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Shorter, Cheaper, Quicker, Better

Linking Measures of Household Food Security to Nutritional Outcomes in Bangladesh, Nepal, Pakistan, Uganda, and Tanzania

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Abstract

Using nationally representative household survey data from five countries—three from South Asia (Bangladesh, Pakistan, and Nepal) and two from Sub-Saharan Africa (Tanzania and Uganda)—this paper conducts a systematic assessment of the correlation between various measures of household food security and nutritional outcomes of children. The analysis, following the universally accepted and applied definition of food security, is based on some of the most commonly used indicators of food security. The results show that the various measures of household food security do appear to carry significant signals about the nutritional status of children that reside within the household. This result holds even after the analysis controls for a wide array of other socio-economic characteristics of the households that are generally also thought to be associated with the quality of child nutrition. If using these food security indicators as proxy measures for the underlying nutritional status of children is of some interest, then the results show that simple, cost-effective, and easy-to-collect measures, such as the food consumption score or the dietary diversity score, may carry at least as much information as other measures, such as per capita expenditure or the starchy staple ratio, which require longer and costlier surveys with detailed food consumption modules. Across five different countries in South Asia and Africa, the results suggest that the food consumption score, in particular, performs extremely well in comparison with all other measures from the perspective of nutritional targeting as well as for monitoring nutritional outcomes.

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Shorter, Cheaper, Quicker, Better: Linking Measures of Household Food Security to Nutritional Outcomes in Bangladesh, Nepal, Pakistan, Uganda, and Tanzania

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"Measurement drives diagnosis and response. As global attention returns to food security, new opportunities emerge to improve its measurement…"

■ Chris Barrett (2010), *Science*

1 INTRODUCTION

The world is facing significant and interrelated challenges in the areas of food security, malnutrition, and chronic poverty. A large portion of the world's population still lives below the poverty line, and despite rapid economic growth and a significant reduction in extreme economic poverty, hunger and malnutrition have remained stubbornly high in some parts of the world, particularly in South Asia and Sub-Saharan Africa (United Nations, 2012). Moreover, even in regions where food security improved significantly prior to 2005, food price shocks experienced in 2008 and 2011 reversed some of this progress, leading to increased poverty (Ivanic and Martin, 2008; Ivanic et al, 2011) and undernourishment (Tiwari and Zaman, 2010). From a policy perspective, these issues underscore the need for sustained efforts to address the vulnerabilities that the world's poor face in meeting their basic food and nutritional needs.

Of particular concern is the extent to which children are affected by these shocks. Young children are known to be especially vulnerable to any shock that may weaken the household's ability to secure food during times of economic distress. In addition, since body size at adulthood is strongly correlated with stature at age three, any growth faltering experienced in these early formative years may leave a permanent physiological as well as socio-economic scar. The latter is due to the fact that children's nutritional status in early childhood has been found to be correlated with cognitive outcomes, productivity, earnings and the risk of cardio-vascular and obstructive lung diseases.[1]

Two kinds of interventions are particularly emphasized to protect children's nutritional status during times of economic distress. The first takes the form of social safety nets and is intended to provide immediate relief in the form of direct transfers – of cash or often also food – to households most likely to be affected by these shocks. The second takes a more medium- to long-term perspective and is geared towards building resilience to future shocks through better integration with national and international agricultural markets through commerce and trade, crop diversification, increased productivity through use of weather -resistant seed varieties, increased production of nutrient-dense food items etc. Even though it is now well understood that malnutrition is a multidimensional problem and requires coordinated action on several fronts, the goal of these interventions is to ensure that the causal pathway linking nutrition to household food security remains intact, and in particular, the quantity and quality of nutritional intake does not suffer.[2] This view is at the very foundation of the renewed emphasis, particularly in program activities in the agricultural sector, on sharpening their nutritional focus.

Regardless of whether our concern for malnutrition is embedded in the context of economic shocks or not, any discussion of social safety nets to protect and bolster food and nutritional security in the short run or nutritionally sensitive agricultural programs to improve nutritional status through improved quantity and quality of diets in the medium run necessarily raises questions about indicators of food and nutrition security. What kind of targeting devices should be used to identify children or households that are most likely to be in need of assistance? Should a geographical targeting method be used? Should a geography-based targeting be further fine-tuned using some sort of a poverty-based targeting mechanism? How should the nutritional impact of agricultural projects containing nutritional components be measured? Should one collect anthropometric data for every child in the project area before and after the project? Since food is only one of several inputs into child nutrition, how should any difference in the observed nutritional status be interpreted?

It is encouraging that in recent years, researchers as well as practitioners have developed a wide range of indicators to measure various aspects of food security. Yet, given how nebulous the concept itself is, the inability of any one indicator in particular to holistically capture all or most aspects of food security is only natural.[3]

The choice of which indicator to use is often guided by the context and purpose of the analysis as well as tradeoffs between comprehensiveness on the one hand, and the ease and cost of data collection on the other. For example, the FAO uses national level food balance sheets to come up with global undernourishment or hunger figures (hunger being the extreme manifestation of food insecurity). The World Bank, in much of its own work on poverty, regards those below the food poverty line as food insecure. Likewise, policy makers may need to address issues of transitory food security caused by drought or political upheaval, in which case their main concern may be adequate calorie availability. Alternatively, they may want to address chronic hunger and malnutrition, which may require more detailed data collection at the household or individual level. Some indicators of food security may work well for populations that are relatively food secure, but less well for those living in chronic poverty (Haddad, 1992). Similarly, there may be variations based on culture, climate, agriculture, and food traditions and preferences to which any particular food security measure will have to be sensitive (Ruel, 2002). Because different indicators provide contrasting and sometimes contradictory accounts of the state of food security, the decision about which indicators to use may impact policy decisions about food security interventions (Barrett, 2010).

While there is indisputable merit to the idea that the purpose for which food security is being measured should guide the choice of the indicator, food security – irrespective of how it is measured – is often not an end in itself: it is a pathway toward securing good nutritional outcomes. If one is to take this perspective – and one has to, particularly while considering the highly policy relevant issues of nutritional

targeting and monitoring the effectiveness of nutrition-sensitive agricultural programs – then it becomes reasonable to expect that in addition to the appropriateness of the context and the associated ease and cost-effectiveness of the requisite instrument, the choice of food security indicator should also be guided by the extent to which it carries useful signals about the nutritional status of the underlying population. An indicator of food security that is easy and cost-effective to collect *and* best correlated with nutritional status would be the most useful for nutritional targeting as well as monitoring of the effect of particular projects designed to improve nutrition through food security.

Therefore, the central question we attempt to answer in this work is the following: How well are the existing measures of household food security correlated with the underlying nutritional status of children? If they are correlated, is it possible to rank these measures in terms of this degree of correlation?

The proposed question is both novel and policy relevant. It is novel because the idea that these food security measures could and perhaps also should be evaluated based on the degree of useful information they carry on nutritional status has not received serious consideration from academics or policymakers. Even if it has received attention from some quarters, the lack of appropriate data has stymied any effort to convert this curiosity into serious empirical work. Our work has been possible due to a number of new surveys that enable us (a) to construct multiple household-level food security measures for the same population and (b) to observe the anthropometric health indicators for children in the same households.

This work is also highly policy relevant because food security is often not an end in itself. To the extent that food security is seen as an input into better nutrition, information on which measure of food security carries the most information on nutritional status will help shape the discussion on the kind of data that should be collected to monitor and track progress on these outcomes and better target appropriate assistance. It is worthwhile for researchers and policymakers to consider the strengths and limitations of each indicator. While there already exists adequate knowledge on the cost and time effectiveness of some of these indicators, the objective of this work is to supplement that with a ranking based on an additional dimension, namely, the degree of association with the underlying nutritional status.

Our methodology consists of a series of ordinary least square regressions specified under two broad regimes. The first regime is a parsimonious specification and includes only the food security measures (one at a time) and the geographical variables (urban/rural and regions). The rationale for doing this is that the crudest form of nutritional targeting – or the first approximation that may exist in any country – is often based on geography. The question we are essentially asking and answering with these specifications then is how these food security indicators compare in terms of providing a higher resolution to the targeting lens over and beyond any geographical targeting that may already exist. This will help us

answer the question of whether or not food security indicators are useful for nutritional targeting and also give us a sense of the ranking of these indicators in terms of their performance.

The second regime is a more egalitarian one where we include in the regression all other proximate correlates of nutritional status. This is in addition to the food security measures and the geographic variables included in the parsimonious regime. The rationale for doing this is the following. If we want to use these food security indicators as proxies for nutritional status within monitoring and evaluation frameworks of particular "nutrition-sensitive" agricultural projects, then we need to ensure that we take into account all the other mediating factors that may have an independent effect on child nutrition. For example, a homestead garden project may have ended up improving nutritional status by improving household dietary diversity, but there may have been a concurrent improvement due to an expansion of a clean drinking water project. This implies that when evaluating our food security indicators, we need to condition on other potentially confounding factors that may also have a bearing on any changes in nutritional status.

In addition to the ordinary least squares, we also use unconditional quantile regression methods to tease out any potential heterogeneities in these relationships across the distribution of nutrition. From a public health or program intervention perspective, one may be more concerned with the lower left tail of the z-score distribution and in particular with cases that fall below the −2 standard deviations of the reference population. What this method will allow us to do is further refine our results and test whether the rankings of these food security indicators are different if we focus on children who are already malnourished.

We conduct the analysis for five countries: three of these are in South Asia (Bangladesh, Nepal, and Pakistan) and two in Sub-Saharan Africa (Tanzania and Uganda). Following the FAO's universally accepted and applied definition of food security, we pick some of the commonly used measures of food security which map into at least one of the pillars of food security: availability, access, utilization, or stability. Food security measures considered in this work are: per capita expenditure; share of food in total expenditure; per capita caloric availability; food consumption score (FCS); household dietary diversity score (HDDS); mother's dietary diversity score (MDDS); child dietary diversity score (CDDS); household food insecurity access scale (HFIAS); starchy staple ratio (SSR); and share of food expenditure on starchy staples (SSEXR).

Results of our analysis show a resounding support for the idea that food and food security related dimensions remain a critical piece in the malnutrition puzzle. In our results, the various measures of household food security do appear to carry significant signals about the nutritional status of children that reside within the household. This result holds even after we control for a wide array of other socio-economic characteristics of the households that are generally also thought to be associated with the

quality of child nutrition. Among the more important factors our results are conditioned on include household economic status (measured by the stock of wealth), mother's education level, region of residence, child care practices such as breastfeeding, and epidemiological factors, particularly as they relate to quality of drinking water and sanitation facilities.

If using these food security indicators as proxy measures for the underlying nutritional status of children is of some interest, then our results show that simple, cost-effective, and easy-to-collect measures such as the food consumption score or the dietary diversity score may carry at least as much information as measures such as per capita expenditure or starchy staple ratio, which require longer and costlier surveys with detailed food consumption modules. Across five different countries in South Asia and Africa, our results suggest that the food consumption score (FCS), in particular, performs extremely well in comparison to all other measures from the perspective of nutritional targeting as well as monitoring of nutritional outcomes.

The rest of the report is structured as follows. In Section 2, we present our conceptual framework, empirical strategy, and a brief review of relevant literature. In Section 3, we introduce the datasets and present a discussion of the basic descriptive statistics. The results of the estimation are reported in Section 4, followed in Section 5 by a synthesis of these results, particularly from the perspective of their relevance for policy. Finally Section 6 includes a summary of the key results and some reflections on the way forward on improving food security measurement systems.

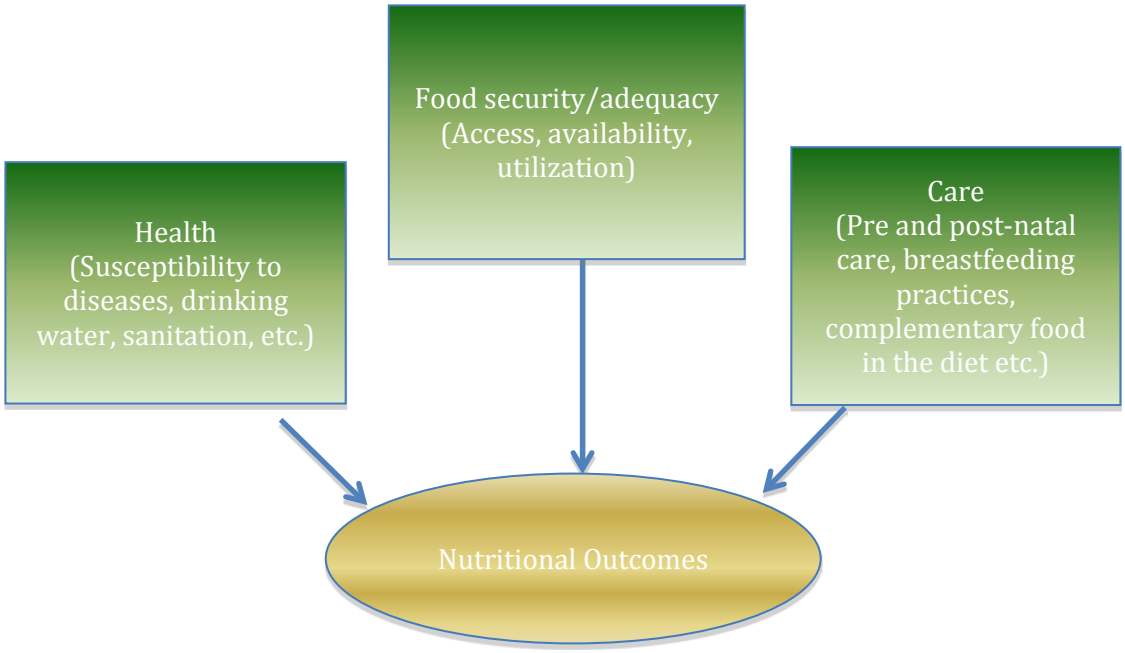
2 CONCEPTUAL FRAMEWORK AND EMPIRICAL STRATEGY

2.1 Conceptual Framework

While adequacy of food is a necessary condition for good nutrition, it is not a sufficient one. There are a number of non-food factors that also influence nutritional outcomes for children. Of particular salience are the physical and environmental health of the household and its members and the quality of care that the child receives. On the one hand, morbidity related to states of illness through diseases such as diarrhea, for example, diminishes the absorptive capacity of the child's body, rendering it unable to utilize the nutrients contained in the food that is consumed. On the other hand, environmental factors such as access to clean drinking water and sanitation facilities have a direct bearing on the incidence of such diseases. This implies that food is only one of numerous inputs into good nutrition, and any effort to assess the impact of food security on nutritional outcome should take into account the effect of these intervening factors.

This is the idea that is in fact embedded in the UNICEF framework of nutrition (UNICEF, 1990) that emphasizes the important roles that food, environmental health, and care play in whether children are stunted. Figure 1 summarizes this framework visually.

