FCS. In relation to the constant, a health shock does not necessarily result in food insecurity, as it only decreases the FCS by 2.5 points. The decrease in the FCS as such indicates that households who experience a health shock consequently adapt their diet. While the effect of a single kilocalorie seems to be economically marginal, the distribution of kilocalorie consumption puts this into perspective. If we compare the median per capita kilocalories to the standard deviation in our sample (see Table 3) this translates into a difference of 4.6 FCS points. Regarding the underlying causes of food insecurity, the value of remittances has a positive and statistically significant influence. Similarly, households who consume more meat from own production have a higher FCS. In terms of the resources of care, each additional year education is positively associated with food security. In addition, households that have access to a safe and healthy environment, represented by access to sanitation, score higher on the FCS. Inequality captured in the set of basic causes appears to be negatively and significantly related to the FCS. Households in the poorest two consumption quartiles have lower FCS scores compared to households in the highest quartile. Asset wealth and ethnicity, however, are not associated to the FCS score.

For the rCSI (columns 2 and 5) our results suggest that kilocalorie consumption per capita is significant. Interestingly, the coefficient is negative indicating that a higher rCSI score is associated with lower kilocalorie intake. While this might appear counterintuitive, it has to be interpreted together with the home consumption value of fish and meat, which are significantly and positively related to the rCSI. Since the economic significance of additional kilocalorie consumption is low (0.000638) and the value is offset by the coefficients from the meat and fish consumption value the overall effect of kilocalories, at least from major protein sources, is positive. One reason for this could be that households in our sample generally have a rice-based diet. While they consume enough rice to satisfy their calorie needs, other aspects of food security, measured by the rCSI, are not met. In addition, the coefficient is only significant at the 10% level when controlling for household fixed effects (column 5).

Similar to the FCS, households with higher education and access to sanitation are associated to have a significantly higher rCSI score. Access to safe drinking water, however, is significantly negatively correlated to food security. We think that this could be related to the fact that households who participate in food aid programs typically are also provided with access to safe water. In addition, in the mountainous region in Savannakhet drinking water comes from safe mountain sources while household food security is low (WFP 2007). Contrary to the results from the FCS, poverty and inequality measures are only weakly related to the rCSI score. However, the asset factor, which represents household wealth, has a significant and positive effect on the rCSI.

Finally, the results shown in columns (3) and (6), suggest that there is limited correlation with the immediate causes and food insecurity measured by the HFIAS. Similar to the rCSI, the relation between kilocalorie intake and the HFIAS score seems to be negative (column 3). However, when controlling for household fixed effects (column 6) the coefficient becomes insignificant. From the resources for food intake protein consumption from fish is statistically significant indicating the importance of fishing for rural households. This effect has been further disentangled in two related papers dealing with the role of fishing for food security (Hartje et al. 2016; Hartje et al. 2017). Higher education and access to sanitation are positively related to the HFIAS score. Similar to the rCSI poverty and inequality are weakly significant in relation to the HIFAS score. Household wealth, in contrast, has a positive and statistically significant effect.

Table 4: Influence of socio-economic characteristics on FS indicators (OLS regression)

Causes	VARIABLES	(1) FCS	(2) rCSI (reverted)	(3) HFIAS (reverted)	(4) FCS	(5) rCSI (reverted)	(6) HFIAS (reverted)
Immediate	Food consumption (kcal pc/day)	0.00233***	-0.000638***	-0.000375***	0.00344***	-0.000462*	-0.000176
		(0.000600)	(0.000201)	(0.000117)	(0.000908)	(0.000247)	(0.000188)
	Health shock (dummy)	-2.486**	0.00645	-0.236	-3.272**	0.260	-0.456
		(0.998)	(0.428)	(0.327)	(1.560)	(0.649)	(0.491)
Underlying	Remittances (log)	0.539***	0.130**	0.0275	0.595**	0.190*	0.00790
		(0.167)	(0.0598)	(0.0531)	(0.262)	(0.107)	(0.0929)
	Home consumption fish (log)	0.162	0.426***	0.211***	0.319	0.652***	0.376***
		(0.200)	(0.0846)	(0.0684)	(0.335)	(0.143)	(0.107)
	Home consumption meat (log)	0.518**	0.231**	0.115	0.401	0.248	0.147
		(0.237)	(0.0991)	(0.0853)	(0.391)	(0.162)	(0.134)
	Transfer food (log)	0.171	-0.275	-0.380**	0.213	-0.112	-0.171
		(0.344)	(0.181)	(0.150)	(0.618)	(0.272)	(0.198)
	Blue collar wage worker (number)	0.0567	-0.208	-0.450	2.961**	-0.143	-0.255
		(0.657)	(0.264)	(0.342)	(1.201)	(0.485)	(0.544)
	Gender dummy household head	0.0824	-0.308	-0.456	-0.0493	1.886	2.165
		(1.491)	(0.658)	(0.486)	(8.850)	(2.637)	(2.421)
	Age head (years)	-0.0175	0.00329	0.00346	0.0671	-0.106*	-0.0645
		(0.0490)	(0.0202)	(0.0159)	(0.145)	(0.0577)	(0.0620)
	Highest education (years)	0.440***	0.242***	0.201***	-0.220	0.607***	0.402***
		(0.159)	(0.0687)	(0.0533)	(0.391)	(0.199)	(0.148)
	Access to safe drinking water (dummy)	1.361	-1.537**	-0.609	-1.461	-1.588**	-0.520
		(1.289)	(0.610)	(0.394)	(1.915)	(0.808)	(0.591)
	Access to sanitation facility (dummy)	3.473**	2.126***	1.558***	1.509	-0.894	-0.122
		(1.359)	(0.567)	(0.453)	(2.557)	(0.926)	(0.854)
	Electricity (dummy)	-0.755	-0.0273	0.442	-0.740	0.0189	0.579
		(1.475)	(0.559)	(0.501)	(2.465)	(0.838)	(0.717)
Basic	25th consumption quartile	-6.819***	-1.227	-1.172**	-5.928**	0.157	0.423
		(1.771)	(0.827)	(0.578)	(2.861)	(1.123)	(0.864)
	50st consumption quartile	-3.348**	-0.669	-0.524	-3.763	-0.959	-0.312
		(1.608)	(0.699)	(0.514)	(2.477)	(0.990)	(0.774)
	75th consumption quartile	-1.474	-1.014*	-0.574	-1.051	-0.779	-0.540
		(1.478)	(0.583)	(0.453)	(2.251)	(0.796)	(0.645)
	Asset factor	0.262	1.022***	0.822***	0.0236	0.637	0.694**
		(0.617)	(0.280)	(0.201)	(0.995)	(0.429)	(0.318)
	Majority ethnicity (dummy)	-0.110	-0.346	-0.304	0.299	-0.701	-1.186
		(1.794)	(0.716)	(0.643)	(5.670)	(1.959)	(1.859)
	Constant	64.20***	53.52***	24.57***	60.68***	52.30***	22.62***
		(5.829)	(2.224)	(2.121)	(10.94)	(3.900)	(3.900)
	Household composition controls	x	x	x	x	x	x
	Wave fixed effects	x	x	x	x	x	x
	Village fixed effects	x	x	x	x	x	x
	Household fixed effects				x	x	x
	Observations (hhid)	2,159	2,159	2,159	2,159	2,159	2,159
	R-squared	0.386	0.349	0.487	0.708	0.715	0.773
	Adjusted R-squared	0.357	0.319	0.464	0.373	0.388	0.511
	F	11.77	7.107	24.71	11.95	9.682	22.98
	Rmse	15.61	6.620	5.178	15.42	6.275	4.942

Note: Robust standard errors in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Household composition controls include household size, share of household members in different age groups.

Overall, the regressions suggest that food security captured by the three household indicators relates to different causes. In the pooled regression, the FCS shows strong correlations with causes from all categories. Especially, the immediate causes show the expected effects. In addition, we find a strong relation between poverty and food insecurity measured by the FCS. For both the rCSI and the HFIAS our results show only weak relations with the immediate causes. Especially health shocks appear not to be important. In contrast to the other indicators the rCSI is stronger related to underlying causes, especially food production and safe environment. In sum, our results suggest that the indicators pick up on different causes and dimensions of food security. Thus, to get a holistic picture of household food security, indicators which capture different dimensions should be assessed.

4.3 Determinants of household food security status

In the second set of regressions we analyze the relation between the causes of food insecurity and the households' food security status measured by the three indicators. The results of the ordered probit model are presented in Table 5. In line with the previous results we find that kilocalorie consumption is decisive for the households' food security status across all three indicators. However, while higher kilocalorie intake decreases the likelihood to be food insecure according to the FCS, the results for the rCSI and the HFIAS again show that higher kilocalorie consumption is associated with a higher probability to be food insecure. As argued above, this coefficient should be seen in relation to the positive effect of protein from own production (HC fish and HC meat) and the fact that households rely on rice consumption in times of need. Thus, it is plausible that higher kilocalorie consumption as such does not necessarily increase overall food security of the household.

In terms of the underlying causes, our results are in line with the baseline results. Households with higher protein from home consumption and higher education are more likely to be food secure across all indicators. In addition, access to health care (distance to hospital) is an important factor for food security measured by the rCSI and the HFIAS. Households' food security status based on the HFIAS is also strongly related to other health and environmental variables indicating that it captures this part of the use and utilization dimension. Furthermore, ethnicity plays a statistically significant role for the food security classifications by the rCSI.