Figure 1: The UNICEF Framework for Nutrition



Our empirical strategy derives directly from this framework and consists mainly of running a series of regressions of the following form:

$$NS_{ih} = \beta_0 + \beta_1 FS_h + \beta_2 X_{ih} + \varepsilon_{ih} \qquad (1)$$

where NS_{ih} is the nutritional outcome, measured by height-for-age or weight-for-age z-score, of child i in household h; FS_h is a one of the nine measures of food security considered in this analysis, and X_{ih} is a vector of control variables, which includes individual, household, demographic, socio-economic, and environmental characteristics, and ε_{ih} is the random disturbance term. Here, β_1 is our parameter of interest, which represents the relationship between food security and nutritional outcome. Since our primary interest is in comparing the strength of the association across the various measures of food

security, which are measured in different units, we standardize the food security measures so that the estimated parameters are actually beta coefficients.[4]

We consider height-for-age, which is a measure of chronic malnutrition, as well as weight-for-age, which is measure of underweight, as our dependent variables of interest. The rationale for considering these two is to try and understand if there are meaningful differences in the way the various food security indicators relate to different states of malnutrition. To the extent that the state of being underweight is largely a reflection of caloric deficiency, it is *a priori* plausible to imagine food security measures that are able to better capture the quantity of the diet to be better related with weight-for-age. On the other hand, measures that capture elements of quality of the diet may be better suited for the purposes of either targeting or monitoring of interventions related to chronic malnutrition.

Analyzing a longer term measure of health such as height-for-age alongside measures of food security that are generally constructed using dietary information at the household and individual levels from 24-hour, 7-day, and 30-day recall periods raises the usual question of time consistency. How can nutritional outcome measured by height-for-age, which is the product of long-term cumulative processes, be related to what a child ate yesterday or over the last week? The argument there is that recent dietary information can be meaningful as a contributor to a child's linear growth to the extent that it reflects dietary patterns and nutrient adequacy over longer, biologically meaningful period of time (Arimond and Ruel, 2004). Therefore, the analysis is carried out based on the assumption that, under normal circumstances, households' recent dietary patterns are a good proxy of their long-term food consumption behavior.

This assumption will be too restrictive if the period of the survey is particularly unusual for any reason (e.g., economic shocks such as drought) or if there are strong seasonalities. However, this possibility is somewhat mitigated by the fact that the surveys that we use for the five countries we analyze were mostly during what appear to have been normal years.

In order to gear our analysis to make it directly applicable to policymakers interested in either carrying out nutritional targeting or monitoring of the nutritional impacts of agricultural projects, we conduct it under two different regimes. This essentially amounts to estimating the above equation (1) with and without the conditioning variables, X_{ih}.

If our goal is to find an indicator suitable for nutritional targeting, we want to run the specification without the conditioning factors. This is because in this case our interest will primarily be in picking out the food security indicator that best predicts the nutritional outcomes. The mental exercise that underpins this idea is the following: How confident can we be that a household is nutritionally insecure based on what we observe the household food security status is (based on various measures) *if we have no other information on the household*? This is similar in principle to proxy means testing in the

poverty targeting literature.[5] In the implementation, however, we also exploit the fact that there are strong regional patterns of nutritional insecurity in many of these countries. In other words, we do include the basic geographical variables (urban/rural residence as well as regions) in all regressions. The evaluation criterion thus becomes the following: What additional resolution do the food security indicators add to the targeting lens to fine-tune it over and beyond the first approximation based on geographical characteristics?

On the other hand, estimating equation (1) above controlling for the full range of potentially confounding factors allows us to understand what levels of improvements in nutritional outcomes can be achieved through food security interventions net of other factors that may be contributing to this change independently. Thus, a food security indicator that contains valuable information about nutritional outcomes independently of other influencing factors can be used to monitor the nutritional impacts of different agricultural and food security projects.

Furthermore, from a public health or program intervention perspective, rather than restricting the analysis to the average impact, one may be more concerned with the distributional consequences of food security. More specifically, one might be more interested in assessing the impact of food security on a section of the population at greatest health and nutritional risk, i.e., the lower left-hand tail of z-score distribution, and in particular with cases that fall below the -2 standard deviation of the reference population. If this is the case, then estimating ordinary least squares (OLS) and restricting the analysis to conditional means will be too restrictive. Therefore, we also estimate the above equation using unconditional quantile regression (UQR). The UQR methodology is more flexible than the OLS estimation in that it estimates the impact of a covariate at different quantiles of the unconditional distribution of the dependent variable (see Firpo et al, 2009, and Supplemental Web Appendix A for details).

2.2 Food Security Measures Considered

Following the FAO's universally accepted and applied definition of food security, we pick some of the most commonly used measures which map into at least one of the three main pillars. Specifically, the measures we consider are: per capita expenditure; share of food in total expenditure; per capita caloric availability; food consumption score (FCS); household dietary diversity score (HDDS); child dietary diversity score (CDDS); mother's dietary diversity score (MDDS); household food insecurity access scale (HFIAS); starchy staple ratio (SSR); and share of food expenditure on starchy staples (SSEXR).

Per capita expenditure is a widely used measure of a household's wealth status and overall well-being. It is indicative of resources that are available to a household that the household can tap into to satisfy its food requirements. It is thus used as one of the measures of the access component of food

security. Food share of total expenditure is an indicator of the household's economic vulnerability and can be a proxy measure of household's ability to access food. Households that spend a larger proportion of their total expenditure on food do not have sufficient safety net of non-food expenditure to rely on and thus are more susceptible to food deprivation. In an event of negative income shock or increase in food prices, households with higher share of food expenditure will have to adjust either by reducing food quantity or by lowering the quality of food they eat.

Per capita caloric availability is an indicator of diet quantity and relates to the access component of food security. It is one of the most widely used quantitative indicators of food security. It measures whether a household has acquired sufficient calories to meet the daily energy requirements of its members. If a household's estimated per capita daily energy availability is lower than its per capita daily requirement, then the household is considered energy deficient and can be classified as food insecure.

Dietary diversity is a measure of diet quality and reflects the variation in food typically consumed by households. In general, it is defined as a sum of the number of food items or food groups consumed over a given reference period. Although there is no general consensus in constructing a measure of dietary diversity, studies have shown that various measures of dietary diversity are positively correlated with others measures of household food security, such as per capita consumption, calorie availability, calorie intake, and intake of essential nutrients.[6]

For the purpose of our analysis, we consider three different measures of dietary diversity: household dietary diversity score (HDDS), individual dietary diversity score (IDDS), and food consumption score (FCS). Two of the most commonly used indicators of dietary diversity are household dietary diversity score (HDDS) and individual dietary diversity score (IDDS), developed by USAID Food and Nutritional Technical Assistance (FANTA). Under IDDS, we construct two separate dietary diversity scores: one for children below the age of five (CDDS) and one for mothers (MDDS). HDDS is defined as the number of different food groups consumed at the household level by an average member over a 24-hour recall period, whereas IDDS is defined as the number of different food groups consumed by an individual over a 24-hour recall period. FANTA/FAO uses twelve, eight, and nine food group classifications to construct the HDDS, CDDS, and MDDS, respectively (see Supplemental Web Appendix B for food group classifications). The value of HDDS ranges from 0 to 12, and the values of CDDS and MDDS range from 0 to 8 and 0 to 9, respectively.

Food consumption score (FCS) is a measure of the access component of food security developed by the WFP. WFP uses FCS as one of the core measures of food consumption and food security to monitor, assess, and track changes in the food security situation and needs of countries and regions in which it has programs. It is a composite score that incorporates dietary diversity, food frequency, and relative nutritional importance of different food groups consumed by a household. For the calculation of

the FCS, data are collected on the 7-day recall of frequency of consumption of different food items, and food items are grouped into 8 specific food groups with each group given a weight representing the nutrient density of that food group (see Supplemental Web Appendix C for classification and their corresponding weights). The value of FCS ranges from 0 to 112 with a higher FCS representing a higher dietary diversity and/or frequency of consumption and higher nutritional value of a household's diet and vice versa.

The household food insecurity access scale (HFIAS) is a measure developed by FANTA to assess food access problems faced by households during a recall period of 30 days. It aims to capture the changes in food consumption patterns and reflect the severity of food insecurity faced by households due to lack of or limited resources to access food. It is composed of nine questions, and these questions relate to three different domains of the access component food insecurity: anxiety and uncertainty about household food access, insufficient quality, and insufficient food intake (Swindale et al, 2006). Each question has four response options: never, rarely, sometimes, and often, which are coded 0, 1, 2, and 3 in order of increasing frequency (see Supplemental Web Appendix D for the complete list of questions asked to construct HFIAS). Responses to these nine questions are summed to construct a food insecurity score, with a maximum score of 27 indicating most food insecure households.

Another measure of food security we consider is the share of calories derived from starchy staples – or starchy staples ratio (SSR). It is measured as the percentage of calories derived from starchy staples. Starchy staples are energy-dense but are low in protein and micronutrients, which means that households with higher value of SSR will have a lower quality diet and will be more vulnerable to protein and micronutrient deficiencies. Moreover, starchy staples are not only cheaper sources of energy but also figure prominently as a part of household's staple diet. Jensen and Miller (2010) suggest this to be a potentially promising way to capture food security within the household. It relies on consumption behavior to reveal the household food security situation, as opposed to caloric norms.[7] Finally, we also use the expenditure analog of the starchy staples ratio, which is the share of food expenditures that is devoted to the purchase of starchy staples. We call this the starchy staples expenditure ratio (SSEXR).

It is important to note that while this is the comprehensive list of all the food security indicators we analyze, what we actually have for each individual country is a strict subset of this list. This is because we use different surveys for different countries, and the kind of information available in these surveys varies quite a bit. One of the key caveats that should also be pointed out up front is that each of these food security measures is constructed at the household level except for the child dietary diversity score and mother's dietary diversity score, which are available only for Bangladesh. It is well known that intra-household food requirements and food allocation differ significantly depending on the gender, age, and

status of household member. The fact that we do not have individual level intake information precludes us from examining issues of inequality in food access within the household.

2.3 Related Literature

This work shares similarities with a number of existing efforts. The earliest work in this area was naturally focused more on whether or not caloric adequacy is sufficient for good nutritional outcomes. Alderman and Garcia (1994) in their study in Pakistan found no significant association between food security, as measured by estimated per capita caloric availability, and stunting or wasting among pre-school aged children. This was a departure from earlier work by Schnepf (1990) who found that in Rwanda per capita caloric availability was significantly associated with child stunting, wasting, and underweight.

There have also been studies examining the association between food security, as measured by variants of dietary diversity score, and child nutritional outcomes (see Ruel 2002 for a review). The majority of these studies found a positive association between dietary diversity and child nutritional outcomes. However, many of these studies lacked appropriate controls for socioeconomic and environmental factors, which could have confounded the association between dietary diversity and nutritional outcomes. Arimond and Ruel (2006) using the Demographic and Health Survey (DHS) data from 11 developing countries, show that dietary diversity has a strong bivariate association with height-for-age z-score in nine of the eleven countries. In a multivariate analysis, controlling for biological and household socioeconomic factors, they find significant association between dietary diversity and height-for-age Z-score in six of the eleven countries.

The same dietary diversity scores have also been validated with respect to other more conventional measures of food security. Hoddinott and Yohannes (2002) examine the correlations between dietary diversity and other measures of food security. Particularly, they find strong associations between dietary diversity and per capita expenditures on food, as well as between dietary diversity and number of calories consumed from non-staples. In most cases, the also find positive associations between dietary diversity and caloric availability from staples. More recently, Wiesmann et al (2009) also uses calorie consumption per capita as a benchmark to validate the FCS as an assessment tool. They find the associations between the FCS and calorie consumption to be both positive and statistically significant.

Even though the general flavor of analysis is similar, most of the existing research is generally in the spirit of validating particular measures of food security where the validation is done either in terms of correlation with other, existing measures of food security or in some cases with the nutritional outcomes. To the best of our knowledge, there hasn't been any prior study that takes a variety of food security measures and attempts to systematically rank them by the strength of their correlations with nutritional

status. Headey and Ecker (2012) is perhaps the closest relative of our paper: they also evaluate a set of food security indicators but do it at a much broader level using lenses of cross-sectional validity, nutritional relevance, and inter-temporal validity. Even though the countries they analyze and the food security measures they use do not entirely overlap with what we do here, the spirit of their work, particularly the component related to nutritional relevance, is identical to ours.

3 DATA

In this section, we introduce the data and descriptive statistics for the key variables used in the analysis. For each country, height-for-age and weight-for-age z-scores are constructed using the World Health Organization's (WHO) Anthro program, which uses the WHO multicenter growth reference study (MGRS) growth data as the reference population.[8] The value of the z-score indicates the number of standard deviations an individual child of a certain age and gender deviates from the median of a "healthy" reference population. Z-score's cut-off point of less than 2 standard deviations from the median of the reference population is used to identify children with low height-for-age (stunting) and low weight-for-age (underweight). For all countries, following the WHO's fixed exclusion range, we drop child observations with z-scores outside a certain range. [9]

3.1 Bangladesh

For Bangladesh, we use data from the 2011 Bangladesh Food Security and Nutrition Surveillance Project (FSNSP) surveys administered by Helen Keller International (HKI) in partnership with the Bangladesh Bureau of Statistics and the James P. Grant School of Public Health of BRAC University. FSNSP is a comprehensive survey developed specifically to track seasonal variations and changes over time in key food security, nutrition and health indicators. The survey has three rounds of data covering the three major agricultural seasons in Bangladesh: the post-aman harvest season (February - April); the monsoon season (June - August); and the harvest season (October - December). Over the course of three rounds, the 2011 FSNSP survey interviewed more than 26,000 households and collected anthropometric and dietary information on more than 12,000 children under the age of five from 56 districts across Bangladesh.[10]

The survey contains detailed information on child anthropometric measurements such as weight, height, and mid-upper arm circumference (muac). Restricting the analysis to the youngest child under the age of five for whom anthropometric measurements are available and dropping observations with z-scores outside fixed exclusion range gives a sample of 11,556 children. Summary statistics on the nutritional

indicators broken down by the main regions as well as gender and age groups are presented in Supplemental Web Appendix tables E1 and E2.

On the food security front, the survey contains detailed information on the nature of shocks faced by the household, on the intra-household food allocation during shocks, and on the coping strategies. For example, the surveys asked whether there were any instances in the last month where someone in the household had to reduce the number of meals eaten in a day or go an entire day without eating and if so, which household member(s) was it. The surveys also contain information on consumption of different food groups at the household level as well as at the individual level for the youngest child below the age of five and the mother.[11] Using these different sets of information, we construct three different measures of food security: household food insecurity access scale (HFAIS); food consumption score (FCS); and two sets of individual dietary diversity score: child dietary diversity score (CDDS) and mother's dietary diversity score (MDDS).

3.2 Nepal

For Nepal, we use data from the third round of household living standards survey (NLSS-III) conducted by the Center Bureau of Statistics (CBS) between February 2010 and January 2011. It is a nationally representative multi-topic survey which collects a wide range of socioeconomic information at the household and individual levels. The survey covers a cross-sectional sample size of about 35,000 individuals from 6000 households across 71 districts of Nepal which includes 2,846 children under the age of five.[12] Restricting the analysis to children under the age of five for whom anthropometric measurements were collected gives a sample size of 2,515 children[13] and dropping observations with z-scores outside fixed exclusion range leaves us with an effective sample size of 2,483 observations for height-for-age and 2,502 observations for weight-for-age. Summary statistics on the nutritional indicators broken down by the main regions as well as gender and age groups are presented in Supplemental Web Appendix tables F1 and F2.

The survey contains detailed information on household food consumption with 7-day and 30-day recall periods. Using the consumption module and supplementing it with the information on household expenditure, we construct seven different measures of household food security: per capita expenditure; share of food on total expenditure; per capita caloric availability; food consumption score (FCS); household dietary diversity score (HDDS); starchy staple ratio (SSR); and starchy staples expenditure ratio (SSEXR). All the food security measures are constructed at the household level and are based on a 7-day recall period. Household level food security measures are divided by the number of days in the reference period and the number of household members to get a corresponding daily per capita value, where necessary.

3.3 Pakistan

For Pakistan, we use data from the Pakistan Panel Household Survey (PPHS) carried out by the Pakistan Institute of Development Economics (PIDE) in the year 2010. The survey contains detailed data on anthropometric measures for children less than six years old. In addition, the survey includes a detailed consumption module covering all aspects of household consumption in the food and non-food categories. The food consumption module in particular allows us to construct six measures of food security for our analysis: per capita household expenditure, food share of total expenditure, per capita daily caloric availability, starchy staple ratio, starchy staple expenditure ration, and food consumption score.[14] Summary statistics on the nutritional indicators broken down by the main regions as well as gender and age groups are presented in Supplemental Web Appendix tables G1 and G2.

3.4 Tanzania

The data for Tanzania come from the 2008-2009 first round of the National Panel Survey administered by Tanzania National Bureau of Statistics. The NPS is a nationally representative "integrated" household survey which covers a broad range of topics. The survey covers 3,280 households spanning all regions and all districts in Tanzania, both mainland and Zanzibar. The comprehensive questionnaire includes a detailed consumption section which allows us to construct measures of food security. It also collects information on child anthropometric measures for children below the age of five. This allows us to construct measures of nutritional outcomes. Restricting the analysis to children under age 5 for whom anthropometric measurements were collected and excluding z-scores outside a certain range leaves us with an effective sample size of 4,392 children for weight-for-age and 4,374 children for height-for-age. There is a considerable variation in nutritional indicators across different regions in the country. Summary statistics on the nutritional indicators broken down by the main regions as well as gender and age groups are presented in Supplemental Web Appendix tables H1 and H2.

The survey contains detailed information on household food consumption with a 7-day recall period. Using the consumption module and supplementing it with the information on household expenditure, we construct seven different measures of household food security: per capita expenditure, share of food in total expenditure, starchy staple ratio (SSR), starchy staple expenditure ratio (SSEXR), household dietary diversity score (HDDS), food consumption score (FCS), and per capital caloric availability.

3.5 Uganda

For Uganda we use data from the 2009/2010 Uganda National Panel Survey administered by the Uganda Bureau of Statistics. It is a multi-topic survey which aims to inform and guide policymaking. The survey contains information on child anthropometric measurements such as weight and height. Summary statistics on the nutritional indicators broken down by regions as well as gender and age groups are presented in Supplemental Web Appendix tables I1 and I2.

The survey also contained information on composition and expenditures on food. The sample is composed of 3,123 households that were distributed over 322 enumeration areas in each of the central regions with the exception of Kampala district, eastern region, western region, and northern region. The food security indicators constructed for Uganda are per capita expenditures, food share of total consumption, food consumption score, household dietary diversity score, and starchy staple expenditure ratio.[15]

4 RESULTS

We present the results for height-for-age and weight-for-age for Bangladesh, Nepal, Pakistan, Tanzania, and Uganda respectively in this section. In all the tables, Model 1 corresponds to the specification with limited control variables while Model 2 corresponds to the specification with an expanded set of control variables. Only the coefficients on the variables of interest, i.e., the food security measures, are presented in these tables (Refer to Supplemental Web Appendix E-I for full sets of results from the OLS estimations). In all the tables, for each model, the first column presents the results of OLS estimation, and the remaining columns present the results of unconditional quantile regression at the 10^{th}, 25^{th}, 50^{th}, and 75^{th} quantiles. Since all the food security measures are standardized, the coefficients are interpreted as the change in terms of standard deviations in the dependent variable that result from a change of one standard deviation in the independent variable.

4.1 Bangladesh

For Bangladesh, Table 1 presents the regression results for height-for-age, and Table 2 presents the results for weight-for-age. For height-for-age, Model 1 shows that coefficients on all food security measures are statistically significant both at the mean as well as across the distribution of the height-for-age z-score. Results from both the OLS and UQR indicate that household-level food security measures, food consumption score and HFIAS, have higher correlation with the height-for-age than individual-level food security measures, child dietary diversity score and mother's dietary diversity score. At the higher

end of the distribution, FCS has a stronger association than HFIAS. However, at the lower tail of the distribution (at the 10th and 25th quantiles) the effects of FCS and HFIAS on height-for-age are similar.

Table 1: Height-for-age Z-score (Bangladesh)

	Model 1 - Without Controls				
VARIABLES	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
HFIAS	-0.179***	-0.177***	-0.189***	-0.178***	-0.181***
	(0.010)	(0.018)	(0.013)	(0.012)	(0.013)
CDDS	-0.088***	-0.046***	-0.083***	-0.114***	-0.112***
	(0.010)	(0.014)	(0.012)	(0.012)	(0.015)
FCS	0.192***	0.180***	0.186***	0.190***	0.203***
	(0.011)	(0.017)	(0.013)	(0.013)	(0.014)
MDDS	0.128***	0.145***	0.126***	0.120***	0.137***
	(0.011)	(0.018)	(0.014)	(0.013)	(0.015)

	Model 2 - With Controls				
VARIABLES	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
HFIAS	-0.032**	-0.036	-0.049***	-0.033**	-0.032*
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
CDDS	0.036***	0.062***	0.044**	0.014	0.004
	(0.02)	(0.03)	(0.02)	(0.02)	(0.02)
FCS	0.043***	0.031	0.032*	0.048***	0.045***
	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
MDDS	0.038***	0.060***	0.038***	0.035***	0.046***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)

Controlling for potentially confounding factors in Model 2, all four food security measures remain statistically significant in the OLS estimation. Similar to the parsimonious model, even after controlling for confounding factors, on average food consumption score has the strongest correlation with the height-for-age. However, net of the confounding factors, neither food consumption score nor HFIAS are statistically significant at the lower end of the distribution (at the 10th quantile). At the lower end of the distribution (at the 10th and 25th quantiles), the coefficient on CDDS is the highest followed by MDDS.

In the case of weight-for-age, for the parsimonious model, results are qualitatively similar to the ones from height-for-age. All the coefficients on the food security measures are highly significant, with

food consumption score and HFIAS having higher coefficients both at the mean and across the distribution of weight-for-age.

Table 2: Weight-for-age Z-score (Bangladesh)

	Model 1 - Without Controls				
VARIABLES	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
HFIAS	-0.162***	-0.121***	-0.136***	-0.153***	-0.176***
	(0.009)	(0.013)	(0.011)	(0.011)	(0.014)
CDDS	-0.244***	-0.051***	-0.100***	-0.211***	-0.402***
	(0.010)	(0.010)	(0.009)	(0.010)	(0.016)
FCS	0.166***	0.121***	0.125***	0.142***	0.183***
	(0.010)	(0.013)	(0.011)	(0.012)	(0.015)
MDDS	0.098***	0.078***	0.094***	0.081***	0.087***
	(0.011)	(0.014)	(0.012)	(0.012)	(0.016)

	Model 2 - With Controls				
VARIABLES	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
HFIAS	-0.034***	-0.028*	-0.038***	-0.028**	-0.037**
	(0.011)	(0.017)	(0.014)	(0.014)	(0.016)
CDDS	-0.036***	0.040**	0.043***	-0.015	-0.087***
	(0.014)	(0.020)	(0.017)	(0.016)	(0.021)
FCS	0.034***	0.035**	0.023	0.010	0.037**
	(0.011)	(0.016)	(0.015)	(0.014)	(0.018)
MDDS	0.034***	0.020	0.038***	0.020	0.028*
	(0.010)	(0.015)	(0.013)	(0.012)	(0.016)

Controlling for confounding factors in Model 2, all food security measures are statistically significant in the OLS estimation, with all four food security indicators having similar quantitative effects on weight-for-age. However, at the lower end of the distribution, child DDS has the highest association with weight-for-age.

Contrary to our expectation, the coefficient on child DDS has a negative sign in the parsimonious models for both height-for-age and weight-for-age, in the OLS estimation of weight-for-age, and in the higher end of UQR in Model 2. A negative coefficient on child DDS implies that a higher child DDS is associated with lower height-for-age (or weight-for-age), which is counterintuitive except perhaps in the case of children at the higher end of the weight distribution. One explanation for this could be the way child DDS is constructed and the CDDS values assigned to children. In our analysis we consider children

between the ages of 0 – 60 months. It is well known that children up to 6 months old should be exclusively breastfed. Therefore, increasing dietary diversity for children in this age group might do more harm than good. It could also be the case of reverse causality where more diverse food is given to more malnourished children.

Another potential explanation could be that in the parsimonious models, where food security measures and geographical dummies are the only explanatory variables, food security as measured by child DDS might be capturing other characteristics specific to child care environment that might have bearing on the child's nutritional outcomes. When controlling for confounding factors, in the case of height-for-age, the sign on the coefficient of child DDS becomes positive. Even in the case of weight-for-age, controlling for confounding factors, the coefficient on child DDS is positive at the lower end of the weight-for-age distribution.

Tables 1 and 2 present the OLS and UQR estimates of the food security measures at different quantiles for the reduced and full models for height-for-age and weight-for-age. Unlike the OLS coefficients which are constant across quantiles, the UQR estimates follow a non-linear pattern, indicating the existence of parameter heterogeneity across the distribution. Overall, the results indicate that it is important to investigate the effects based on the UQR before we make inferences or formulate policies based on the OLS estimations. Nonetheless, based on the results discussed above, food consumption score and HFIAS remain the food security indicators that "best" predict the nutritional outcomes (both height-for-age and weight-for-age) of children at the conditional mean as well as at the lower end of the height distribution, implying that these two measures of food security are best suited for targeting the food and nutrition insecure population.

Controlling for the confounding factors, we find that food consumption score has the highest coefficients at the conditional mean for both measures of nutritional outcomes. At the lower end of the distribution (i.e, at the 10^{th} and 25^{th} quantiles), child and mother DDS have higher association with height-for-age, and child DDS and FCS/HFIAS have higher association with weight-for-age. The results indicate that any policy or program interventions that aim to improve the food security as measured by food consumption score will be most effective in improving average child nutrition.

4.2 Nepal

For Nepal, results for height-for age are presented in Tables 3 and 4. For height-for-age, in our parsimonious model (Model 1), coefficients on all food security measures are statistically significant both at the conditional mean as well as across the unconditional distribution of the height-for-age z-score.

Table 3: Height-for-age Z-score (Nepal)

VARIABLES	Model 1- Without Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	0.101***	0.114***	0.136***	0.111***	0.028
	(0.029)	(0.038)	(0.033)	(0.035)	(0.041)
1-SSR	0.199***	0.183***	0.174***	0.240***	0.148***
	(0.033)	(0.043)	(0.037)	(0.039)	(0.046)
1 - SSEXR	0.202***	0.195***	0.168***	0.232***	0.161***
	(0.033)	(0.042)	(0.037)	(0.038)	(0.044)
FCS	0.256***	0.218***	0.250***	0.297***	0.250***
	(0.032)	(0.042)	(0.036)	(0.037)	(0.044)
HDDS	0.230***	0.196***	0.228***	0.255***	0.204***
	(0.032)	(0.043)	(0.037)	(0.037)	(0.043)
Per capita consumption	0.279***	0.212***	0.225***	0.301***	0.273***
	(0.043)	(0.047)	(0.043)	(0.052)	(0.051)
Food share	-0.267***	-0.233***	-0.223***	-0.310***	-0.249***
	(0.035)	(0.039)	(0.036)	(0.040)	(0.050)

VARIABLES	Model 1- Without Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	0.085***	0.099**	0.114***	0.094***	0.031
	(0.028)	(0.039)	(0.033)	(0.036)	(0.040)
1-SSR	0.012	0.043	0.004	0.032	-0.069
	(0.036)	(0.052)	(0.044)	(0.044)	(0.050)
1 - SSEXR	0.038	0.073	0.015	0.042	-0.025
	(0.033)	(0.047)	(0.042)	(0.041)	(0.045)
FCS	0.094***	0.128***	0.122***	0.118***	0.074
	(0.033)	(0.047)	(0.041)	(0.041)	(0.048)
HDDS	0.083**	0.106**	0.100**	0.080**	0.05
	(0.034)	(0.047)	(0.040)	(0.041)	(0.047)
Per capita consumption	0.077**	0.068	0.061	0.073*	0.052
	(0.032)	(0.042)	(0.036)	(0.040)	(0.055)
Food share	-0.065	-0.076	-0.041	-0.076	-0.033
	(0.040)	(0.054)	(0.047)	(0.049)	(0.059)

OLS estimates reveal per capita consumption, with a beta coefficient of 0.279, to be the most important, followed by food share, food consumption score, and dietary diversity score, with per capita caloric availability being the least important. At the lower tail of the height-for-age distribution, food share and food consumption score show higher association with height-for-age, followed by per capita

consumption and dietary diversity score. At the bottom 10th quantile of the z-score distribution, one standard deviation decrease in food share is associated with 0.233 standard deviation improvement in height-for-age z-score, and one standard deviation increase in food consumption score is associated with 0.218 standard deviation increase in height-for-age z-score. The ranking of these food security measures changes as we move up along the distribution. At the 25th quantile, food consumption score, with a coefficient of 0.243, has the highest impact on height-for-age z-score.

Controlling for potential confounding factors in Model 2, only four out of seven food security measures remain statistically significant in OLS estimation. On average, food consumption score has the highest association with height-for-age, followed by per capita caloric availability, dietary diversity score, and per capita consumption. Across the distribution, the UQR results suggest that food security measures have stronger effects at the lower end of the z-score distribution, i.e., malnourished children benefit more from improvements in food security measures. Net of the confounding factors, none of the food security measures are statistically significant at the higher end of the distribution (at the 75th quantile). Even at the lower end of the distribution, only three out of seven food security measures remain statistically significant. In terms of their strength of association with the height-for-age, food consumption score has the strongest correlation across the distribution.

Results for weight-for-age are presented in Table 4. Results show that per capita consumption has the highest correlation with weight-for-age at the conditional means and as well as across the distribution in both the parsimonious and expanded models. In Model 1, in terms of the correlation with weight-for-age, per capita consumption is followed by food share, expenditure share of non-starchy staple food (1-SSEXR), share of calories derived from non-starchy staple food (1- SSR), and food consumption score. Controlling for the potential confounding factors in Model 2, for the OLS estimates, per capita consumption is followed by food share, food consumption score, and 1-SSEXR. On the lower end of the distribution (at the 10th quantile), except for per capita consumption, none of the food security measures are significant. At the 25th quantile, per capita consumption is followed by food consumption score and 1-SSEXR.