Table 5: Probability of food security (marginal effects from ordered probit regression)

		FCS			rCSI		
		(1) severely insecure	(2) mildly insecure	(3) secure	(4) severely insecure	(5) mildly insecure	(6) secure
Causes	VARIABLES	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx
Immediate	Food consumption (kcal)	-3.73e-06*	-2.32e-05**	2.69e-05**	1.06e-05***	1.62e-05***	-2.68e-05***
		(1.98e-06)	(1.05e-05)	(1.23e-05)	(3.21e-06)	(4.97e-06)	(8.06e-06)
	Health shock (dummy)	0.00429	0.0267*	-0.0310*	-0.00288	-0.00438	0.00726
		(0.00276)	(0.0161)	(0.0187)	(0.00941)	(0.0143)	(0.0237)
	Distance to town	8.04e-06	4.99e-05	-5.80e-05	-0.000133	-0.000202	0.000335
		(3.08e-05)	(0.000191)	(0.000222)	(0.000115)	(0.000176)	(0.000291)
Underlying	Remittances (log)	-0.000408	-0.00253	0.00294	-0.00244	-0.00372	0.00616
		(0.000454)	(0.00273)	(0.00317)	(0.00158)	(0.00240)	(0.00396)
	HC fish (log)	-0.000644	-0.00400	0.00464	-0.00641***	-0.00977***	0.0162***
		(0.000546)	(0.00333)	(0.00386)	(0.00197)	(0.00283)	(0.00473)
	HC meat (log)	-0.00168**	-0.0104**	0.0121**	-0.00399	-0.00607	0.0101
		(0.000788)	(0.00466)	(0.00536)	(0.00250)	(0.00380)	(0.00628)
	Transfer food (log)	-0.000547	-0.00340	0.00394	0.00722**	0.0110**	-0.0182**
		(0.00113)	(0.00703)	(0.00816)	(0.00337)	(0.00521)	(0.00853)
	Blue collar worker (no)	-0.00104	-0.00644	0.00748	0.00953	0.0145	-0.0241
		(0.00184)	(0.0116)	(0.0135)	(0.00691)	(0.0105)	(0.0174)
	Gender head	0.00119	0.00738	-0.00857	0.00248	0.00378	-0.00626
		(0.00385)	(0.0238)	(0.0276)	(0.0148)	(0.0225)	(0.0373)
	Age head (yrs)	-8.66e-05	-0.000538	0.000625	-6.60e-05	-0.000100	0.000166
		(0.000121)	(0.000743)	(0.000862)	(0.000444)	(0.000676)	(0.00112)
	Highest education (yrs)	-0.000946**	-0.00588**	0.00683**	-0.00457***	-0.00696***	0.0115***
		(0.000456)	(0.00245)	(0.00285)	(0.00153)	(0.00230)	(0.00378)
	Safe drinking water (D)	0.00436	0.0271	-0.0315	0.0173	0.0263	-0.0436
		(0.00279)	(0.0172)	(0.0199)	(0.0111)	(0.0167)	(0.0277)
	Sanitation facility (D)	-0.00963**	-0.0598***	0.0695***	-0.0597***	-0.0909***	0.151***
		(0.00410)	(0.0213)	(0.0248)	(0.0126)	(0.0180)	(0.0296)
	Waste (D)	-0.00223	-0.0139	0.0161	0.0303	0.0462	-0.0765
		(0.00700)	(0.0432)	(0.0502)	(0.0232)	(0.0355)	(0.0586)
	Distance to hospital	8.37e-06	5.20e-05	-6.04e-05	0.000732**	0.00111**	-0.00185**
		(9.31e-05)	(0.000578)	(0.000672)	(0.000369)	(0.000563)	(0.000926)
	Electricity (D)	0.000348	0.00216	-0.00251	0.00246	0.00375	-0.00621
		(0.00327)	(0.0202)	(0.0234)	(0.0109)	(0.0165)	(0.0274)
Basic	25th quartile	0.0115**	0.0717**	-0.0833**	0.0235	0.0358	-0.0594
		(0.00510)	(0.0289)	(0.0333)	(0.0169)	(0.0255)	(0.0423)
	50st quartile	0.000625	0.00388	-0.00451	0.0115	0.0175	-0.0290
		(0.00435)	(0.0271)	(0.0314)	(0.0160)	(0.0241)	(0.0401)
	75th quartile	0.00168	0.0104	-0.0121	0.0272*	0.0415*	-0.0687*
		(0.00408)	(0.0251)	(0.0292)	(0.0145)	(0.0217)	(0.0360)
	Asset factor	-0.00245*	-0.0152**	0.0177**	-0.0296***	-0.0450***	0.0746***
		(0.00130)	(0.00738)	(0.00856)	(0.00557)	(0.00821)	(0.0132)
	Majority ethnicity (D)	-0.00566	-0.0351*	0.0408*	-0.0273**	-0.0416**	0.0690**
		(0.00369)	(0.0204)	(0.0239)	(0.0125)	(0.0189)	(0.0312)
	Household composition	x	x	x	x	x	x
	Wave fixed effects	x	x	x	x	x	x
	District fixed effects	x	x	x	x	x	x
	Observations (hhid)	2,159	2,159	2,159	2,159	2,159	2,159

Note: Robust standard errors in parentheses. Significance levels: ******* p<0.01, ** p<0.05, * p<0.1. Household composition controls for: household size, share of household members in different age groups

Table 5 (continued): Probability of food security (marginal effects from ordered probit regression)

		HFIAS		
		(7)	(8)	(9)
		severely insecure	mildly insecure	secure
Causes	VARIABLES	dy/dx	dy/dx	dy/dx
Immediate	Food consumption (kcal)	1.79e-05**	-2.69e-06**	-1.53e-05**
		(7.67e-06)	(1.19e-06)	(6.56e-06)
	Health shock (dummy)	0.0256	-0.00384	-0.0218
		(0.0217)	(0.00331)	(0.0185)
	Distance to town	-0.000157	2.36e-05	0.000134
		(0.000260)	(3.93e-05)	(0.000221)
Underlying	Remittances (log)	-0.00120	0.000180	0.00102
		(0.00329)	(0.000494)	(0.00280)
	HC fish (log)	-0.0119***	0.00179***	0.0101***
		(0.00408)	(0.000676)	(0.00347)
	HC meat (log)	-0.0106**	0.00159**	0.00899**
		(0.00483)	(0.000778)	(0.00409)
	Transfer food (log)	0.0324***	-0.00487***	-0.0276***
		(0.00754)	(0.00136)	(0.00645)
	Blue collar worker (no)	0.0159	-0.00238	-0.0135
		(0.0159)	(0.00244)	(0.0135)
	Gender head	-0.00222	0.000333	0.00189
		(0.0294)	(0.00441)	(0.0250)
	Age head (yrs)	0.000211	-3.16e-05	-0.000179
		(0.000957)	(0.000144)	(0.000813)
	Highest education (yrs)	-0.0105***	0.00158***	0.00892***
		(0.00300)	(0.000523)	(0.00254)
	Safe drinking water (D)	0.0634***	-0.00952**	-0.0539***
		(0.0242)	(0.00393)	(0.0206)
	Sanitation facility (D)	-0.0665***	0.00999**	0.0566***
		(0.0255)	(0.00420)	(0.0216)
	Waste (D)	-0.000108	1.62e-05	9.16e-05
		(0.0465)	(0.00698)	(0.0395)
	Distance to hospital	0.00240***	-0.000360**	-0.00204***
		(0.000836)	(0.000141)	(0.000708)
	Electricity (D)	-0.0592**	0.00889**	0.0503**
		(0.0256)	(0.00417)	(0.0217)
Basic	25th quartile	0.0653*	-0.00980*	-0.0555*
		(0.0360)	(0.00573)	(0.0305)
	50st quartile	0.0601*	-0.00901*	-0.0510*
		(0.0310)	(0.00490)	(0.0263)
	75th quartile	0.0210	-0.00315	-0.0178
		(0.0286)	(0.00436)	(0.0243)
	Asset factor	-0.0326***	0.00490***	0.0277***
		(0.0110)	(0.00179)	(0.00940)
	Majority ethnicity (D)	0.0167	-0.00251	-0.0142
		(0.0263)	(0.00398)	(0.0224)
	Household composition	x	x	x
	Wave fixed effects	x	x	x
	District fixed effects	x	x	x
	Observations (hhid)	2,159	2,159	2,159

Note: Robust standard errors in parentheses. Significance levels: ******* p<0.01, ** p<0.05, * p<0.1. Household composition controls for: household size, share of household members in different age groups

Overall, the dynamics between the different food security groups reveal that for the FCS and the rCSI mild and severe food insecurity are rather similar. The sign of the coefficient only changes for the group of the food secure. In contrast, the results for the HFIAS show that for this indicator the sign of the coefficients change between the severely food insecure and the mildly food insecure. The probability model on the one hand loses some complexity with respect to the OLS regression as households are classified according to their food security status. On the other hand, this regression allows to detect how the effect of the causes of food insecurity changes conditional on the households' food security classification.