Table 4: Weight-for-age Z-score (Nepal)

VARIABLES	Model 1- Without Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	0.016	0.060	0.055*	0.046	-0.014
	(0.022)	(0.037)	(0.032)	(0.028)	(0.030)
1-SSR	0.185***	0.132***	0.188***	0.197***	0.165***
	(0.026)	(0.043)	(0.036)	(0.032)	(0.035)
1 - SSEXR	0.193***	0.168***	0.206***	0.202***	0.189***
	(0.025)	(0.040)	(0.035)	(0.030)	(0.033)
FCS	0.164***	0.106***	0.174***	0.187***	0.174***
	(0.025)	(0.040)	(0.033)	(0.030)	(0.033)
HDDS	0.110***	0.073*	0.133***	0.136***	0.091***
	(0.025)	(0.038)	(0.034)	(0.030)	(0.033)
Per capita consumption	0.279***	0.221***	0.241***	0.281***	0.316***
	(0.047)	(0.048)	(0.044)	(0.047)	(0.050)
Food share	-0.215***	-0.166***	-0.206***	-0.191***	-0.233***
	(0.027)	(0.039)	(0.034)	(0.032)	(0.037)

VARIABLES	Model 2- With Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	0.019	0.055	0.054*	0.053*	0.003
	(0.022)	(0.039)	(0.032)	(0.029)	(0.031)
1-SSR	0.017	-0.036	0.034	0.013	0.004
	(0.029)	(0.053)	(0.043)	(0.037)	(0.039)
1 - SSEXR	0.057**	0.040	0.069*	0.044	0.065*
	(0.026)	(0.044)	(0.039)	(0.034)	(0.035)
FCS	0.068**	0.012	0.081**	0.081**	0.080**
	(0.027)	(0.046)	(0.038)	(0.034)	(0.037)
HDDS	0.029	-0.008	0.053	0.047	0.012
	(0.026)	(0.043)	(0.038)	(0.034)	(0.037)
Per capita consumption	0.139***	0.082**	0.097***	0.132***	0.193***
	(0.036)	(0.041)	(0.036)	(0.036)	(0.045)
Food share	-0.075**	-0.018	-0.069	-0.024	-0.111**
	(0.032)	(0.051)	(0.045)	(0.041)	(0.045)

4.3 Pakistan

Results for height-for-age and weight-for-age for Pakistan are presented in Tables 5 and 6, respectively. In the parsimonious model, unlike the results from Bangladesh and Nepal, most of the food

security measures are statistically insignificant for both height-for-age and weight-for-age. The few exceptions are the coefficient on household dietary diversity score (HDDS), which is significant for height-for-age at the conditional mean and at the 25th and 50th quantiles, and 1-SSEXR and per capita expenditure, which are significant at the 25th quantile.

Table 5: Height-for-age Z-score (Pakistan)

VARIABLES	**Model 1 - Without Controls**				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	0.040	0.040	0.068	0.001	0.072
	(0.043)	(0.042)	(0.049)	(0.054)	(0.071)
1-SSR	0.072	0.024	0.082	0.109*	0.124*
	(0.050)	(0.057)	(0.061)	(0.057)	(0.072)
1 - SSEXR	0.065	0.089	0.111*	0.043	0.051
	(0.050)	(0.058)	(0.061)	(0.055)	(0.067)
HDDS	0.115**	-0.004	0.125**	0.120**	0.092
	(0.053)	(0.058)	(0.060)	(0.055)	(0.070)
Per capita expenditure	0.051	0.021	0.109*	0.060	0.056
	(0.048)	(0.050)	(0.057)	(0.057)	(0.074)
Food share	-0.024	-0.053	-0.080	-0.052	-0.058
	(0.047)	(0.050)	(0.059)	(0.056)	(0.069)

VARIABLES	**Model 2 - With Controls**				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	0.023	0.032	0.050	-0.007	0.050
	(0.049)	(0.042)	(0.058)	(0.060)	(0.079)
1-SSR	0.056	-0.011	0.072	0.047	0.143*
	(0.056)	(0.067)	(0.077)	(0.065)	(0.082)
1 - SSEXR	0.043	0.090	0.110	-0.017	0.022
	(0.059)	(0.070)	(0.079)	(0.066)	(0.079)
HDDS	0.068	-0.003	0.080	0.049	0.003
	(0.072)	(0.072)	(0.080)	(0.067)	(0.090)
Per capita expenditure	0.043	0.004	0.116	0.041	0.050
	(0.061)	(0.062)	(0.074)	(0.067)	(0.095)
Food share	-0.040	-0.073	-0.101	-0.046	-0.066
	(0.053)	(0.056)	(0.071)	(0.062)	(0.079)

Similarly, the coefficients on all food security measures remain insignificant when control variables are introduced in the model in both height-for-age and weight-for-age regressions. This

resonates with findings from other studies that report that food related issues explain little variation in malnutrition related indicators in Pakistan.

Table 6: Weight-for-age Z-score (Pakistan)

VARIABLES	Model 1 - Without Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	-0.002	-0.017	0.023	0.024	-0.013
	(0.033)	(0.054)	(0.043)	(0.050)	(0.049)
1-SSR	0.026	-0.059	-0.001	0.096*	0.056
	(0.038)	(0.067)	(0.053)	(0.051)	(0.053)
1 - SSEXR	0.007	0.058	0.011	0.015	-0.010
	(0.036)	(0.066)	(0.054)	(0.049)	(0.049)
HDDS	-0.035	-0.004	-0.035	0.047	-0.057
	(0.036)	(0.067)	(0.052)	(0.048)	(0.049)
Per capita expenditure	-0.006	-0.080	-0.087	0.022	0.017
	(0.042)	(0.070)	(0.055)	(0.056)	(0.057)
Food share	0.003	-0.049	0.037	-0.012	-0.009
	(0.037)	(0.061)	(0.052)	(0.051)	(0.052)

VARIABLES	Model 2 - With Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	0.002	-0.038	-0.022	0.027	-0.009
	(0.036)	(0.066)	(0.061)	(0.054)	(0.051)
1-SSR	-0.012	-0.150**	-0.058	0.061	0.064
	(0.044)	(0.074)	(0.065)	(0.057)	(0.061)
1 - SSEXR	0.005	-0.011	-0.036	-0.025	0.020
	(0.044)	(0.075)	(0.068)	(0.057)	(0.059)
HDDS	-0.054	-0.118	-0.080	0.002	-0.049
	(0.046)	(0.077)	(0.069)	(0.059)	(0.062)
Per capita expenditure	-0.004	-0.119	-0.140*	-0.021	0.025
	(0.052)	(0.088)	(0.076)	(0.065)	(0.067)
Food share	0.036	-0.038	0.063	0.047	0.038
	(0.042)	(0.065)	(0.062)	(0.055)	(0.057)

4.4 Tanzania

For Tanzania, results for height-for-age and weight-for-age are presented in Tables 7 and 8, respectively. Looking at the OLS coefficients, it appears that in the parsimonious model, HDDS exhibits

the strongest association with both measures of nutritional outcome, followed by food share and 1-SSEXR. The same broad pattern can be observed when we focus on the lower end of the distribution.

Table 7: Height-for-age Z-score (Tanzania)

VARIABLES	**Model 1 - Without Controls**				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	-0.004	0.015	-0.005	-0.006	0.041
	(0.053)	(0.090)	(0.058)	(0.060)	(0.072)
1-SSR	0.005	-0.023	-0.021	0.034	-0.011
	(0.047)	(0.073)	(0.052)	(0.056)	(0.065)
1-SSEXR	0.049	0.042	0.098*	0.125**	0.032
	(0.046)	(0.074)	(0.052)	(0.056)	(0.064)
HDDS	0.147***	0.172**	0.131**	0.136**	0.200***
	(0.045)	(0.078)	(0.053)	(0.058)	(0.066)
Per capita expenditure	-0.002	-0.066	-0.035	0.017	0.110
	(0.054)	(0.099)	(0.061)	(0.063)	(0.074)
Food share	-0.149***	-0.176***	-0.178***	-0.133**	-0.110
	(0.046)	(0.057)	(0.047)	(0.058)	(0.072)

VARIABLES	**Model 2 - With Controls**				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	0.001	0.057	0.014	-0.056	0.022
	(0.058)	(0.095)	(0.063)	(0.065)	(0.079)
1-SSR	-0.028	-0.045	-0.046	0.030	-0.040
	(0.048)	(0.079)	(0.054)	(0.058)	(0.067)
1-SSEXR	-0.001	0.045	0.082	0.097*	-0.042
	(0.048)	(0.080)	(0.055)	(0.057)	(0.065)
HDDS	0.067	0.164*	0.084	0.023	0.103
	(0.051)	(0.086)	(0.059)	(0.063)	(0.076)
Per capita expenditure	-0.027	-0.063	-0.053	-0.061	0.053
	(0.059)	(0.109)	(0.069)	(0.074)	(0.083)
Food share	-0.070	-0.137**	-0.143***	-0.083	-0.006
	(0.047)	(0.068)	(0.055)	(0.063)	(0.078)

Controlling for the confounding factors, none of the OLS estimates of food security measures are statistically significant for either height-for-age or weight-for-age. At the lower end of the distribution (at the 10^{th} quantile), HDDS and food share are significant for height-for-age, whereas only food share is significant for weight-for-age.

Table 8: Weight-for-age Z-score (Tanzania)

VARIABLES	Model 1 - Without Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	-0.017	0.000	-0.028	-0.013	-0.051
	(0.041)	(0.071)	(0.057)	(0.043)	(0.055)
1-SSR	0.049	0.086	0.051	-0.000	0.075
	(0.038)	(0.061)	(0.051)	(0.039)	(0.052)
1-SSEXR	0.089**	0.151**	0.125**	0.038	0.110**
	(0.037)	(0.064)	(0.051)	(0.039)	(0.051)
HDDS	0.142***	0.192***	0.171***	0.101**	0.205***
	(0.037)	(0.068)	(0.054)	(0.040)	(0.052)
Per capita expenditure	0.045	0.038	0.038	0.048	0.059
	(0.041)	(0.063)	(0.054)	(0.046)	(0.061)
Food share	-0.098***	-0.185***	-0.086*	-0.050	-0.092
	(0.038)	(0.050)	(0.050)	(0.041)	(0.058)

VARIABLES	Model 2 - With Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
Per capita kcal	-0.034	0.012	-0.028	-0.033	-0.093
	(0.044)	(0.077)	(0.062)	(0.046)	(0.059)
1-SSR	0.034	0.054	0.017	-0.010	0.056
	(0.039)	(0.060)	(0.053)	(0.040)	(0.054)
1-SSEXR	0.033	0.081	0.061	0.002	0.048
	(0.036)	(0.063)	(0.052)	(0.040)	(0.052)
HDDS	0.065	0.091	0.094	0.029	0.124**
	(0.041)	(0.068)	(0.058)	(0.044)	(0.058)
Per capita expenditure	0.016	0.049	0.029	0.011	0.000
	(0.047)	(0.075)	(0.063)	(0.050)	(0.066)
Food share	-0.031	-0.118**	-0.021	0.001	-0.012
	(0.037)	(0.048)	(0.055)	(0.044)	(0.065)

4.5 Uganda

Finally, we present the main results for height-for-age and weight-for-age for Uganda in Tables 9 and 10, respectively. In the parsimonious model, for height-for-age, only four out of five food security measures are statistically significant in the OLS specification, and only two out of the same five are statistically significant at the 10^{th} quantile. Similarly, in the weight-for-age regressions, three out of the five food security measures considered are statistically significant in the OLS estimate, while at the lower end of

the distribution (at 10th and 25th quantiles), four indicators come out statistically significant. Comparing the magnitude of the coefficients, the results from OLS and UQR from Model 1 suggest that food consumption score has the highest association with both of the nutritional outcomes followed by per capita expenditure.

Table 9: Height-for-age Z-score (Uganda)

VARIABLES	Model 1 - Without Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
1 – SSEXR	0.071*	0.064	0.126**	0.090**	0.104*
	(0.041)	(0.068)	(0.050)	(0.045)	(0.053)
FCS	0.197***	0.241***	0.229***	0.225***	0.239***
	(0.038)	(0.067)	(0.048)	(0.042)	(0.050)
HDDS	0.085**	0.094	0.115**	0.113**	0.082
	(0.041)	(0.074)	(0.050)	(0.045)	(0.052)
Per capita expenditure	0.139***	0.236***	0.150***	0.118***	0.115**
	(0.041)	(0.065)	(0.051)	(0.045)	(0.056)
Food share	0.029	0.075	0.030	0.019	0.043
	(0.038)	(0.065)	(0.045)	(0.041)	(0.048)

VARIABLES	Model 2 - With Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
1 - SSEXR	0.036	-0.069	0.085	0.066	0.097*
	(0.045)	(0.077)	(0.055)	(0.048)	(0.056)
FCS	0.150***	0.133*	0.179***	0.172***	0.200***
	(0.042)	(0.076)	(0.055)	(0.048)	(0.057)
HDDS	0.021	-0.048	0.055	0.053	0.007
	(0.049)	(0.089)	(0.058)	(0.051)	(0.060)
Per capita expenditure	0.121**	0.177**	0.154**	0.122**	0.094
	(0.050)	(0.083)	(0.063)	(0.053)	(0.062)
Food share	0.005	0.077	0.018	-0.028	0.009
	(0.041)	(0.070)	(0.048)	(0.043)	(0.050)

When we control for a broader set of characteristics that could also be correlated with nutritional status in Model 2, only two measures – namely food consumption score and per capita expenditure – remain statistically significant for both height-for-age and weight-for-age. This result remains qualitatively similar to the results from Model 1, with food consumption score having the highest association with both measures of nutritional outcomes followed by per capita expenditure.

Table 10: Weight-for-age Z-score (Uganda)

VARIABLES	Model 1 - Without Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
1 - SSEXR	0.073**	0.114*	0.084**	0.106***	0.060
	(0.031)	(0.065)	(0.041)	(0.035)	(0.037)
FCS	0.127***	0.227***	0.138***	0.130***	0.120***
	(0.028)	(0.058)	(0.039)	(0.034)	(0.035)
HDDS	0.036	0.105*	0.067*	0.056	0.005
	(0.031)	(0.063)	(0.040)	(0.035)	(0.036)
Per capita expenditure	0.104***	0.161***	0.118***	0.103***	0.066*
	(0.033)	(0.062)	(0.038)	(0.035)	(0.038)
Food share	-0.023	-0.036	-0.036	-0.026	0.014
	(0.029)	(0.058)	(0.037)	(0.033)	(0.033)

VARIABLES	Model 2 - With Controls				
	OLS	Unconditional quantile regression			
		10th	25th	50th	75th
1 – SSEXR	0.044	0.053	0.056	0.089**	0.052
	(0.034)	(0.070)	(0.044)	(0.038)	(0.040)
FCS	0.084***	0.157**	0.103**	0.100***	0.089**
	(0.031)	(0.062)	(0.044)	(0.039)	(0.040)
HDDS	-0.017	0.003	0.011	0.019	-0.029
	(0.036)	(0.071)	(0.046)	(0.041)	(0.043)
Per capita expenditure	0.075*	0.128	0.107**	0.084**	0.052
	(0.040)	(0.079)	(0.044)	(0.040)	(0.048)
Food share	-0.035	-0.057	-0.039	-0.033	0.008
	(0.030)	(0.059)	(0.039)	(0.034)	(0.036)

5 SYNTHESIS OF RESULTS

The data, the underlying surveys, and in fact the set of food security indicators we were able to analyze for each country were quite different. Yet there was enough overlap between these indicators for us to draw some general conclusions on the robustness of our main conclusion in various socio-economic, agro-climatic, and cultural settings. Overall, we find strong support for two broad conclusions.

The first is the resounding support for the idea that food and food security-related dimensions remain a critical piece in the malnutrition puzzle. In our results, the various measures of household food security do appear to carry significant signals about the nutritional status of children that reside within the household. This result holds even after we control for a wide array of other socio-economic characteristics of the households that are generally also thought to be associated with the quality of child nutrition.

Among the more important factors our results are conditioned on include household economic status (measured by the stock of wealth as well as flow of expenditures), mother's education level, region of residence, child care practices such as breastfeeding, and epidemiological factors, particularly as they related to quality of drinking water and sanitation facilities.

A notable exception to this general conclusion above is the case of Pakistan where food security – at least the dimensions that we are able to capture with our indicators – appears to have a substantially weaker association with nutritional status. This result in some ways resonates with the conventional wisdom in Pakistan that epidemiological factors have a greater sway in explaining the variations in child nutritional outcomes in comparison to food related factors. While existing studies have mainly looked at food availability dimensions (daily per capita calories) and self-perception of food insecurity, we confirm this for a broader set of food security indicators.[16]

This is a useful caveat for any generalizing statements we may make about the strength of links between food security and nutritional security based on our results. While food security is never sufficient to ensure nutrition security, in the case of Pakistan it appears that, at least statistically, other factors are perhaps of a higher order of importance. This could be because of particularly low attainment levels in these other areas.

But what does this imply for the expected efficacy of food security enhancing interventions in, say, the agriculture sector, to improve child nutrition? Should we have limited expectations? Not necessarily. Agriculture can affect nutrition through several channels. The quality and quantity of food intake is one of them and the one we have focused on exclusively in this report. But agriculture remains the primary economic activity of the majority of the world's poor and as such, it is intimately linked to incomes of the poor. A majority of the world's malnourished children also live in agricultural households. So any intervention that gives a meaningful boost to agricultural incomes will inevitably end up affecting nutritional status, if not through food intake, then by enhancing households' capabilities to access better health services. In addition, specifically targeted agricultural interventions may also lead to women's empowerment which is again known to affect child nutrition (World Bank, 2012).

The second conclusion we draw from this exercise is that simple indicators such as the food consumption score or the dietary diversity score perform at least as well, if not better than indicators of household food security derived out of richer, more expensive, and time-consuming surveys. The notion of performance here is based on nutritional relevance or the strength of underlying signals on nutritional status, which is important from the point of view of monitoring as well as targeting of interventions attempting to bolster nutrition security.

In Table 11 below we present a ranking of each of these indicators based on how well they correlate with height-for-age z-score under the two empirical regimes of a limited set of mostly

geographical controls and an expanded list of controls that includes a large number of other proximate correlates of child nutrition. In each case, we also present an aggregate rank which is a simple average of the rank of each food security indicator across the five different countries. This is admittedly a very crude procedure and is intended only to come up with an aggregate ranking for the food security indicators across the five countries.

Table 11: Ranking of Food Security Indicators (Height-for-age)

Model 1: Based on usefulness for nutritional targeting over and beyond the geographical

Food Security Measures	Rank within each country					**Overall rank**
	Bangladesh	Nepal	Pakistan	Tanzania	Uganda	
Per capita kcal		7	5	5		5.7
SSR		6	2	3		3.7
SSEXR		5	3	4	4	4.0
FCS	1	3			1	1.7
HDDS		4	1	1	3	2.3
MDDS	3					3.0
CDDS	4					4.0
HFIAS	2					2.0
Per capita expenditure		1	4	6	2	3.3
Food share		2	6	2	5	3.8

Model 2: Based on usefulness for nutritional monitoring

Food Security Measures	Rank within each country					**Overall rank**
	Bangladesh	Nepal	Pakistan	Tanzania	Uganda	
Per capita kcal		3	6	6		5.0
SSR		7	3	3		4.3
SSEXR		6	4	5	5	5.0
FCS	1	1			1	1.0
HDDS		2	1	1	3	1.8
MDDS	2					2.0
CDDS	3					3.0
HFIAS	4					4.0
Per capita expenditure		4	2	4	2	3.0
Food share		5	5	2	4	4.0

At the outset, it is important to point out that it is difficult to interpret the aggregate ranks of MDDS, CDDS, and HFIAS, because these indicators are available only for Bangladesh. However, given that these are indicators based on actual individual-level dietary intake and psychological perceptions

about food security, and that all of these indicators are highly significant statistically as well as economically in our regressions, they hold a lot of promise, and perhaps more work should be done on validating their nutritional relevance in other settings.

Focusing on the other indicators, however, there are several interesting patterns that emerge. From the point of view of nutritional targeting, it appears that the food consumption score performs the best, as it emerges with the highest rank. In fact, with the exception of Nepal, where poverty and household well-being related indicators (per capita expenditure and food share of total expenditure) appear to occupy the top two positions, the food consumption score occupies the top rank in all countries where the consumption module allowed the construction of this indicator. In both countries where this indicator could not be constructed (Pakistan and Tanzania), the household dietary diversity indicator comes out in the top position. The indicator of per capita caloric availability consistently performs the worst among all the indicators, and this suggests that, conditional on the geographic variables, this indicator may not provide a fine enough resolution to pick out nutritionally insecure households.

The results on nutritional monitoring, which are based on specifications that include an expanded set of controls, further confirm the dominance of food consumption score. For every country in which this indicator could be constructed, the food consumption score came up in the highest rank. This suggests that, net of all the other proximate correlates of nutritional status, including measures of household wealth, the food security measure that is best associated with nutritional status of children in the household is the food consumption score. The household dietary diversity score comes in a close second. We haven't presented the rankings based on the association of these measures with weight-for-age here, but as can be inferred from Tables 2, 4, 6, 8, and 10 above, the same broad conclusion on the importance of food consumption score and household dietary diversity score emerges.

This finding in some ways also confirms the importance of dietary quality for child nutrition. Resource-poor environments such as the ones we have analyzed in this report are often characterized by low-quality, calorie-dense diets for the majority of the population. Even during times of economic stress (such as droughts), households are to a large extent able to make necessary substitutions at the margins to protect their overall caloric intake. Often, however, the substitution to cheaper calories exacerbates the already low diversity of their diet and deprives particularly the children in the household of the micro- and macronutrients that are essential for healthy growth. The indicators of food security that are more closely related to quality aspects of the diet such as frequency, variety, and diversity therefore may be better able to pick out instances of these nutrient deficiencies or "hidden hunger," as this condition is known in common parlance. The household dietary diversity score in fact has been shown to be a very good proxy for micronutrient adequacy for children as well as women in a variety of settings (Ruel, 2010).

What does all of this imply for indicator selection, namely for monitoring nutritional outcomes or nutritional targeting? Clearly, from the nutritional relevance point of view we established that dietary quality may be the most effective lever, and food consumption score and dietary diversity score the most discriminating indicators, but what about the considerations of time and cost effectiveness? A careful comparison of those two dimensions for this exact set of food security indicators is perhaps something that has not been done. But if the length of the questionnaire that one needs to field to obtain the necessary information to come up with each of these indicators is a guide, one can again crudely rank these indicators also in terms of their time and cost effectiveness. See Table 12.

Table 12: Comprehensive Ranking of Food Security Indicators

Indicator	Nutritional relevance rank	Time and cost effectiveness rank
Per capita calories	8	5
Starchy staple ratio (SSR)	6	4
Starchy staple expenditure ratio (SSEXR)	7	4
Food consumption score (FCS)	1	2
Household dietary diversity score (HDDS)	2	1
Mother's dietary diversity score (MDDS)	2	1
Child's dietary diversity score (CDDS)	2	1
Household Food Insecurity Access Scale (HFIAS)	3	3
Per capita expenditure	4	4
Share of food in total expenditure	5	4

The household dietary diversity score can be constructed simply on the basis of a series of 9-12 yes/no questions and is perhaps the simplest, cheapest, and quickest indicator. The food consumption score similarly requires only a limited number of questions of the interviewee, but the responses need to be weighted a certain way to come up with the aggregate score. The HFIAS, based on a series of nested yes/no questions, is computationally still simple but captures multiple notions and dimensions of food security. The other food security indicators on the list are computationally more demanding and require a significantly richer set of information that generally comes from elaborate household surveys. The calculation of caloric intake is the most "costly" indicator in this manner of classification because in addition to detailed information on the quantity of various kinds of food items consumed, it also requires accurate food conversion tables.

One of the main conclusions of this report is that the shorter, easier to collect, cheaper indicators such as the food consumption score and the dietary diversity score are also the best performers in terms of nutritional relevance. Food consumption score, in particular, has an additional desirable feature: its

weights can be adjusted, making it amenable to application in cultural settings with diverse dietary preferences.

6 SUMMARY AND CONCLUSION

Food security is important both to ensure human rights and to support economic development. While policy makers, economists, and health professionals agree on its importance, they do not agree on the most relevant and effective ways to measure food security. There currently exist a wide variety of indicators that provide useful information about different dimensions of food security. Analysts often choose which food security indicators to use based on the appropriateness of the indicator to the context and how cost-effective the data are to collect and analyze.

In this report, we take the view that food security is often not an end in itself. It is a pathway toward securing good nutritional outcomes, including adequate physical growth and cognitive development in children. When selecting an indicator, therefore, analysts may want to consider the extent to which the chosen indicator carries useful signals about the nutritional status of the underlying population. In other words, how relevant are the given indicators from the perspective of child nutritional status? The central question we attempted to answer in this work is following: How well are the existing measures of household food security correlated with underlying nutritional status of the children? If they are correlated, is it possible to rank these measures in terms of this degree of correlation?

All of the measures analyzed here map to at least one dimension of food security, be it availability, access, or utilization. If using these food security indicators as proxy measures for the underlying nutritional status of children is of some interest, then our results show that simple, cost-effective, and easy-to-collect measures such as the food consumption score or the dietary diversity score may carry at least as much information as measures such as per capita expenditure or starchy staple ratio, which require longer, more time-consuming, and costlier surveys with detailed food consumption modules.

Across five different countries in South Asia and Africa, our results suggest that the food consumption score, in particular, performs extremely well in comparison to a number of other measures from the perspective of nutritional targeting as well as monitoring of nutritional outcomes. There should be further validation of this in other settings as well but these results have important implications for the way in which data is collected in surveys as well as in monitoring and evaluation exercises for agricultural projects that attempt to address malnutrition by improving food access and utilization. There are implications also for nutritional targeting exercises. In many countries, the most granular level at which nutritional targeting is often done is at the geographic level. Our results show that short of doing

detailed poverty based targeting over and beyond any geographic targeting that may already be in place, there could be some added value to using indicators like the food consumption score to identify the nutritional insecure households.

7 NOTES

[1] See Alderman et al (2006), Glewwe et al (2001) and Maluccio et al (2009).
[2] In addition to dietary intake and health, child malnutrition is influenced also by child care practices and other environmental factors such as access to clean drinking water, improved sanitation (UNICEF, 1990).
[3] According to the definition adopted by the World Food summit organized by the FAO in 1996 food security is defined as "a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe, nutritious food that meets their dietary needs and food preferences for an active and healthy life." This definition is a significant departure from previous conceptualizations of food security which focused inordinately on the availability of food at the national or local level. But, in being broad and all encompassing, this definition is also a difficult one to operationalize, as it emphasizes the importance of access and utilization of food just as much as availability.
[4] In statistics, standardized coefficients or beta coefficients are the estimates resulting from an analysis performed on variables that have been standardized so that their variances are 1. This is done to answer the question of which of the independent variables has a greater effect on the dependent variable in multiple regression setting.
[5] One would like to identify the poor, vulnerable and those needing assistance but given the practical difficulties of doing so accurately in developing countries, proxy means testing is an exercise in identifying characteristics of households that are likely to be most well correlated with poverty and using these characteristics (or some combined configuration of them) to identify the poor and target assistance appropriately.
[6] Ruel (2002), Weismann et al(2009) and Hoddinott and Yohannes (2002)
[7] It is based on the idea that at levels below subsistence, individuals have high marginal utilities for calories and are likely to choose cheap sources of calories such as rice, wheat, cassava etc. As they pass subsistence, their marginal utility of calories begins to decline and they begin to value other non-nutritional attributes of food such as taste and start diversifying their diet. While the actual subsistence threshold is unobserved, their "dietary transition" is and this can be used to identify whether or not they have crossed the food security threshold. By relying directly on consumption behavior to elicit information on hunger and food security, this method obviates the need to impose caloric norms and thresholds.
[8] Anthro program files can be downloaded from http://www.who.int/childgrowth/software/en/
[9] Exclusion ranges suggested by WHO are: + 6 > HAZ < - 6 and + 5> WAZ < - 6.
[10] Out of 64 districts rounds 1, 2, and 3 cover 48, 49 and 43 districts, respectively.
[11] Individual level consumption of different food groups is based on a 24-hour recall, whereas household level consumption of different food groups is based on a 7-day recall period.
[12] Nepal is divided into 75 districts. The survey excludes Dolpa, Mustang, Humla, and Manang districts.
[13] We exclude 331 children under 5 for whom we have no information on anthropometric measurements. Lack of anthropometric measurements is either because the child was too sick or the interviewer was unable to meet the child in person after multiple site visits.
[14] The conversion from food to calories was done using food tables provided by the Planning Commission. The consumed calories include food received as gifts and in-kind payment as well as readymade meal purchased outside the home.
[15] Due to the fact that reliable food conversion tables were not available for Uganda, we could not construct calorie based measures such as per capita daily calories as well as the starchy staple ratio.
[16] Alderman and Garcia (1994) conclude that the availability dimension of food security does not have a significant association with child nutritional status in Pakistan. Arif (2012) draws the same conclusion by analyzing self-perceived household food security measure.

8 REFERENCES

Alderman, H., Hoddinott, J., and B. Kinsey (2006). "Long term Consequences of Early Childhood Malnutrtion", *Oxford Economic Papers*, 58(3): 450-474.

Alderman, H., M.Garcia (1994). "Food Security and Health Security: Explaining the Levels of Nutritional Status in Pakistan," *Economic Development and Cultural Change*, 42(3): 485-507.

Arimond, M., MT. Ruel (2004). "Dietary Diversity is Associated with Child Nutritional Status: Evidence from 11 Demographic and Health Surveys," *Journal of Nutrition*, 34(10):2579-85.