4.4 Regional differences

As our descriptive statistics in Section 4.1 show, household food insecurity in our study area varies by country. We specifically address this issue by looking at the causes of food insecurity for Cambodia and Lao PDR separately. Appendix Tables 9 and 10 show the results for the ordered probit regression by country.

The results for Cambodia suggest that the immediate causes are not decisive for households' food security status measured by the rCSI or the HFIAS. Similarly, the influence of higher protein consumption from own production on the probability of being food secure is weakly significant. Transfer of food and the quality of employment, however, are significant causes for food insecurity measured by the HFIAS. Thus, we conclude that for Stung Treng, households' income earning activities are more important for food security in terms of use and utilization compared to the availability and access dimensions.

For the households in Savannakhet, kilocalorie intake is associated with all three indicators. Also, higher home consumption values from meat and fish have a positive and significant influence on the probability to be classified as food secure. In contrast to Stung Treng, resources for care and resources for a healthy environment have a strong and positive influence on food security in Savannakhet, especially for the food security status based on the rCSI and HFIAS. In addition, households who belong to the majority ethnicity in Savannakhet have a higher likelihood of being classified as food secure in terms of the FCS and the rCSI.

In sum, the country level analysis shows that the causes of food insecurity differ not only across indicators but also across countries. Therefore, food security indicators need to be analyzed in relation to the country setting since the associations differ quite substantially. Overall, our claim that the FCS captures mainly dietary quality and, to a certain extent, hygienic conditions is supported. In terms of the rCSI and the HFIAS we find different causes which are related to the food security classification by country. The analysis of only one indicator thus leads to an incomplete picture of household food security.

4.5 Influence of household food insecurity on child undernutrition

Based on our conceptual framework household food insecurity should have some influence on the nutrition status of its members. To test this hypothesis, we perform an ordered probit regression to assess the relation between the household food security status and child undernutrition. The results, presented in Figure 3 below and Tables 11 and 12 in the Appendix, show that the relation varies by indicator.

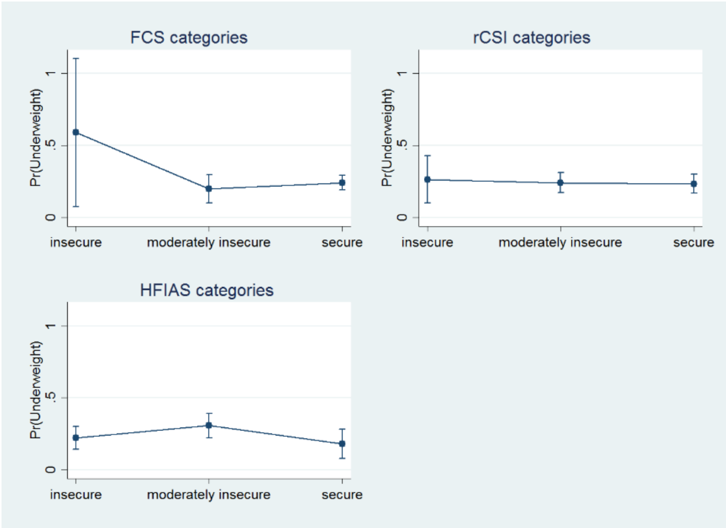
Children who live in households classified as food secure or moderately food insecure by the FCS are significantly less likely to be underweight compared to children from households classified as severely food insecure. Since the FCS gives information on households' dietary intake in the past week this result shows that child underweight is indeed driven by dietary quantity and quality measured at the household level. Contrarily, the probability of child underweight is not statistically related to household food security status based on the rCSI. Given that our household level regression shows a negative relation between daily per capita kilocalorie intake and the rCSI this finding supports the notion that the rCSI captures a different angle of food security. For the HFIAS the results suggest that children of households classified as food secure have a lower probability to be underweight.

Both the FCS and the underweight measure are short-term measures of food security, based on consumption in the past week or current weight of children. Similarly, the HFIAS is also rather short term as it refers to the last four weeks. In contrast, the time horizon of the rCSI is related to the past year. Thus, it might well be that children from households who faced food insecurity during the cause of the past year show no signs of acute undernutrition measured by the underweight indicator.

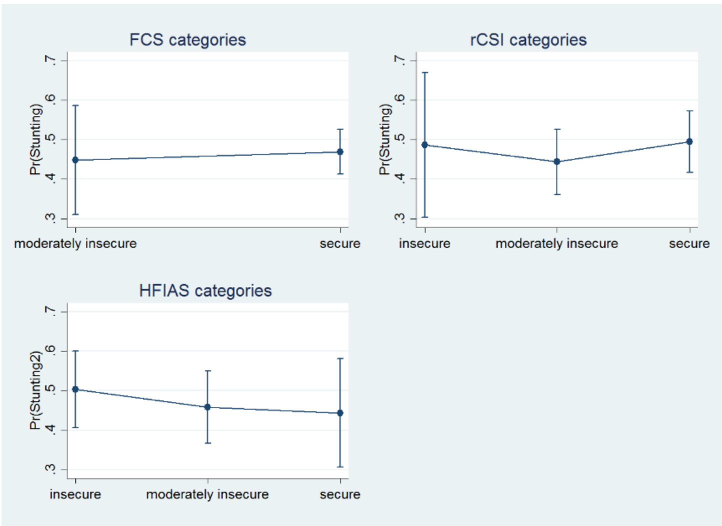
The relation between household food insecurity and child stunting is statistically insignificant across all three indicators. Overall, the results suggest that short-term undernutrition, measured by underweight, can be partly predicted by the household's food security status. These findings are in line with earlier findings from Bhattacharya et al. (2004) who show that household food security predicts the nutrition outcomes of older household members but has no consistent correlation with children's diets.

Figure 3: Influence of household food security status on undernutrition in children under 5

a) Influence of household food security on probability of underweight in children under 5



b) Influence of household food security on probability of stunting in children under 5



Note: Marginal effects of probit regression are displayed with 95% confidence intervals. Household and district controls are included.

To investigate this further we use older children's and adult BMI as a proxy for malnutrition for older household members. The results, presented in table 13 in the Appendix, show no consistent significant relation between older children's or adult BMI and household level food security. Therefore, it seems that household food security and undernutrition of individuals seems to be uncorrelated in our sample.

4.6 Importance of child- and mother-specific characteristics

To disentangle the causes of undernutrition in children further, we expand our regression of causes of food insecurity and assess the impact of child- and mother-specific characteristics on undernutrition in children under five. The results suggest that after controlling for the immediate, underlying, and basic causes at the household level child- and mother-specific factors are decisive.

Table 6: Probability of undernutrition conditional on child- and mother-specific characteristics

VARIABLES	(1) Underweight dy/dx	(2) Underweight dy/dx	(3) Wasting dy/dx	(4) Wasting dy/dx	(5) Stunting dy/dx	(6) Stunting dy/dx
Age child (months)	0.00372***	0.00356***	0.00222**	0.00226**	0.00278**	0.00287**
	(0.00122)	(0.00121)	(0.00111)	(0.00110)	(0.00133)	(0.00132)
Gender child (1=female)	-0.0378	-0.0330	0.00858	0.00873	-0.131***	-0.131***
	(0.0356)	(0.0355)	(0.0310)	(0.0309)	(0.0375)	(0.0374)
Birth order child	-0.0622	-0.0603	-0.0270	-0.0259	-0.108**	-0.112**
	(0.0488)	(0.0490)	(0.0398)	(0.0399)	(0.0500)	(0.0497)
Health shock child	-0.104*	-0.135**	0.0471	0.0585	0.0288	0.0317
	(0.0617)	(0.0608)	(0.0505)	(0.0518)	(0.0619)	(0.0625)
Age mother (years)		-0.000748		0.00133		0.000309
		(0.00202)		(0.00162)		(0.00254)
Education mother (years)		0.00245		0.00611		-0.0163**
		(0.00798)		(0.00556)		(0.00709)
BMI mother		-0.0211***		0.00295		-0.0159**
		(0.00696)		(0.00539)		(0.00680)
Health shock mother		-0.0251		0.0492		-0.0417
		(0.0552)		(0.0458)		(0.0611)
ID	x	x	x	x	x	x
UD	x	x	x	x	x	x
BD	x	x	x	x	x	x
Household composition controls	x	x	x	x	x	x
Wave fixed effects	x	x	x	x	x	x
District fixed effects	x	x	x	x	x	x
Observations	645	645	645	645	645	645

Robust standard errors are given in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Household composition controls include household size, share of household members in different age groups.

Starting with the child-specific characteristics, our results suggest that older children are more likely to be undernourished compared to younger ones. This finding is in line with the literature. However, as Klasen (2008) points out, this might be a measurement issue related to the construction of the anthropometric indicators, especially for South-East Asia. Children who experienced a health shock in the past year appear to be less likely to be underweight. One explanation for this finding could be that sick children might receive special attention and their overall situation improves based on successful treatment. Gender and birth order appears to be related with stunting. Accordingly, girls and children who have older siblings have a lower probability to be stunted.