Arimond, M, D. Wiesmann, E. Ecquey, A.Carriquiry, M. Daniels, M. Deitchler, N. Fanou, E. Ferguson, M. Joseph, G. Kennedy, Y. Martin-Prevel (2011). "Dietary Diversity as a Measure of the Micronutrient Adequacy of Women's Diets in Resource-Poor Areas : Summary of Results from Five Sites,'' FANTA Technical Report

Barrett, C. B. (2010). "Measuring Food Insecurity", *Science*, 327 (5967): 825-828

CFS (2012). *Coming to Terms with Food Security, Nutrition Security, Food Security and Nutrition, Food and Nutrition Security*, available at: http://www.fao.org/docrep/meeting/026/MD776E.pdf Accessed 19 July 2013

Coates, J., A. Swindale, and P. Bilinsky (2007). "Household Food Insecurity Access Scale (HFIAS) for Measurement of Household Food Access: Indicator Guide (v.3)." Washington, D.C.: Food and Nutrition Technical Assistance Project, Academy for Educational Development.

Firpo, S., N.M. Fortin, T. Lemieux (2009). "Unconditional Quantile Regressions," *Econometrica*, 77(3): 953-973.

Glewwe, P., Jacoby, H., and E. King (2001). "Early Childhood Nutrition and Academic Achievement: A longitudinal Analysis", *Journal of Public Economics*, 81(3):345-368.

Headey, D. and O. Ecker. (2012). "Improving the Measurement of Food Security*", IFPRI Discussion Paper01225*

Hoddinott, J. and Y. Yohannes (2002). "Dietary Diversity as a Household Food Security Indicator," Food and Nutrition Technical Assistance Project, Academy for Educational Development, Washington, D.C.Ivanic, M., and Martin, W. (2008). "Implications of higher global food prices for poverty in low-income countries," *Agricultural Economics*, 39 405-16.

Ivanic, M., Martin, W. and H. Zaman (2011). "Estimating the Short Run Poverty Impacts of the 2010-2011 Surge in Food Prices", World Bank Policy Research Working Paper

Jensen, R.T. and N.H. Miller (2010). "A Revealed Preference Approach to Measuring Hunger and Undernutrition," NBER Working Paper 16555.

Maluccio, J.A., J. Hoddinott, J.R. Behrman, R. Martorell, A.R. Quisumbing, and A.D. Stein (2009). "The Impact of Improving Nutrition During Early Childhood on Education Among Guatemalan Adults," *Economic Journal*, 119(537): 734-763.

Newman, J. (2013). “How Stunting is Related to Having Adequate Food, Environmental Health and Care: Evidence from India, Bangladesh and Peru”, World Bank *mimeo*

Ruel, M. (2002). “Is Dietary Diversity an Indicator of Food Security or Diet Quality? A Review of Measurement Issues and Research Needs,” FCND Discussion Paper No. 140, IFPRI, Washington, D.C.

Schnepf, Randall D. (1992). “Nutritional Status of Households: Survey Evidence on the Role of Household Consumption Behavior,”*Working Paper no. 23*. Cornell Food and Nutrition Policy Program.

Swindindale, A. and P. Bilinsky (2006). “Household Dietary Diversity Score (HDDS) for Measurement of Household Food Access: Indicator Guide (v2),” Washington, D.C.: Food and Nutrition Technical Assistance Project, Academy for Educational Development.

World Food Programme (WFP). (2008). “Food Consumption Analysis: Calculation and Use of the Food Consumption Score in food Security Analysis,” Technical Guidance Sheet. Rome.

Wiesmann, D., J. Hoddinott, N. Aberman, and M. Ruel. (2006). “Review and Validation of Dietary Diversity, Food Frequency, and Other Proxy Indicators of Household Food Insecurity,”

Wiesmann, D., L.Bassett, T.Benson, and J. Hoddinott. (2009). “Validation of the World Food Programme’s Food Consumption Score and Alternative Indicators of household Food Security,” IFPRI Discussion Paper 00870

Tiwari, S. and H. Zaman (2010), “The Impact of Economic Shocks on Global Undernourishment,” World Bank Policy Research Working Paper #5215

UNICEF. (1990). “Strategy for Improved Nutrition of Children and Women in Developing Countries,” New York: UNICEF

SUPPLEMENTAL WEB APPENDICES

APPENDIX A: UNCONDITIONAL QUANTILE REGRESSION

The unconditional quantile regression (UQR) is a new regression method, proposed by Firpo, Fortin, and Lemieux (2009), to estimate the impact of explanatory variables on the unconditional quantiles of the outcome variable. The core of the UQR method is a recentered influence function (RIF) which builds upon the concept of the influence function (IF), a widely used tool in robust estimation techniques.

Consider the Influence function, IF(Y:v,F_Y). The influence function, IF(Y:v,F_Y), represents the influence of an individual observation on the distributional statistic, $v(F_Y)$, where $v(F_Y)$ can be the mean, median, or any quantile. The authors add the statistics $v(F_Y)$ to the influence function generating a new function called a recentered influence function (RIF),

$$E(RIF(Y:v,F_Y)|X)=m_v(X)$$

Since, influence function can be computed for most distributional statistics, the RIF for a quantile q_τ is given by

$$E(RIF(Y:q_\tau,F_Y)|X)= q_\tau +(\tau\text{-}I\{Y\leq q_\tau\}/f_Y(q_\tau)).^{17}$$

where q_τ is the τ^{th} quantile and f_Y is the marginal density function of Y, and I(.) an indicator function. Assuming a linear relationship between RIF(Y:q_τ,F_Y) and X, the model can be estimated by ordinary least squares (RIF-OLS).[18]

[17] The RIF(Y:q_τ,F_Y) satisfies the following properties: E(RIF(Y:q_τ,F_Y)= q_τ; E(E(RIF(Y:q_τ,F_Y)|X))= q_τ.
[18] Firpo et al (2009) also provide two other alternative estimation methods: RIF-logit and nonparametric-RIF.

APPENDIX B: HDDS AND IDDS FOOD GROUP CLASSIFICATIONS

Table B: Food group classification for Household Dietary Diversity Score (HDDS) and Individual Dietary Diversity Score (IDDS)

	HDDS	**Individual Dietary Diversity Score (IDDS)**			
	Food Groups (Score: 0-12)	**Child DDS Food Groups (Score: 0 -8)**		**Mother's DDS Food Groups (Score: 0 -9)**	
1	Cereals	1	Grains, roots or tubers	1	Grain, roots or tubers
2	Roots and tubers	2	Vitamin A – rich plant foods	2	Dark green leafy vegetables
3	Vegetables	3	Other fruits or vegetables	3	Vitamin A rich fruits and vegetables
4	Fruits	4	Meat, poultry, fish seafood	4	Other fruits and vegetables
5	Meat, poultry	5	Eggs	5	Meat and fish
6	Eggs	6	Pulses/legumes/nuts	6	Organ meat
7	Fish and Seafood	7	Milk and milk products	7	Eggs
8	Pulses/legume/nuts	8	Foods cooked in oil/fat	8	Milk and milk products
9	Milk and milk products			9	Foods cooked in oil/fat
10	Oils/fats				
11	Sugar/honey				
12	Misc.				

Source: Swindale and Blinsky (2006)/FAO

APPENDIX C: FCS FOOD GROUPS AND WEIGHTS

Table C: Food groups and their corresponding weights for Food Consumption Score (FCS)

	FOOD ITEMS (examples)	Food groups	Weight	Justification for weight
1	Maize, rice, millet, wheat, bread, sorghum, other cereals, cassava, potatoes, sweet potatoes, and other tubers	Main staples	2	Energy dense, protein content lower and poorer quality than legumes, micronutrients (bound by phytates)
2	Legumes, beans, peas, peanuts, nuts	Pulses	3	Energy dense, high amounts of protein but of lower quality than meats, micronutrients (inhibited by phytates), low fat
3	Vegetables, leaves	Vegetables	1	Low energy, low protein, no fat, micronutrients
4	Fruits	Fruit	1	Low energy, low protein, no fat, micronutrients
5	Beef, goat, poultry, pork, eggs, fish, insects	Meat and fish	4	Highest quality protein, easily absorbable micronutrients (no phytates), energy dense, fat. Even when consumed in small quantities, improvements to the quality of diet are large
6	Milk, yogurt, and other dairy	Milk	4	Highest quality protein, micronutrients, vitamin A, energy. However, milk could be consumed only in very small amounts and should then be treated as condiment, and therefore reclassification in such cases is needed.
7	Sugar and sugar products, honey	Sugar	0.5	Empty calories. Usually consumed in small quantities.
8	Vegetable oil, fats and butter	Oil	0.5	Energy dense but usually no other micronutrients. Usually consumed in small quantities.
9	Spices, tea, coffee, salt, fish powder, small amounts of milk for tea	Condiments	0	These foods are by definition eaten in very small quantities and not considered to have an important impact on overall diet.

Source: World Food Programme (2008)

APPENDIX D: HFIAS QUESTIONNAIRE MODULE

Table D: Household Food Insecurity Access Scale (HFIAS) Questionnaire Module

No	Questions	Response	Code
1.	In the past [4 weeks/30 days] did you worry that your household would not have enough food?	0=NO (Skip to Q2) 1=Yes	|___|
1.a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1-2 times) 2 = Sometimes (3-10 times) 3 = Often (more than 10 times)	|___|
2	In the past [4 weeks/30 days] were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	0=NO (Skip to Q3) 1=Yes	|___|
2.a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1-2 times) 2 = Sometimes (3-10 times) 3 = Often (more than 10 times)	|___|
3	In the past [4 weeks/30 days] did you or any household member have to eat a limited variety of foods due to a lack of resources?	0=NO (Skip to Q4) 1=Yes	|___|
3.a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1-2 times) 2 = Sometimes (3-10 times) 3 = Often (more than 10 times)	|___|
4	In the past [4 weeks/30 days] did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0=NO (Skip to Q5) 1=Yes	|___|
4.a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1-2 times) 2 = Sometimes (3-10 times) 3 = Often (more than 10 times)	|___|
5	In the past [4 weeks/30 days] did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0=NO (Skip to Q6) 1=Yes	|___|

No	Questions	Response	Code
5.a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1-2 times) 2 = Sometimes (3-10 times) 3 = Often (more than 10 times)	|___|
6	In the past [4 weeks/30 days] did you or any other household member have to eat fewer meals in a day because there was not enough food?	0=NO (Skip to Q7) 1=Yes	|___|
6.a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1-2 times) 2 = Sometimes (3-10 times) 3 = Often (more than 10 times)	|___|
7	In the past [4 weeks/30 days] was there ever no food to eat of any kind in your household because of lack of resources to get food?	0=NO (Skip to Q8) 1=Yes	|___|
7.a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1-2 times) 2 = Sometimes (3-10 times) 3 = Often (more than 10 times)	|___|
8	In the past [4 weeks/ 30 days] did you or any household member go to sleep at night hungry because there was not enough food?	0=NO (Skip to Q9) 1=Yes	|___|
8.a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1-2 times) 2 = Sometimes (3-10 times) 3 = Often (more than 10 times)	|___|
9	In the past [4 weeks/30days] did you or any household member go a whole day and night without eating anything because there was not enough food?	0=NO (questionnaire is finished) 1=Yes	|___|
9.a	How often did this happen in the past [4 weeks/30 days]?	1 = Rarely (1-2 times) 2 = Sometimes (3-10 times) 3 = Often (more than 10 times)	|___|

Source: Coates et. al. (2007)

APPENDIX E: BANGLADESH

Table E1: Nutritional Indicators, by region

	Mean HAZ	Stunting incidence	Mean WAZ	Underweight incidence
All	-1.50	0.31	-1.68	0.40
Urban	-1.14	0.19	-1.29	0.27
Rural	-1.53	0.32	-1.72	0.41
by Division				
Rajshahi	-1.49	0.31	-1.73	0.43
Khulna	-1.27	0.22	-1.57	0.36
Barisal	-1.60	0.35	-1.73	0.43
Dhaka	-1.44	0.30	-1.59	0.37
Sylhet	-1.73	0.39	-1.88	0.48
Chittagong	-1.47	0.30	-1.61	0.38
Rangpur	-1.57	0.32	-1.79	0.43

Table E2: Nutritional Indicators, by gender and age group

Age in months	Boys		Girls	
	Mean HAZ	Stunting incidence	Mean HAZ	Stunting incidence
0-5	-0.90	0.13	-0.83	0.10
6-11	-1.24	0.21	-1.16	0.20
12-23	-1.71	0.38	-1.76	0.40
24-35	-1.41	0.28	-1.51	0.32
36-47	-1.64	0.34	-1.69	0.39
48-60	-1.65	0.35	-1.64	0.35

Table E3: Descriptive Statistics of Key Variables (Bangladesh)

Variable	Mean	Std. Dev.	Min	Max
Z-scores				
HAZ	-1.5	1.1	-6	5.73
WAZ	-1.68	1.03	-5.44	3.75
Food Security measures				
HFIAS Score	7.45	6.39	0	26
Child DDS	3.8	1.98	0	8
FCS	64.59	226.61	0	112
MDDS	4.02	1.28	1	9
Age in months	28.4	16.76	0	59.9
Age squared	1087.39	1010.76	0	3588.01
Child is female	0.48	0.5	0	1
HH size	5.38	2.16	2	27
Share of kids under 5	0.26	0.11	0.06	0.67
HH Head Characteristics				
Female-headed HH	0.11	0.31	0	1
HH Head's Education				
No education	0.44	0.5	0	1
Literate, or < 5 yrs of schooling	0.14	0.35	0	1
Completed [5-7] yrs of schooling	0.19	0.39	0	1
Completed [8-10] yrs of schooling	0.17	0.37	0	1
Completed 11 + yrs of schooling	0.05	0.23	0	1
Mother's Education				
No education	0.27	0.44	0	1
Literate, or < 5 yrs of schooling	0.16	0.37	0	1
Completed [5-7] yrs of schooling	0.28	0.45	0	1
Completed [8-10] yrs of schooling	0.25	0.43	0	1
Completed 11 + yrs of schooling	0.03	0.18	0	1
Water & Sanitation				
Improved water	0.94	0.24	0	1
Improved sanitation	0.38	0.49	0	1
Asset index 1 (poorest)	0.23	0.42	0	1
Asset index 2	0.19	0.39	0	1
Asset index 3	0.2	0.4	0	1
Asset index 4	0.19	0.39	0	1
Asset index 5	0.18	0.39	0	1
Region				

Variable	Mean	Std. Dev.	Min	Max
Rural	0.92	0.27	0	1
Rajshahi	0.14	0.35	0	1
Khulna	0.07	0.26	0	1
Barisal	0.07	0.25	0	1
Dhaka	0.26	0.44	0	1
Sylhet	0.11	0.32	0	1
Chittagong	0.21	0.41	0	1
Rangpur	0.14	0.34	0	1

Source: Authors' calculations

Table E4: Relationship between food security measures and height-for-age z-scores (Bangladesh): Limited Controls Version

VARIABLES	(1)	(2)	(3)	(4)
	Height-for-age z-scores			
HFIAS Score	-0.179***			
	(0.010)			
Child DDS		-0.088***		
		(0.010)		
FCS			0.192***	
			(0.011)	
MDDS				0.128***
				(0.011)
Rural	-0.292***	-0.412***	-0.236***	-0.307***
	(0.038)	(0.039)	(0.038)	(0.041)
Rajshahi	0.045	0.086**	0.055	0.060
	(0.037)	(0.037)	(0.037)	(0.039)
Khulna	0.288***	0.318***	0.242***	0.275***
	(0.043)	(0.043)	(0.043)	(0.046)
Barisal	-0.017	-0.024	-0.067	-0.063
	(0.046)	(0.046)	(0.046)	(0.049)
Dhaka	0.057*	0.112***	-0.004	0.061*
	(0.032)	(0.033)	(0.033)	(0.034)
Sylhet	-0.170***	-0.181***	-0.197***	-0.171***
	(0.040)	(0.040)	(0.040)	(0.043)
Chittagong	0.024	0.033	0.022	0.000
	(0.035)	(0.035)	(0.035)	(0.037)
Season 2	0.056**	0.071***	0.015	0.024
	(0.024)	(0.025)	(0.024)	(0.026)
Season 3	-0.009	-0.007	0.002	0.012
	(0.025)	(0.025)	(0.025)	(0.027)
Constant	-1.275***	-1.193***	-1.291***	-1.261***
	(0.047)	(0.048)	(0.047)	(0.050)
Observations	11,556	11,556	11,556	10,144
R-squared	0.045	0.026	0.047	0.031

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

HFIAS Score is household food insecurity access scale, child DDC is the dietary diversity score constructed for each child, FCS is the food consumption score and MDDS is the mother's dietary diversity score.