Turning to mother-specific characteristics, our results indicate that education and BMI have a statistically significant impact. Children whose mothers have a higher BMI are less likely to be underweight or stunted. Similarly, the probability of stunting is lower for children of higher educated mothers. These findings are supported by health-related research on the influence of caring practices and mother's nutrition status which find a close relation between mother's BMI and child anthropometrics (Black et al. 2013; Özaltin et al. 2010; Vyas et al. 2016).

5. Summary and conclusion

In this paper, we analyze the relationship between causes of food insecurity and three household-level indicators of food security, namely the FCS, rCSI and HFIAS. In addition, we use households' food security status to predict undernutrition in children and explore the role of child- and mother-specific characteristics.

Our results confirm that the indicators capture different aspects of food insecurity. The FCS is mainly related to immediate causes of food insecurity including health shocks and daily kilocalorie intake per capita. However, underlying causes of food insecurity related to remittances, human capital, and sanitation are also important. Basic causes such as inequality and poverty also influence the households' FCS score. Despite the weak correlation between kilocalorie intake and the rCSI, the immediate causes of food insecurity are not related to the HFIAS and rCSI. Among the underlying causes of food insecurity, however, households with more resources for food such as remittances, home consumption of meat and fish, have higher rCSI scores. Similarly, higher education and access to better hygienic conditions increase the food security status. Contrary to the FCS, poverty and inequality are only weakly related to the rCSI and the HFIAS. However, household wealth matters as households with a higher value of assets are more likely to be classified as food secure in terms of the rCSI and the HFIAS.

Overall, the results confirm that the FCS, a dietary intake measure which measures food security in terms of access, is related to immediate and underlying causes of food insecurity linked to access and availability. The rCSI and the HFIAS score, both measures of the use and utilization dimension, show little relation to dietary intake but are driven by underlying and basic causes which reflect the areas of care and healthy environment. However, they show no direct relation to health shocks observed at the household level. These results are supported by the linear probability model estimating the influence of the causes of food insecurity on the likelihood of being food secure.

In our sample, undernutrition at the individual level is much more prominent compared to household level food insecurity. Relating the household level indicators to individual nutrition status, our results suggest that children in households that are classified as food insecure by the FCS have a significantly higher probability to be underweight. However, we find little evidence for a relation between household level food insecurity and underweight for the other two indicators. Our results suggest that child stunting is not related with household food insecurity. These findings support the need for not only targeting food insecure households to address issues of hunger and undernutrition but show that individual level measures are of great importance. Indeed, child undernutrition appears to be driven by child- and mother-specific characteristics, especially mother's education and well-being level (BMI). In addition, intra-household allocations of food resources, which are not accounted for in the household level analysis, play a crucial role.

Based on our results we draw two main conclusions with respect to food policies. First, household level targeting should be based on at least two indicators covering different dimensions of food security. Second, since individual undernutrition in children seems to be only weakly related to the households' food security status, targeting should include individual level measures. In addition, policies should raise awareness for nutrition values of different food groups as the majority of our households' diets depend on rice as the most important food.

Future research should focus on the allocation of food and food preparation practices within households to gain insight on internal behavioral aspects. Norms and values related to food practices and potential differences in relation to gender (esp. of children) should be studied further to disentangle household dynamics. In line with recent advances in the literature our results suggest that girls are less likely to be stunted compared to boys (Dercon & Singh 2012). However, it remains unclear if intra-household allocation practices or gender-related biological features drive this.

6. References

Altonji, J.G., Elder, T.E. & Taber, C.R., 2000. *Selection on observed and unobserved variables: Assessing the effectiveness of catholic schools*, Cambridge, Ma: National Bureau of Economic Research.

Ashworth, A., 1969. Growth rates in children recovering from protein-calorie malnutrition. *British Journal of Nutrition*, 23(4), pp.835–845.

Bagriansky, J. et al., 2014. The economic consequences of malnutrition in Cambodia, more than 400 million US dollar lost annually. *Asia Pacific Journal of Clinical Nutrition*, 23(4), pp.524–531.

Bagriansky, J. & Voladet, S., 2013. *The economic consequences of malnutrition in Lap PDR: A Damage Assessment Report*, Vientiane, Lao PDR: National Economic Research Institute.

Ballard, T. et al., 2011. *Household Hunger Scale: Indicator Definition and Measurement Guide*, Washington DC, USA: USAID.

Barrett, C.B., 2010. Measuring Food Insecurity. *Science*, 327, pp.825–828.

Bhattacharya, J., Currie, J. & Haider, S., 2004. Poverty, food insecurity, and nutritional outcomes in children and adults. *Journal of Health Economics*, 23, pp.839–862.

Black, R.E. et al., 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries. *The Lancet*, 382, pp.427–451.

Borghi, E. et al., 2006. Construcktion of the World Health Organization child growth standards: selection of methods for attained growth curves. *Statistics in Medicine*, 25, pp.247–265.

Cafiero, C., 2013. What do we really know about food security? *NBER Working Paper Series*, Working Paper 18861.

Carletto, C., Zezza, A. & Banerjee, R., 2013. Towards better measuremnt of household food security: Harmonizing indicators and the role of household surveys. *Global Food Security*, 2, pp.30–40.

Coates, J., Swindale, A. & Bilinsky, P., 2007. *Household Food Insecurity Access Scale (HFIAS) for Measurement of Food Access: Indicator Guide*, USAID.

Debes, A.K. et al., 2013. Time to initiation of breastfeeding and neonatal mortality and mprbidity: a systematic review. *BMC Public Health*, 13(Suppl 3).

Dercon, S. & Singh, A., 2012. From Nutrition to Aspirations and Self-Efficacy: Gender Bias over Time among Children in Four Countries. *World Development*, 45, pp.31–50.

Dixon, L.B., Winkleby, M.A. & Radimer, K.L., 2001. Dietary intakes and serum nutrients differ between adults from food-insufficient and food-sufficient families: Third

National Health and Nutrition Examination Survey, 1988-1994. *Journal of Nutrition*, 131(4), pp.1232–46.

Duflo, E., 2003. Grandmothers and Granddaughters: Old-Age Pensions and Intrahousehold Allocation in South Africa. *The World Bank Economic Review*, 17(1), pp.1–25.

Ecker, O. & Diao, X., 2011. *Food Security and Nutrition in Cambodia: Pattern and Pathways*, Washington, D.C., USA: International Food Policy Research Institute.

Di Falco, S., Veronesi, M. & Yesuf, M., 2011. Does Adaptation to Climate Change Provide Food Security? A Micro-Perspective from Ethiopia. *American Journal of Agricultural Economics*, 93(3), pp.829–846.

FAO, 2002. *Measurement and Assessment of Food Deprivation and Undernutrition. Proceedings International Scientific Symposium, Roma, 26-28. June 2002*, Rome, Italy: FAO.

FAO, 1996. *Rome Declaration on World Food Security and World Food Summit Plan of Action*, Rome, Italy: Food and Agricultural Organization of the United Nations.

FAO, 2015. *The State of Food Security in the World. Meeting the 2015 international hunger targets: taking stock of the uneven progress*, Rome, Italy: Food and Agricultural Organization of the United Nations.

Filmer, D. & Pritchett, L.H., 2001. Estimating Wealth Effects without Expenditure Data-or Tears: An Application to Educational Enrollments in States of India. *Demography*, 38(1), pp.115–132.

Glewwe, P., Jacoby, H.G. & King, E.M., 2001. Early childhood nutrition and academic achievement: a longitudinal analysis. *Journal of Public Economics*, 81, pp.345–368.

Greene, W.H., 2012. *Econometric Analysis* 7th ed., Washington DC: Pearson Education Limited.

Haddad, L. et al., 2003. Reducing Child Malnutrition: How Far Does Income Growth Take Us? *The World Bank Economic Review*, 17(1), pp.107–131.

De Haen, H., Klasen, S. & Qaim, M., 2011. What do we really know? Metrics for food insecurity and undernutrition. *Food Policy*, 36(6), pp.760–769.

Hardeweg, B., Klasen, S. & Waibel, H., 2013. Vulnerability to Poverty: Theory, Measurements and Determinants with Case Studies from Thailand and Vietnam. In Hampshire, UK: Palgrave Macmillan.

Hartje, R., Bühler, D. & Grote, U., 2017. Eat your fish and sell it, too - How small scale fishers' livelihood portfolios relate to food security in rural Cambodia. *Working Paper (forthcoming)*.

Hartje, R., Bühler, D. & Grote, U., 2016. Food Security in Rural Cambodia and Fishing in the Mekong in the Light of Declining Fish Stocks. *World Food Policy (forthcoming)*.

Headey, D., 2013. Developmental Drivers of Nutritional Change: a Cross-Country Analysis. *World Development*, 42, pp.76–88.

Headey, D. & Ecker, O., 2013. Rethinking the measurement of food security: From first principles to best practice. *Food security*, 5(3), pp.327–343.

Hong, R. & Mishra, V., 2006. Effect of Wealth Inequality on Chronic Undernutrition in Cambodian Children. *Journal of Health, Population and Nutrition*, 24(1), pp.89–99.

Jacobs, B. & Roberts, E., 2004. Baseline Assessment for Addressing Acute Malnutrition by Public-health Staff in Cambodia. *Journal of Health, Population and Nutrition*, 22(2), pp.212–219.