Table E5: Relationship between food security measures and weight-for-age z-scores (Bangladesh): Limited Controls Version

VARIABLES	(1)	(2)	(3)	(4)
	Weight-for-age z-scores			
HFIAS Score	-0.162***			
	(0.009)			
Child DDS		-0.244***		
		(0.010)		
FCS			0.166***	
			(0.010)	
MDDS				0.098***
				(0.011)
Rural	-0.298***	-0.452***	-0.254***	-0.296***
	(0.039)	(0.039)	(0.040)	(0.042)
Rajshahi	0.034	0.078**	0.044	0.043
	(0.034)	(0.034)	(0.034)	(0.036)
Khulna	0.217***	0.273***	0.179***	0.221***
	(0.042)	(0.041)	(0.042)	(0.045)
Barisal	0.065	0.061	0.021	0.031
	(0.042)	(0.042)	(0.042)	(0.046)
Dhaka	0.130***	0.190***	0.079***	0.143***
	(0.030)	(0.030)	(0.031)	(0.033)
Sylhet	-0.088**	-0.134***	-0.110***	-0.103***
	(0.037)	(0.036)	(0.037)	(0.040)
Chittagong	0.110***	0.099***	0.110***	0.103***
	(0.033)	(0.032)	(0.033)	(0.035)
Season 2	-0.070***	-0.034	-0.105***	-0.085***
	(0.023)	(0.023)	(0.023)	(0.025)
Season 3	-0.019	-0.024	-0.009	0.006
	(0.023)	(0.023)	(0.023)	(0.025)
Constant	-1.451***	-1.338***	-1.463***	-1.462***
	(0.047)	(0.047)	(0.047)	(0.050)
Observations	11,556	11,556	11,556	10,144
R-squared	0.044	0.075	0.043	0.027

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

HFIAS Score is household food insecurity access scale, child DDC is the dietary diversity score constructed for each child, FCS is the food consumption score and MDDS is the mother's dietary diversity score.

Table E6: Relationship between food security measures and height-for-age z-scores (Bangladesh): Expanded Controls Version

VARIABLES	(1)	(2)	(3)	(4)
	Height-for-age z-score			
HFIAS Score	-0.032**			
	(0.012)			
Child DDS		0.036**		
		(0.015)		
FCS			0.043***	
			(0.013)	
MDDS				0.038***
				(0.011)
Age (in month)	-0.041***	-0.046***	-0.041***	-0.042***
	(0.002)	(0.003)	(0.002)	(0.002)
Age squared	0.000***	0.001***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.046**	-0.046**	-0.046**	-0.046**
	(0.020)	(0.020)	(0.020)	(0.020)
Household size	-0.018***	-0.019***	-0.020***	-0.019***
	(0.006)	(0.006)	(0.006)	(0.006)
Share of kids under 5	-0.364***	-0.359***	-0.347***	-0.357***
	(0.117)	(0.117)	(0.117)	(0.117)
Household head education				
Functional education and/or < 5 yrs of education	0.066**	0.066**	0.068**	0.067**
	(0.031)	(0.031)	(0.032)	(0.031)
[5-7 years of education]	0.059**	0.062**	0.061**	0.062**
	(0.029)	(0.029)	(0.029)	(0.029)
[8-10 years of education]	0.141***	0.143***	0.141***	0.143***
	(0.033)	(0.033)	(0.033)	(0.033)
11+ years of education	0.323***	0.327***	0.323***	0.325***
	(0.055)	(0.055)	(0.055)	(0.055)
Female-headed HH	0.049	0.046	0.045	0.046
	(0.034)	(0.034)	(0.034)	(0.034)
Mother's Education				
functional education and/or < 5 yrs of education	0.030	0.030	0.028	0.027
	(0.034)	(0.034)	(0.034)	(0.034)
[5-7 years of education]	0.033	0.037	0.033	0.035
	(0.030)	(0.030)	(0.030)	(0.030)
[8-10 years of education]	0.153***	0.158***	0.150***	0.155***
	(0.035)	(0.035)	(0.035)	(0.035)
11+ years of education	0.305***	0.307***	0.294***	0.303***

VARIABLES	(1)	(2)	(3)	(4)
	Height-for-age z-score			
	(0.073)	(0.073)	(0.073)	(0.073)
Improved water	-0.021	-0.030	-0.035	-0.026
	(0.048)	(0.048)	(0.048)	(0.048)
Improved sanitation	0.083***	0.085***	0.080***	0.083***
	(0.023)	(0.023)	(0.023)	(0.023)
Currently breastfeeding	-0.165***	-0.167***	-0.163***	-0.166***
	(0.030)	(0.030)	(0.030)	(0.030)
Wealth index 2	0.111***	0.118***	0.112***	0.116***
	(0.033)	(0.032)	(0.033)	(0.032)
Wealth index 3	0.135***	0.149***	0.138***	0.143***
	(0.034)	(0.033)	(0.033)	(0.033)
Wealth index 4	0.241***	0.261***	0.239***	0.250***
	(0.037)	(0.036)	(0.036)	(0.036)
Wealth index 5 (Wealthiest)	0.449***	0.476***	0.444***	0.458***
	(0.045)	(0.042)	(0.044)	(0.043)
Rural	-0.029	-0.024	-0.019	-0.022
	(0.040)	(0.040)	(0.040)	(0.040)
Rajshahi	0.046	0.049	0.046	0.051
	(0.038)	(0.038)	(0.038)	(0.038)
Khulna	0.211***	0.204***	0.200***	0.207***
	(0.045)	(0.045)	(0.045)	(0.045)
Barisal	-0.075	-0.077	-0.085*	-0.081*
	(0.047)	(0.047)	(0.047)	(0.047)
Dhaka	0.036	0.040	0.022	0.034
	(0.034)	(0.034)	(0.034)	(0.034)
Sylhet	-0.157***	-0.151***	-0.161***	-0.156***
	(0.042)	(0.042)	(0.043)	(0.042)
Chittagong	0.018	0.023	0.015	0.012
	(0.037)	(0.037)	(0.037)	(0.037)
Season 2	0.048**	0.043*	0.039	0.036
	(0.024)	(0.025)	(0.025)	(0.025)
Season 3	-0.020	-0.018	-0.019	-0.017
	(0.026)	(0.026)	(0.026)	(0.026)
Constant	-0.827***	-0.768***	-0.802***	-0.817***
	(0.108)	(0.113)	(0.109)	(0.108)
Observations	10,144	10,144	10,144	10,144
R-squared	0.134	0.134	0.134	0.134

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

HFIAS Score is household food insecurity access scale, child DDC is the dietary diversity score constructed for each child, FCS is the food consumption score and MDDS is the mother's dietary diversity score.

Table E7: Relationship between food security measures and weight-for-age z-scores (Bangladesh): Expanded Controls Version

VARIABLES	(1)	(2)	(3)	(4)
	Weight-for-age z-score			
HFIAS Score	-0.034***			
	(0.011)			
Child DDS		-0.036***		
		(0.014)		
FCS			0.034***	
			(0.011)	
MDDS				0.034***
				(0.010)
Age (in month)	-0.085***	-0.081***	-0.085***	-0.086***
	(0.002)	(0.003)	(0.002)	(0.002)
Age squared	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Female	-0.077***	-0.079***	-0.077***	-0.077***
	(0.018)	(0.018)	(0.018)	(0.018)
Household size	-0.011*	-0.012**	-0.013**	-0.013**
	(0.006)	(0.006)	(0.006)	(0.006)
Share of kids under 5	-0.352***	-0.348***	-0.338***	-0.346***
	(0.106)	(0.106)	(0.106)	(0.106)
Household head education				
Functional education and/or < 5 yrs of education	0.036	0.040	0.038	0.037
	(0.027)	(0.027)	(0.027)	(0.027)
[5-7 years of education]	0.055**	0.060**	0.057**	0.058**
	(0.026)	(0.026)	(0.026)	(0.026)
[8-10 years of education]	0.111***	0.119***	0.113***	0.114***
	(0.030)	(0.030)	(0.030)	(0.030)
11+ years of education	0.235***	0.248***	0.237***	0.239***
	(0.054)	(0.055)	(0.054)	(0.054)
Female-headed HH	0.022	0.018	0.018	0.019
	(0.030)	(0.030)	(0.030)	(0.030)
Mother's Education				
functional education and/or < 5 yrs of education	0.005	0.010	0.004	0.003
	(0.028)	(0.028)	(0.028)	(0.028)
[5-7 years of education]	0.005	0.017	0.007	0.008
	(0.026)	(0.026)	(0.026)	(0.026)
[8-10 years of education]	0.127***	0.149***	0.129***	0.131***
	(0.031)	(0.031)	(0.031)	(0.031)
11+ years of education	0.310***	0.341***	0.305***	0.310***

VARIABLES	(1)	(2)	(3)	(4)
	Weight-for-age z-score			
	(0.073)	(0.073)	(0.073)	(0.073)
Improved water	-0.103**	-0.105**	-0.116***	-0.109**
	(0.042)	(0.042)	(0.043)	(0.042)
Improved sanitation	0.046**	0.049**	0.044**	0.046**
	(0.021)	(0.021)	(0.021)	(0.021)
Currently breastfeeding	-0.221***	-0.220***	-0.220***	-0.222***
	(0.025)	(0.025)	(0.025)	(0.025)
Wealth index 2	0.071**	0.085***	0.074***	0.076***
	(0.028)	(0.027)	(0.028)	(0.027)
Wealth index 3	0.117***	0.141***	0.124***	0.127***
	(0.029)	(0.028)	(0.029)	(0.028)
Wealth index 4	0.172***	0.208***	0.178***	0.185***
	(0.032)	(0.031)	(0.032)	(0.031)
Wealth index 5 (Wealthiest)	0.365***	0.417***	0.371***	0.379***
	(0.041)	(0.039)	(0.040)	(0.039)
Rural	-0.054	-0.056	-0.046	-0.047
	(0.039)	(0.039)	(0.039)	(0.039)
Rajshahi	0.019	0.026	0.021	0.025
	(0.033)	(0.033)	(0.033)	(0.033)
Khulna	0.161***	0.159***	0.151***	0.157***
	(0.041)	(0.041)	(0.041)	(0.041)
Barisal	0.008	0.005	-0.000	0.002
	(0.042)	(0.042)	(0.041)	(0.041)
Dhaka	0.100***	0.110***	0.091***	0.099***
	(0.030)	(0.030)	(0.030)	(0.030)
Sylhet	-0.137***	-0.135***	-0.139***	-0.135***
	(0.037)	(0.037)	(0.037)	(0.037)
Chittagong	0.057*	0.063*	0.056*	0.053
	(0.033)	(0.033)	(0.033)	(0.033)
Season 2	-0.079***	-0.075***	-0.087***	-0.090***
	(0.022)	(0.022)	(0.022)	(0.022)
Season 3	-0.027	-0.029	-0.026	-0.024
	(0.023)	(0.023)	(0.023)	(0.023)
Constant	-0.242**	-0.346***	-0.228**	-0.237**
	(0.099)	(0.103)	(0.099)	(0.099)
Observations	10,144	10,144	10,144	10,144
R-squared	0.233	0.233	0.233	0.233

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

HFIAS Score is household food insecurity access scale, child DDC is the dietary diversity score constructed for each child, FCS is the food consumption score and MDDS is the mother's dietary diversity score.

Figure E1: Unconditional quantile regression of height-for-age z-scores on food security measures, limited controls (Bangladesh)