Klasen, S., 2008. Poverty, undernutrition, and child mortality: Some inter-regional puzzles and their implications for research and policy. *Journal of Economic Inequality*, 6, pp.89–115.

Klasen, S., Lechtenfeld, T. & Povel, F., 2015. A Feminization of Vulnerability? Female Headship, Poverty and Vulnerability in Thailand and Vietnam. *World Development*, 71, pp.36–53.

Knueppel, D., Demment, M. & Kaiser, L., 2009. Validation of the Household Food Insecurity Access Scale in rural Tanzania. *Public Health Nutrition*, 13(3), pp.360–367.

Larrea, C. & Kawachi, I., 2005. Does economic inequality affect child malnutrition? The case of Ecuador. *Social Science & Medicine*, 60, pp.165–178.

Lema, A.A., Munishi, L.K. & Ndakidemi, P.A., 2014. Assessing vulnerability of food availability to climate change in Hai district, Kilimanjaro region, Tanzania. *American Journal of Climate Change*, 3(3), pp.261–271.

LSB, 2015. *Results of Population and Houseing Census 2015*, Lao Statistics Bureau.

Maxwell, D. & Caldwell, R., 2008. *The Coping Strategies Index.A tool for rapid meaurement of household food security and the impact of aid programs in humanitarian emergencies. Field Methods Manual*, USAID.

Maxwell, D., Vaitla, B. & Coates, J., 2014. How do indicators of household food insecurity measure up? An empirical comparison from Ethiopia. *Food Policy*, 47, pp.107–116.

McKenzie, D.J., 2005. Measuring inequality with asset indicators. *Journal of Population Economics*, 18, pp.229–260.

Nguyen, P.N. et al., 2013. Maternal and Child Dietary Diversity Are Associated in Bangladesh, Vietnam, and Ethiopia. *Journal of Nutrition*, 143, pp.1176–1183.

Nunn, N. & Wantchekon, L., 2011. The Slave Trade and the Origins of Mistrust in Africa. *American Economic Review*, 101, pp.3221–3252.

De Onis, M. & Bloessner, M., 1997. *Database on Child Growth and Malnutrition*, Geneva, Switzerland: WHO.

Özaltin, E., Hill, K. & Subramanian, S.V., 2010. Association of maternal stature with offspring mortality, underweight, and stunting in low- to middle-income countries. *JAMA*, 303, pp.1507–1516.

Rashid, D.A., Smith, L.C. & Rahman, T., 2011. Determinants of Dietary Qulity: Evidence from Bangladesh. *World Development*, 39(12), pp.2221–2231.

Rigg, J., Salamanca, A. & Parnwell, M., 2012. Joining the dots of agrarian change in Asia: A 25 year view from Thailand. *World Development*, (40), pp.1469–1481.

Ruel, M.T., 2006. Operationalizing Dietary Diversity: A Review of Measurement Issues and Research Priorities. *Journal of Nutrition*, (133), pp.3911–3926.

Smith, L.C. & Haddad, L., 2015. Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era. *World Development*, 68, pp.180–204.

Smith, L.C., Obeid, A.E.E. & Jensen, H.H., 2000. Reducing Child Undernutrition: Past Drivers and Priorities for the Post-MDG Era. *Agricultural Economics*, 22, pp.199–215.

Svedberg, P., 2002. Undernutrition Overestimated. *Agricultural Economics*, 51(1), pp.5–36.

Swindale, A. & Bilinsky, P., 2006. *Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide (v.2),* Washington DC, USA: USAID.

Tibesigwa, B. & Viesser, M., 2016. Assessing Gender Inequality in Food Security amoung Small-holder Farm Households in urban and rural South Africa. *World Development*, 88, pp.33–49.

UN, 2005. *Designing Household Survey Samples: Practival Guidelines. Studies in Methods*, New York, USA: United Nations.

UN, 2015. *Transforming our world: the 2030 Agenda for Sustainable Development*, New York, USA: United Nations.

UNICEF, 1998. *The State of the World's Children 1998*, New York: United Nations International Children's Fund.

Vollmer, S. et al., 2014. Association between economic growth and early childhood undernutrition: evidence from 121 Demographic and Health surveys from 36 low?-income and middle-income countries. *The Lancet*, (2), pp.225–34.

Vyas, S. et al., 2016. Disease externalities and net nutrition: Evidence from changes in the sanitation and child height in Cambodia, 2005-2010. *Economics and Human Biology*, 23, pp.235–245.

Wanner, N. et al., 2014. *Refinements to the FAO Methodology for estimating the Prevalence of Undernourishment Indicator,* Rome, Italy: FAO.

WB, 2016a. *Prevalence of stunting, height for age (% of children under 5),* Washington DC, USA: World Bank.

WB, 2016b. *Reducing Vulnerabilities*, Washington DC, USA: World Bank.

WB, 2016c. *Reducing Vulnerabilities*, Washington DC, USA: World Bank.

WB, 2014. *Where Have All The Poor Gone? Cambodia Poverty Assessment 2013*, Washington DC, USA: World Bank.

WFP, 2008. *Food consumption analysis. Calculation and use of the food consumption score in food security analysis*, Rome, Italy: World Food Program.

WFP, 2007. *Lao PDR: Comprehensive Food Security and Vulnerability Analysis (CFSVA)*, Rome, Italy: World Food Program.

WHO, 1986. Use and Interpretation of Anthropometrics Indicators of Nutritional Status. *Bulletin of the World Health Organizaion*, 64(6), pp.929–941.

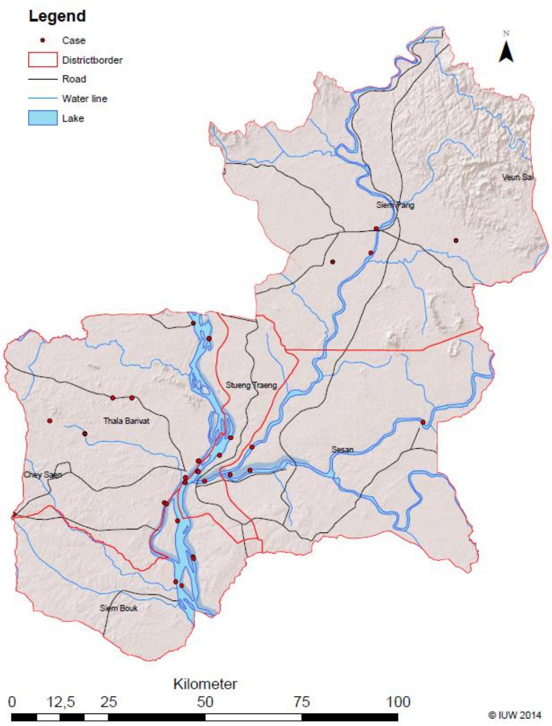
Wiesmann, D. et al., 2009. Validation of the World Food Programme's Food Consumption Score and Alternative Indicators of Household Food Security. *Discussion Paper*, 00870.

Wooldridge, J.M., 2010. *Econometric Analysis of Cross Section and Panel Data* 2nd ed., Cambridge, Massachusetts: MIT Press.

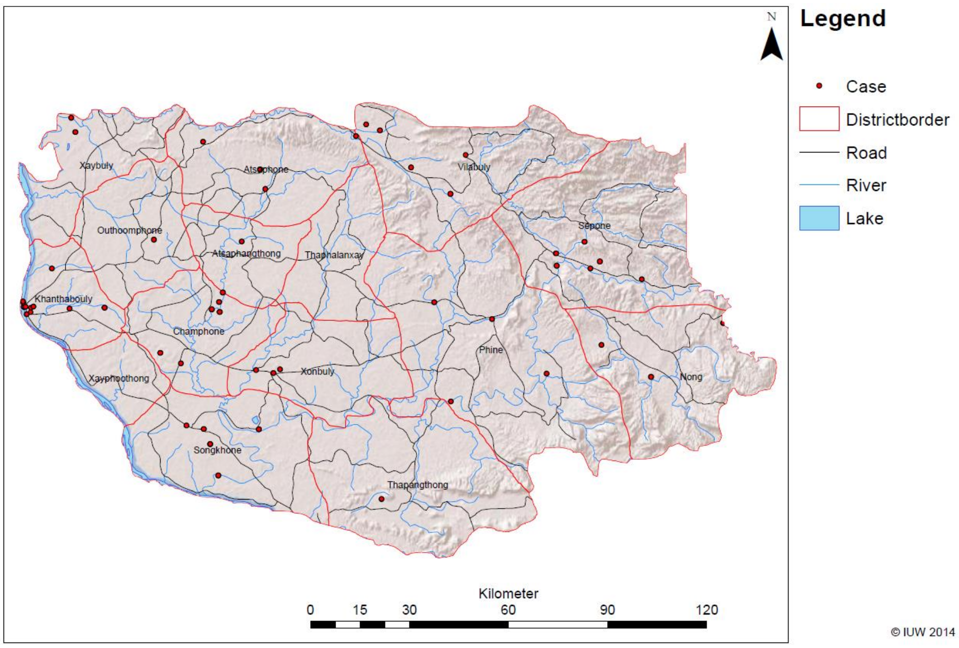
Appendix

Figure 4: Overview Sampling Site

Cambodia – Villages in Stung Treng



Lao PDR – Villages in Savannakhet



Robustness Checks

A. Altonji Ratio

To control for potential omitted variables bias we compute the ratio on selection of observables which allows to assess the potential bias arising from unobservables (Altonji et al. 2000; Nunn & Wantchekon 2011). The ratio compares two regressions, one with a restricted set of controls and one with the full set of controls. The coefficient of interest is denoted as $\hat{\beta}^R$ for the restricted regression and as $\hat{\beta}^F$ for the full regression. The ratio is calculated as: $|\hat{\beta}^F/(\hat{\beta}^R - \hat{\beta}^F)|$ and is (i) decreasing in the denominator and (ii) increasing in $\hat{\beta}^F$. As the difference between the two coefficients decreases the estimate is affected stronger by the selection of the observed variables. Similarly, a higher value of $\hat{\beta}^F$ means that it is less likely that the whole effect measured is purely driven by selection bias. Based on Nunn & Wantchekon (2011), we consider different sets of restricted covariates, starting from including only food consumption as the main explanatory variable and then successively adding the vectors of immediate, underlying, and basic causes, and control variables.

Table 7: Using Selection of observables to assess the bias from unobservables

Controls in restricted set	Controls in full set	FCS	rCSI	HFIAS
Food consumption	Full set of explanatory variables and controls from equation (1)	5.27	2.43	2.78
IC	Full set of explanatory variables and controls from equation (1)	5.02	2.39	2.62
IC and UC	Full set of explanatory variables and controls from equation (1)	3.95	2.13	6.41
IC, UC and BC	Full set of explanatory variables and controls from equation (1)	3.04	12.23	0.94
IC, UC, BC and HC	Full set of explanatory variables and controls from equation (1)	4.58	3.47	0.67
IC, UC, BC, HC and district fixed effects	Full set of explanatory variables and controls from equation (1)	4.00	9.40	1.08
IC, UC, BC, HC, district and village fixed effects	Full set of explanatory variables and controls from equation (1)	3.81	3.28	0.98

Note: Each cell of the Table reports ratios based on the coefficient for kilocalorie consumption per capita per day from two household level regressions. In one, the covariates include the restricted set of control variables as indicated. This coefficient is called: $\hat{\beta}^R$. In the other, the covariates include the full set of controls. This coefficient is called: $\hat{\beta}^F$. In all regression the sample sizes are the same and country and wave fixed effects are included. The reported ratio is calculated as: $|\hat{\beta}^F/(\hat{\beta}^R - \hat{\beta}^F)|$.

Of the 21 ratios reported in Table 7 nearly all exceed the value of one. The ratios for the FCS range from 3.04 to 5.27, with a median of 4.29. Based on this, if the whole OLS estimate was related purely to a selection effect, the selection on unobservables would have to be at least 4 times greater than the selection on observables. In our view, these results make it rather unlikely that the estimated effect of food consumption on the FCS is fully driven by unobservables. The results for the rCSI and the HFIAS are less strong in relation to food consumption.

B. No statistical difference between anthropometrics based on estimated versus measured weight and height values

Due to the layout of the survey, not all children under five were at home during the time of the survey. Thus, for some children we have only estimates regarding their weight and height. To test for the difference between estimated and measured z-scores we run a set of regression that exploits the variation at the household and the village level.

$$z\_score_{ji} = \beta_0 + \beta_1 E_{ji} + \beta_2 IC_i + \beta_3 UC_i + \beta_3 BC_i + \varepsilon_{ji}, \quad (4)$$

where j identifies each child below five years and i the respective household. E_{ji} is a dummy variable which identifies if the height and weight of the child is measured or estimated. We include the vector of immediate (IC), underlying (UC) and basic causes (BC) as control variables. If the E_{ji} dummy is significantly different from zero, our analysis on individual undernutrition should be restricted to those children for who we have actual measurements. The outcomes suggest that there is no significant difference in terms of the anthropometrics between measured and estimated weight and height.

Table 8 depicts the influence of estimated versus measured anthropometrics. The results suggest that the z-scores of children under five are not statistically different in those households with both, measured and estimated weight and height. Similarly, for villages with measured and estimated z-scores we do not find a significant effect, except for the unconditional regression of weight-for-age z-scores (column 8). Based on these results we think it is reasonable to assume that there is no significant statistical difference between the measured and estimated z-scores. To further test the robustness of our results, we run the regression on individual undernutrition also with the restricted sample with only measured anthropometrics (see Table 12). As the overall results remain consistent, we are quite confident that our results are not driven by measurement bias.

Table 8: Within household and village variation of estimated versus measured z-scored of children < 5

	Households with both						Villages with both					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES	WAZ	WAZ	HAZ	HAZ	HWZ	HWZ	WAZ	WAZ	HAZ	HAZ	HWZ	HWZ
Estimated	0.380	0.437	-0.115	0.475	0.762	0.342	0.650***	0.351	0.529	0.180	0.482	0.285
	(0.370)	(0.385)	(0.565)	(0.736)	(0.627)	(0.728)	(0.214)	(0.242)	(0.341)	(0.481)	(0.299)	(0.366)
Constant	-1.597***	-1.330	-2.427***	-3.101*	-0.313	0.993	-1.504***	3.003***	-2.147***	2.006	-0.357**	3.377**
	(0.339)	(1.407)	(0.555)	(1.735)	(0.535)	(1.887)	(0.128)	(0.935)	(0.141)	(1.634)	(0.152)	(1.468)
IC		x		x		x		x		x		x
UC		x		x		x		x		x		x
BC								x		x		x
village controls								x		x		x
Observations	44	44	44	44	44	44	339	339	339	339	339	339
R-squared	0.015	0.468	0.001	0.458	0.027	0.599	0.031	0.409	0.010	0.285	0.009	0.358
Number of clusters	28	28	28	28	28	28	58	58	58	58	58	58

Robust standard errors in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Note that regressions 1 to 6 are clustered at the household level and regressions 7 to 12 are clustered at the village level. Due to the sample size, we could not include the full set of control variables in the first set of regressions.

Table 9: Probability of food insecurity, mild food insecurity, food security by indicator, Stung Treng (Cambodia)

	FCS			rCSI			HFIAS		
	severely insecure	mildly insecure	secure	severely insecure	mildly insecure	secure	severely insecure	mildly insecure	secure
VARIABLES	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx
Food consumption (kcal)	-6.68e-06**	-2.81e-05**	3.48e-05**	-1.20e-06	-1.55e-05	1.67e-05	-3.70e-06	-1.21e-06	4.92e-06
	(3.39e-06)	(1.29e-05)	(1.60e-05)	(1.60e-06)	(2.01e-05)	(2.16e-05)	(1.01e-05)	(3.33e-06)	(1.34e-05)
Health shock (dummy)	0.00286	0.0120	-0.0149	0.00172	0.0221	-0.0238	-0.0102	-0.00333	0.0135
	(0.00314)	(0.0128)	(0.0159)	(0.00175)	(0.0218)	(0.0234)	(0.0113)	(0.00388)	(0.0151)
Distance to town	6.85e-05**	0.000288***	-0.000356***	-8.13e-06	-0.000104	0.000113	-2.84e-06	-9.32e-07	3.78e-06
	(2.87e-05)	(0.000105)	(0.000129)	(1.88e-05)	(0.000247)	(0.000265)	(0.000119)	(3.90e-05)	(0.000158)
Remittances (log)	0.000236	0.000990	-0.00123	-0.000234	-0.00300	0.00324	0.000540	0.000177	-0.000717
	(0.000620)	(0.00264)	(0.00326)	(0.000365)	(0.00473)	(0.00509)	(0.00217)	(0.000708)	(0.00288)
HC fish (log)	-0.00148**	-0.00621***	0.00769***	6.11e-05	0.000785	-0.000846	0.000375	0.000123	-0.000497
	(0.000672)	(0.00215)	(0.00274)	(0.000309)	(0.00391)	(0.00422)	(0.00197)	(0.000652)	(0.00262)
HC meat (log)	-0.00132*	-0.00555*	0.00686*	-0.000724	-0.00930*	0.0100*	-0.00491*	-0.00161	0.00652*
	(0.000787)	(0.00304)	(0.00377)	(0.000478)	(0.00531)	(0.00574)	(0.00265)	(0.000977)	(0.00353)
Transfer food (log)	0.00112	0.00472	-0.00584	0.00121*	0.0155*	-0.0167*	0.0144***	0.00471**	-0.0191**
	(0.00137)	(0.00560)	(0.00694)	(0.000696)	(0.00833)	(0.00893)	(0.00548)	(0.00238)	(0.00753)
Blue collar worker (no)	0.00203	0.00853	-0.0106	0.000649	0.00833	-0.00898	0.0118**	0.00387*	-0.0157**
	(0.00131)	(0.00534)	(0.00656)	(0.000795)	(0.00970)	(0.0105)	(0.00518)	(0.00202)	(0.00694)
Gender head	0.00344	0.0145	-0.0179	0.00250	0.0322	-0.0347	0.0120	0.00394	-0.0160
	(0.00477)	(0.0198)	(0.0245)	(0.00239)	(0.0307)	(0.0329)	(0.0157)	(0.00516)	(0.0208)
Age head (yrs)	-0.000104	-0.000438	0.000542	0.000134	0.00172*	-0.00186*	0.000176	5.76e-05	-0.000233
	(0.000137)	(0.000574)	(0.000710)	(8.38e-05)	(0.000946)	(0.00102)	(0.000481)	(0.000160)	(0.000641)
Highest education (yrs)	-0.00104*	-0.00438*	0.00542*	0.000144	0.00185	-0.00199	-0.000556	-0.000182	0.000739
	(0.000581)	(0.00227)	(0.00280)	(0.000318)	(0.00402)	(0.00434)	(0.00192)	(0.000633)	(0.00255)
Safe drinking water (D)	0.000266	0.00112	-0.00138	0.000750	0.00963	-0.0104	0.0203	0.00664	-0.0269
	(0.00494)	(0.0207)	(0.0256)	(0.00313)	(0.0400)	(0.0431)	(0.0161)	(0.00567)	(0.0215)
Sanitation facility (D)	0.000893	0.00375	-0.00464	-0.00217	-0.0279	0.0301	-0.00128	-0.000418	0.00169
	(0.00367)	(0.0155)	(0.0191)	(0.00227)	(0.0281)	(0.0302)	(0.0134)	(0.00441)	(0.0178)
Waste (D)	0.00711	0.0299	-0.0370	0.00607	0.0780	-0.0841	0.0490	0.0160	-0.0650
	(0.00798)	(0.0330)	(0.0409)	(0.00467)	(0.0566)	(0.0609)	(0.0300)	(0.0104)	(0.0395)
Distance to hospital	-1.29e-05	-5.41e-05	6.70e-05	6.57e-05	0.000844	-0.000909	0.000117	3.84e-05	-0.000156
	(9.01e-05)	(0.000379)	(0.000469)	(6.16e-05)	(0.000784)	(0.000842)	(0.000383)	(0.000126)	(0.000509)
Electricity (D)	-0.00688	-0.0289*	0.0358*	-0.00155	-0.0200	0.0215	-0.00570	-0.00187	0.00757
	(0.00446)	(0.0173)	(0.0215)	(0.00247)	(0.0313)	(0.0337)	(0.0133)	(0.00444)	(0.0177)
25th quartile	0.0118*	0.0494**	-0.0612**	0.00992**	0.127***	-0.137***	0.0434**	0.0142*	-0.0577**
	(0.00606)	(0.0221)	(0.0275)	(0.00428)	(0.0399)	(0.0430)	(0.0201)	(0.00752)	(0.0267)
50st quartile	0.00837	0.0352*	-0.0436*	0.00724**	0.0931***	-0.100***	0.0217	0.00711	-0.0288
	(0.00557)	(0.0212)	(0.0265)	(0.00344)	(0.0342)	(0.0369)	(0.0170)	(0.00584)	(0.0225)
75th quartile	0.0109**	0.0457**	-0.0565**	0.00388	0.0498	-0.0537	0.0187	0.00612	-0.0248
	(0.00531)	(0.0197)	(0.0244)	(0.00290)	(0.0344)	(0.0370)	(0.0162)	(0.00559)	(0.0216)
Asset factor	-0.000130	-0.000546	0.000675	-0.00232**	-0.0298***	0.0321***	-0.00572	-0.00187	0.00760
	(0.00158)	(0.00666)	(0.00824)	(0.00117)	(0.0111)	(0.0120)	(0.00542)	(0.00182)	(0.00717)
Majority ethnicity (D)	-0.00302	-0.0127	0.0157	0.00351	0.0451	-0.0486	0.00846	0.00277	-0.0112
	(0.00422)	(0.0171)	(0.0213)	(0.00283)	(0.0334)	(0.0360)	(0.0158)	(0.00530)	(0.0211)
Household composition	x	x	x	x	x	x	x	x	x
Wave fixed effects	x	x	x	x	x	x	x	x	x
District controls	x	x	x	x	x	x	x	x	x
Observations (hhid)	1,154	1,154	1,154	1,154	1,154	1,154	1,154	1,154	1,154

Note: Robust standard errors in parentheses. Significance levels: ******* p<0.01, ** p<0.05, * p<0.1. Household composition controls for: household size, share of household members in different age groups. Cut-offs for different groups are significant for all indicators.

Table 10: Probability of food insecurity, mild food insecurity, food security by indicator, Savannakhet (Lao PDR)

	FCS			rCSI			HFIAS		
	severely insecure	mildly insecure	secure	severely insecure	mildly insecure	secure	severely insecure	mildly insecure	secure
VARIABLES	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx	dy/dx
Food consumption (kcal)	-3.73e-06*	-2.41e-05**	2.78e-05**	1.25e-05***	1.63e-05***	-2.88e-05***	2.06e-05**	-4.34e-06**	-1.62e-05**
	(2.09e-06)	(1.12e-05)	(1.31e-05)	(3.67e-06)	(4.91e-06)	(8.42e-06)	(8.27e-06)	(1.78e-06)	(6.58e-06)
Health shock (dummy)	0.00427	0.0276	-0.0319	-0.00635	-0.00831	0.0147	0.0307	-0.00649	-0.0243
	(0.00312)	(0.0189)	(0.0218)	(0.0117)	(0.0152)	(0.0269)	(0.0263)	(0.00560)	(0.0208)
Distance to town	-2.10e-05	-0.000136	0.000157	-0.000127	-0.000166	0.000293	1.66e-05	-3.50e-06	-1.31e-05
	(4.41e-05)	(0.000283)	(0.000327)	(0.000169)	(0.000221)	(0.000390)	(0.000398)	(8.41e-05)	(0.000314)
Remittances (log)	-0.000485	-0.00313	0.00362	-0.00264	-0.00345	0.00609	-0.000791	0.000167	0.000624
	(0.000499)	(0.00307)	(0.00355)	(0.00189)	(0.00246)	(0.00434)	(0.00374)	(0.000790)	(0.00295)
HC fish (log)	-0.000323	-0.00209	0.00241	-0.00849***	-0.0111***	0.0196***	-0.0157***	0.00332***	0.0124***
	(0.000634)	(0.00409)	(0.00472)	(0.00258)	(0.00318)	(0.00566)	(0.00525)	(0.00119)	(0.00414)
HC meat (log)	-0.00174*	-0.0112**	0.0130**	-0.00445	-0.00582	0.0103	-0.0124**	0.00261**	0.00975**
	(0.000912)	(0.00557)	(0.00638)	(0.00314)	(0.00411)	(0.00723)	(0.00589)	(0.00130)	(0.00464)
Transfer food (log)	-0.000834	-0.00539	0.00622	0.00800*	0.0105*	-0.0185*	0.0401***	-0.00848***	-0.0317***
	(0.00143)	(0.00920)	(0.0106)	(0.00456)	(0.00607)	(0.0106)	(0.0105)	(0.00240)	(0.00839)
Blue collar worker (no)	-0.00255	-0.0165	0.0190	0.0179	0.0234	-0.0413	0.0345	-0.00729	-0.0272
	(0.00340)	(0.0224)	(0.0258)	(0.0120)	(0.0157)	(0.0276)	(0.0299)	(0.00639)	(0.0235)
Gender head	0.00107	0.00694	-0.00802	0.00224	0.00293	-0.00517	0.000102	-2.15e-05	-8.03e-05
	(0.00429)	(0.0276)	(0.0319)	(0.0181)	(0.0237)	(0.0419)	(0.0343)	(0.00724)	(0.0270)
Age head (yrs)	-8.61e-05	-0.000556	0.000643	-0.000205	-0.000268	0.000473	0.000120	-2.53e-05	-9.46e-05
	(0.000136)	(0.000872)	(0.00101)	(0.000551)	(0.000724)	(0.00127)	(0.00116)	(0.000244)	(0.000912)
Highest education (yrs)	-0.000916*	-0.00592**	0.00684**	-0.00553***	-0.00723***	0.0128***	-0.0118***	0.00249***	0.00931***
	(0.000490)	(0.00272)	(0.00315)	(0.00182)	(0.00237)	(0.00413)	(0.00343)	(0.000801)	(0.00270)
Safe drinking water (D)	0.00493	0.0319*	-0.0368*	0.0216*	0.0283*	-0.0500*	0.0789***	-0.0167***	-0.0622***
	(0.00303)	(0.0192)	(0.0220)	(0.0131)	(0.0170)	(0.0299)	(0.0275)	(0.00613)	(0.0218)
Sanitation facility (D)	-0.0108**	-0.0695***	0.0803***	-0.0730***	-0.0955***	0.169***	-0.0800***	0.0169**	0.0631***
	(0.00473)	(0.0247)	(0.0285)	(0.0154)	(0.0190)	(0.0331)	(0.0306)	(0.00686)	(0.0241)
Waste (D)	-0.00266	-0.0172	0.0198	0.0343	0.0449	-0.0792	-0.00535	0.00113	0.00422
	(0.00764)	(0.0490)	(0.0567)	(0.0277)	(0.0366)	(0.0642)	(0.0529)	(0.0112)	(0.0417)
Distance to hospital	4.62e-05	0.000298	-0.000345	0.000946*	0.00124*	-0.00219*	0.00294**	-0.000620**	-0.00232**
	(0.000120)	(0.000774)	(0.000893)	(0.000517)	(0.000682)	(0.00119)	(0.00122)	(0.000266)	(0.000967)
Electricity (D)	0.00140	0.00903	-0.0104	0.00408	0.00534	-0.00942	-0.0691**	0.0146**	0.0545**
	(0.00363)	(0.0227)	(0.0263)	(0.0131)	(0.0171)	(0.0302)	(0.0299)	(0.00663)	(0.0236)
25th quartile	0.0116**	0.0750**	-0.0867**	0.0177	0.0231	-0.0408	0.0638	-0.0135	-0.0503
	(0.00574)	(0.0337)	(0.0386)	(0.0211)	(0.0275)	(0.0486)	(0.0444)	(0.00962)	(0.0349)
50st quartile	-5.76e-05	-0.000372	0.000430	0.00675	0.00884	-0.0156	0.0660*	-0.0140*	-0.0521*
	(0.00490)	(0.0316)	(0.0365)	(0.0198)	(0.0259)	(0.0457)	(0.0376)	(0.00817)	(0.0297)
75th quartile	0.000666	0.00430	-0.00496	0.0295*	0.0387*	-0.0682*	0.0204	-0.00430	-0.0161
	(0.00453)	(0.0292)	(0.0337)	(0.0178)	(0.0229)	(0.0405)	(0.0341)	(0.00727)	(0.0269)
Asset factor	-0.00238*	-0.0154*	0.0178*	-0.0333***	-0.0436***	0.0769***	-0.0402***	0.00849***	0.0317***
	(0.00142)	(0.00833)	(0.00961)	(0.00670)	(0.00866)	(0.0147)	(0.0132)	(0.00297)	(0.0105)
Majority ethnicity (D)	-0.00615	-0.0397*	0.0459*	-0.0371**	-0.0485**	0.0856**	0.0155	-0.00327	-0.0122
	(0.00421)	(0.0237)	(0.0276)	(0.0153)	(0.0198)	(0.0347)	(0.0303)	(0.00642)	(0.0239)
Household composition	x	x	x	X	x	x	x	x	x
Wave fixed effects	x	x	x	X	x	x	x	x	x
District fixed effects	x	x	x	X	x	x	x	x	x
Observations (hhid)	1,005	1,005	1,005	1,005	1,005	1,005	1,005	1,005	1,005

Note: Robust standard errors in parentheses. Significance levels: ******* p<0.01, ** p<0.05, * p<0.1. Household composition controls for: household size, share of household members in different age groups. For the FCS both cut-offs are statistically significant, for the rCSi and the HFIAS only the first cut-off is significant.

Table 11: Effect of household food security status on probability of child undernutrition

VARIABLES	(1) Underweight	(2) Underweight	(3) Underweight	(4) Wasting	(5) Wasting	(6) Wasting	(7) Stunting	(8) Stunting	(9) Stunting
FCS - dummy moderately insecure	-0.992*			-0.645			-0.000620		
	(0.534)			(0.504)			(0.147)		
FCS - dummy food secure	-1.045**			-0.663			omitted		
	(0.523)			(0.490)					
rCSI - dummy moderately insecure		-0.119			-0.245			-0.270	
		(0.246)			(0.251)			(0.232)	
rCSI - dummy food secure		-0.198			-0.444*			-0.117	
		(0.254)			(0.260)			(0.238)	
HFIAS - dummy moderately insecure			-0.0607			0.00980			-0.215
			(0.141)			(0.156)			(0.135)
HFIAS - dummy food secure			-0.462**			0.142			-0.220
			(0.217)			(0.251)			(0.202)
Constant	-0.994	-1.837***	-1.674***	-1.481*	-1.824***	-2.219***	-0.844*	-0.618	-0.670
	(0.741)	(0.594)	(0.570)	(0.761)	(0.643)	(0.625)	(0.496)	(0.535)	(0.510)
Household composition	x	x	X	x	x	x	x	x	x
Wave fixed effects	x	x	X	x	x	x	x	x	x
District fixed effects	x	x	X	x	x	x	x	x	x
Observations	730	730	730	730	730	730	723	730	730
pseudo R2	0.0485	0.0446	0.0495	0.0320	0.0354	0.0299	0.0277	0.0296	0.0294
chi2	43.08	39.61	43.95	22.16	24.55	20.75	27.74	29.87	29.62

Note: Table displays beta coefficients. Robust standard errors are given in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Household composition controls include: household size, share of household members in different age groups

Table 12: Effect of household food security status on probability of child undernutrition – restricted sample (measured, wave 2)

VARIABLES	(1) Underweight	(2) Underweight	(3) Underweight	(4) Wasting	(5) Wasting	(6) Wasting	(7) Stunting	(8) Stunting	(9) Stunting
FCS - dummy moderately insecure	-1.081			-0.513			-0.134		
	(0.663)			(0.619)			(0.189)		
FCS - dummy food secure	-1.178*			-0.386			omitted		
	(0.654)			(0.603)					
rCSI - dummy moderately insecure		0.553			-0.261			-0.0820	
		(0.353)			(0.325)			(0.303)	
rCSI - dummy food secure		0.541			-0.413			0.202	
		(0.367)			(0.341)			(0.318)	
HFIAS - dummy moderately insecure			-0.0335			-0.156			-0.181
			(0.202)			(0.215)			(0.198)
HFIAS - dummy food secure			omitted			omitted			omitted
Constant	-0.351	-1.913*	-1.465	-1.599	-1.830*	-2.031*	-0.477	-0.604	-0.498
	(1.162)	(1.023)	(0.974)	(1.201)	(1.075)	(1.043)	(0.912)	(0.939)	(0.902)
Household composition	x	x	x	x	x	x	x	x	x
District fixed effects	x	x	x	x	x	x	x	x	x
Observations	350	350	350	350	350	350	345	350	350
pseudo R2	0.0566	0.0542	0.0485	0.0329	0.0353	0.0321	0.0317	0.0390	0.0336
chi2	25.63	24.52	21.94	12.40	13.29	12.07	15.15	18.89	16.26

Note: Table displays beta coefficients. Robust standard errors are given in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Household composition controls include: household size, share of household members in different age groups

Table 13: Effect of household food security status on probability of undernutrition by age cohort

	(1)	(2)	(3)	(4)	(5)	(6)
	children aged >5 to 10 years			children aged >10 to 15 years		
VARIABLES	Underweight (BMI)	Underweight (BMI)	Underweight (BMI)	Underweight (BMI)	Underweight (BMI)	Underweight (BMI)
FCS - dummy moderately insecure	1.143***			0.0334		
	(0.342)			(0.389)		
FCS - dummy food secure	0.959***			-0.281		
	(0.329)			(0.379)		
rCSI - dummy moderately insecure		-0.212			-0.246*	
		(0.134)			(0.133)	
rCSI - dummy food secure		-0.281**			-0.339**	
		(0.140)			(0.138)	
HFIAS - dummy moderately insecure			0.0338			0.0342
			(0.0902)			(0.0870)
HFIAS - dummy food secure			-0.122			-0.126
			(0.115)			(0.119)
Constant	-1.797***	-0.407	-0.574**	-0.524	0.418	0.220
	(0.445)	(0.298)	(0.281)	(0.515)	(0.326)	(0.311)
Household composition	x	x	x	x	x	x
Wave fixed effects	x	x	x	x	x	x
District fixed effects	x	x	x	x	x	x
Observations	1,476	1,476	1,476	1,537	1,537	1,537
pseudo R2	0.0476	0.0460	0.0451	0.0332	0.0322	0.0305
chi2	91.69	93.78	91.89	54.48	68.61	64.91

Note: Table displays beta coefficients. Robust standard errors are given in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Household composition controls include: household size, share of household members in different age groups

Table 13 cont.: Effect of household food security status on probability of undernutrition by age cohort

	(1)	(2)	(3)	(4)	(5)	(6)
	children aged >15 to 20 years			adults >20 years		
VARIABLES	Underweight (BMI)	Underweight (BMI)	Underweight (BMI)	Underweight (BMI)	Underweight (BMI)	Underweight (BMI)
FCS - dummy moderately insecure	0.102			-0.102		
	(0.385)			(0.156)		
FCS - dummy food secure	-0.266			-0.223		
	(0.368)			(0.148)		
rCSI - dummy moderately insecure		0.0881			-0.0384	
		(0.154)			(0.0844)	
rCSI - dummy food secure		0.0597			-0.0849	
		(0.156)			(0.0857)	
HFIAS - dummy moderately insecure			-0.0974			-0.0876*
			(0.0875)			(0.0493)
HFIAS - dummy food secure			0.0582			-0.179***
			(0.118)			(0.0662)
Constant	-2.111***	-0.755***	-0.733***	-0.534***	-0.677***	-0.639***
	(0.557)	(0.275)	(0.250)	(0.181)	(0.131)	(0.114)
Household composition	x	x	x	x	x	x
Wave fixed effects	x	x	x	x	x	x
District fixed effects	x	x	x	x	x	x
Observations	1,713	1,713	1,713	6,954	6,954	6,954
pseudo R2	0.0479	0.0202	0.0214	0.0128	0.0121	0.0131
chi2	28.88	39.35	41.82	76.51	72.52	78.32

Note: Table displays beta coefficients. Robust standard errors are given in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1. Household composition controls include: household size, share of household members in different age groups