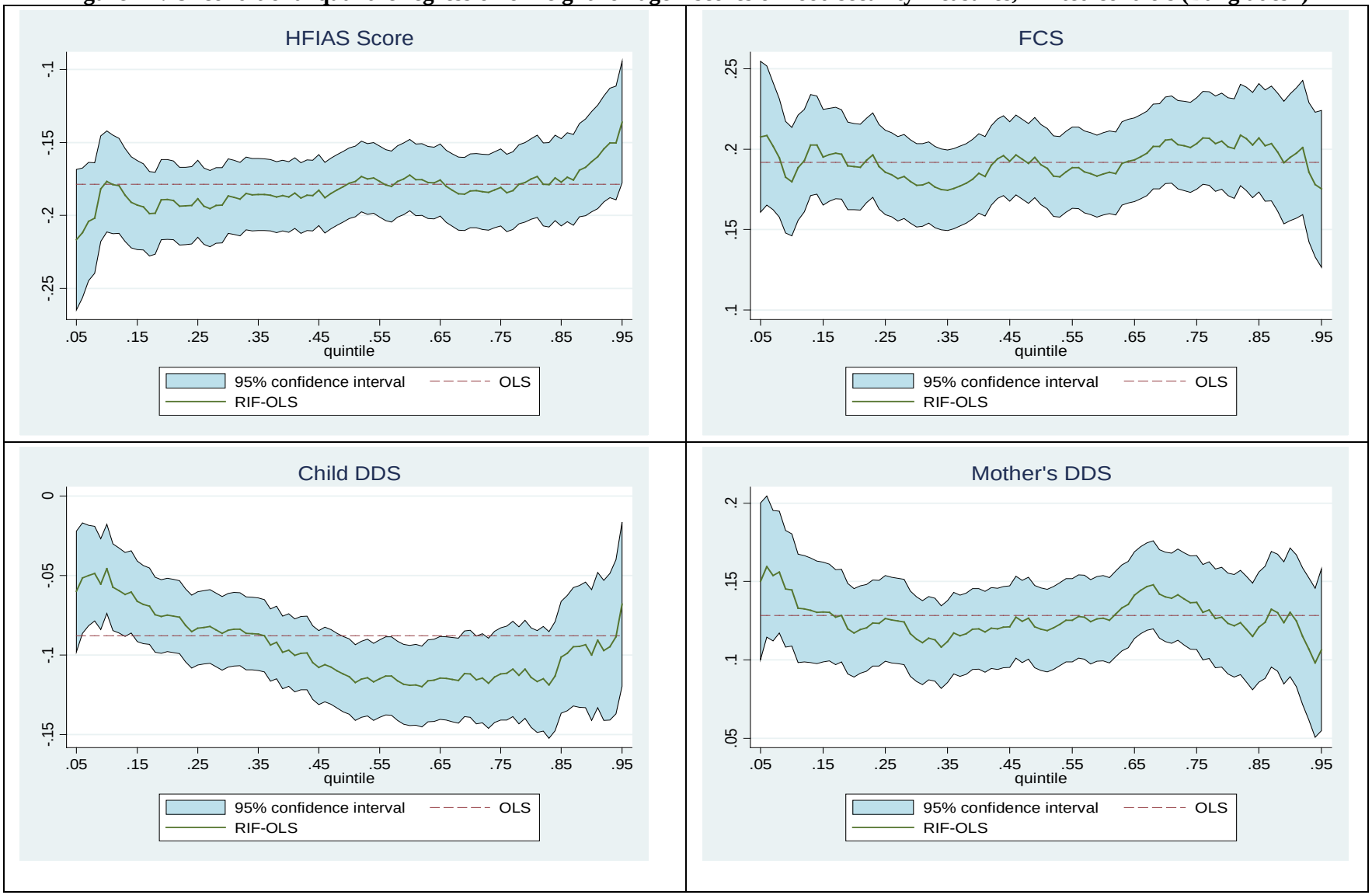
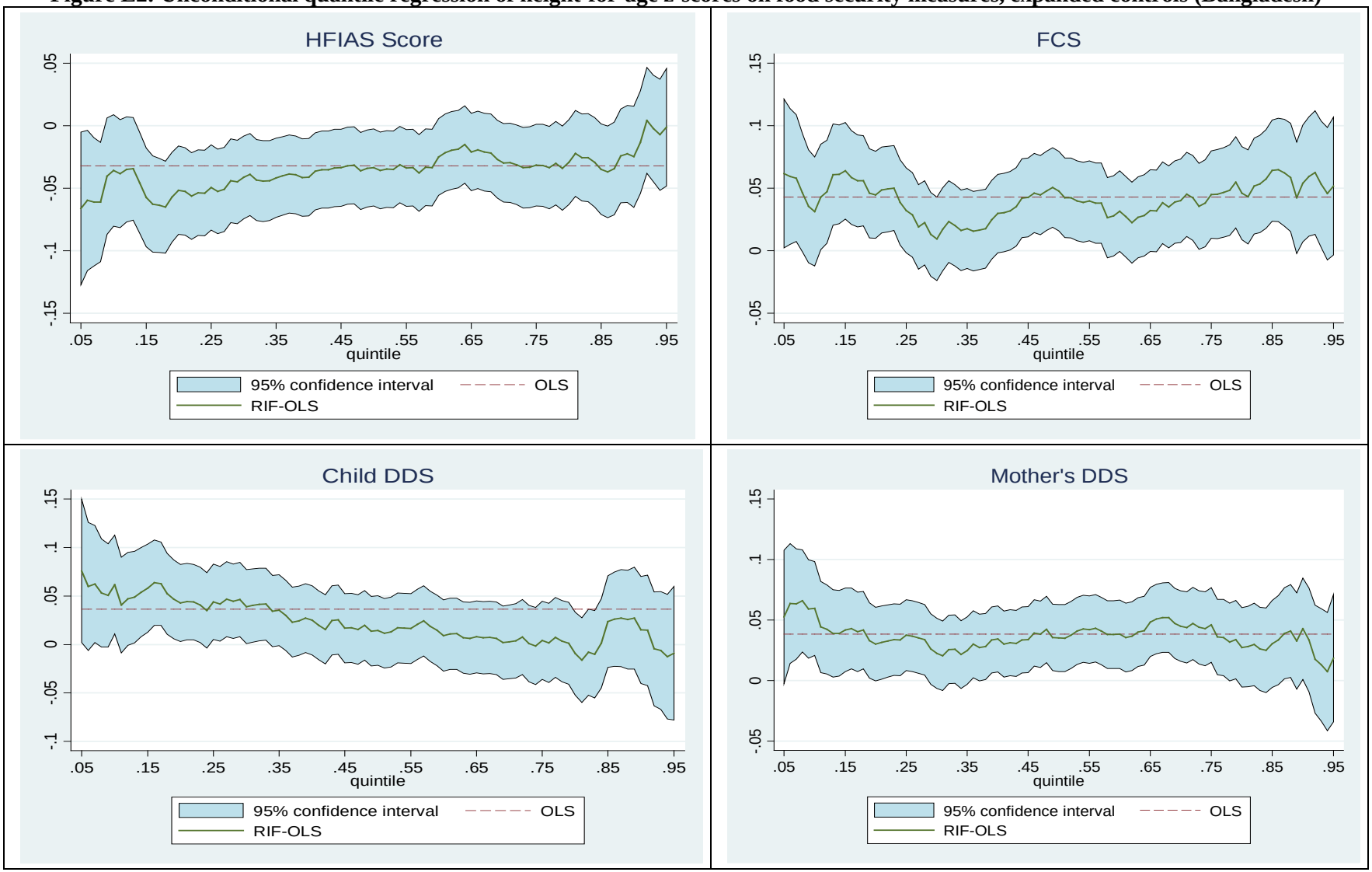


Figure E2: Unconditional quantile regression of height-for-age z-scores on food security measures, expanded controls (Bangladesh)



APPENDIX F: NEPAL

Table F1: Nutritional Indicators, by region

	Mean HAZ	Stunting incidence	Mean WAZ	Underweight incidence
All	-1.78	0.46	-1.61	0.36
Urban	-1.29	0.30	-1.18	0.22
Rural	-1.85	0.49	-1.67	0.38
by Region				
Mountain	-2.22	0.63	-1.77	0.43
Urban-Kathmandu	-0.91	0.22	-0.56	0.09
Urban- Hill	-1.32	0.30	-1.12	0.16
Rural Hill – Eastern	-1.91	0.51	-1.28	0.22
Rural Hill – Central	-1.86	0.44	-1.39	0.31
Rural Hill – Western	-1.90	0.46	-1.33	0.28
Rural Hill – Mid Western	-2.02	0.53	-1.67	0.36
Rural Hill – Far Western	-2.05	0.56	-1.71	0.39
Urban – Terai	-1.43	0.32	-1.48	0.30
Rural Terai – Eastern	-1.63	0.46	-1.64	0.27
Rural Terai – Central	-1.76	0.47	-1.95	0.48
Rural Terai – Western	-1.83	0.47	-1.86	0.41
Rural Terai – Mid Western	-1.69	0.48	-1.57	0.37
Rural Terai – Far Western	-1.68	0.40	-1.43	0.30

Table F2: Nutritional Indicators, by gender and age group

Age in months	Boys		Girls	
	Mean HAZ	Stunting incidence	Mean HAZ	Stunting incidence
0-5	-0.60	0.17	-0.61	0.14
6-11	-0.93	0.26	-0.96	0.21
12-23	-1.93	0.51	-1.71	0.46
24-35	-1.96	0.51	-2.02	0.55
36-47	-2.08	0.56	-2.08	0.56
48-60	-2.05	0.49	-2.18	0.57

Table F3: Descriptive Statistics of Key Variables (Nepal)

Variable	Mean	Std. Dev.	Min	Max
Z-Scores				
HAZ	-1.78	1.5	-6	5.28
WAZ	-1.474	1.16	-5.86	3.01
Food Security Measures				
PC kcal	2487.85	802.55	628.75	6457.53
1-SSR	0.37	0.13	0.07	1
1-SSEXR	0.63	0.15	0.16	1
FCS	70.76	21.47	0	112
DDS	8.8	1.81	0	12
PC consumption	71.18	54.41	12.47	1403.11
Food Share	0.66	0.14	0.06	0.92
Child Age (in months)	30.5	17.08	0.1	60.25
Age squared	1222.01	1063.22	0.01	3630.063
Child is female	0.49	0.5	0	1
Household size	7.95	3.46	2	20
Share of kids under 5	0.28	0.11	0.0625	0.75
HH Head Characteristics				
Female-headed HH	0.17	0.38	0	1
HH Head's Education				
No education*	0.48	0.5	0	1
Literate, or < 5 yrs of schooling	0.2	0.4	0	1
Completed [5-7] yrs of schooling	0.13	0.34	0	1
Completed [8-10] yrs of schooling	0.1	0.29	0	1
Completed 11 + yrs of schooling	0.1	0.3	0	1
Head occupation (SE in agriculture)	0.55	0.5	0	1
Ethnicity/Caste				
Brahmin/Chhetri	0.27	0.44	0	1
Newar*	0.03	0.17	0	1
Terai Middle Class	0.21	0.41	0	1
Janajati (Indigenous groups)	0.26	0.44	0	1
Dalit (untouchable caste)	0.17	0.37	0	1
Muslim/Others	0.06	0.24	0	1
Mother's Education				
No education*	0.53	0.5	0	1
Literate, or < 5 yrs of schooling	0.15	0.36	0	1
Completed [5-7] yrs of schooling	0.14	0.35	0	1
Completed [8-10] yrs of schooling	0.09	0.28	0	1

Variable	Mean	Std. Dev.	Min	Max
Completed 11 + yrs of schooling	0.09	0.29	0	1
Access to facilities: within 30 mins distance to				
Health post	0.51	0.5	0	1
Hospital	0.28	0.45	0	1
Dirt Road	0.68	0.47	0	1
Paved Road	0.42	0.49	0	1
Water & Sanitation				
Piped water connected to house	0.12	0.33	0	1
Flush toilet	0.23	0.42	0	1
Latrine	0.18	0.39	0	1
No toilet*	0.58	0.49	0	1
Feeding Practices				
Child exclusively breastfed for first 6 months	0.76	0.43	0	1
Months breastfed	15.68	11.95	0	59
Complementary food	6.31	4.09	0	44
Suffer from chronic illness	0.01	0.09	0	1
Suffered from health problems	0.32	0.47	0	1
Asset Index				
Asset index 1 (poorest)*	0.18	0.39	0	1
Asset index 2	0.18	0.38	0	1
Asset index 3	0.19	0.39	0	1
Asset index 4	0.21	0.41	0	1
Asset index 5 (Wealthiest)	0.24	0.42	0	1
Region				
Rural	0.87	0.34	0	1
Eastern	0.21	0.41	0	1
Central	0.36	0.48	0	1
Western*	0.16	0.37	0	1
Mid-Western	0.1	0.3	0	1
Far-Western	0.17	0.37	0	1

Source: Authors' calculations

Table F4: Relationship between food security measures and height-for-age z-scores (Nepal): Limited Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Height-for-age z-scores						
Per capita kcal	0.101***						
	(0.029)						
1-SSR		0.199***					
		(0.033)					
1 - SSEXR			0.202***				
			(0.033)				
FCS				0.256***			
				(0.032)			
DDS					0.230***		
					(0.032)		
PC consumption						0.279***	
						(0.043)	
Food share							-0.267***
							(0.035)
Rural	-0.596***	-0.427***	-0.444***	-0.407***	-0.432***	-0.324***	-0.298***
	(0.069)	(0.073)	(0.072)	(0.072)	(0.072)	(0.078)	(0.078)
Eastern	0.066	0.130	0.130	0.153*	0.118	0.140	0.176**
	(0.090)	(0.090)	(0.090)	(0.089)	(0.090)	(0.090)	(0.089)
Central	0.103	0.129	0.125	0.162*	0.139	0.077	0.089
	(0.085)	(0.085)	(0.084)	(0.084)	(0.085)	(0.085)	(0.085)
Midwestern	-0.150	-0.055	-0.077	-0.020	-0.050	-0.094	-0.094
	(0.097)	(0.099)	(0.097)	(0.097)	(0.097)	(0.096)	(0.095)
Far Western	-0.052	0.037	0.045	0.000	0.017	0.049	-0.010
	(0.114)	(0.115)	(0.116)	(0.113)	(0.113)	(0.113)	(0.114)
Constant	-1.258***	-1.434***	-1.416***	-1.468***	-1.431***	-1.491***	-1.517***

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Height-for-age z-scores						
	(0.083)	(0.087)	(0.086)	(0.085)	(0.086)	(0.087)	(0.087)
Observations	2,471	2,471	2,471	2,483	2,483	2,483	2,483
R-squared	0.043	0.053	0.054	0.064	0.059	0.065	0.062

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in the total food expenditure, FCS is the food consumption score and DDS is the household level dietary diversity score, PC consumption is the per capita consumption, and Food share is the share of food expenditure on total expenditure.

Table F5: Relationship between food security measures and weight-for-age z-scores (Nepal): Limited Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	weight-for-age z-scores						
Per capita kcal	0.016						
	(0.022)						
1-SSR		0.185***					
		(0.026)					
1 - SSEXR			0.193***				
			(0.025)				
FCS				0.164***			
				(0.025)			
DDS					0.110***		
					(0.025)		
PC consumption						0.279***	
						(0.047)	
Food share							-0.215***
							(0.027)
Rural	-0.518***	-0.373***	-0.386***	-0.402***	-0.443***	-0.258***	-0.287***
	(0.056)	(0.059)	(0.057)	(0.059)	(0.058)	(0.069)	(0.061)
Eastern	-0.011	0.034	0.034	0.058	0.033	0.063	0.085
	(0.072)	(0.071)	(0.071)	(0.072)	(0.072)	(0.071)	(0.072)
Central	-0.007	0.003	-0.000	0.029	0.014	-0.046	-0.025
	(0.068)	(0.067)	(0.067)	(0.068)	(0.068)	(0.067)	(0.067)
Midwestern	-0.178**	-0.079	-0.097	-0.082	-0.118	-0.110	-0.121*
	(0.073)	(0.075)	(0.074)	(0.074)	(0.074)	(0.074)	(0.073)
Far Western	-0.138	-0.051	-0.042	-0.098	-0.099	-0.029	-0.095
	(0.084)	(0.085)	(0.085)	(0.083)	(0.084)	(0.084)	(0.084)
Constant	-1.037***	-1.185***	-1.172***	-1.168***	-1.121***	-1.256***	-1.236***
	(0.068)	(0.071)	(0.069)	(0.070)	(0.070)	(0.074)	(0.070)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	weight-for-age z-scores						
Observations	2,490	2,490	2,490	2,502	2,502	2,502	2,502
R-squared	0.046	0.066	0.069	0.063	0.053	0.090	0.070

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in the total food expenditure, FCS is the food consumption score and DDS is the household level dietary diversity score, PC consumption is the per capita consumption, and Food share is the share of food expenditure on total expenditure.

Table F6: Relationship between food security measures and height-for-age z-scores (Nepal): Expanded Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Height-for-age-z-scores						
Per capita kcal	0.085***						
	(0.028)						
1-SSR		0.012					
		(0.036)					
1 - SSEXR			0.038				
			(0.033)				
FCS				0.094***			
				(0.033)			
DDS					0.083**		
					(0.034)		
PC consumption						0.077**	
						(0.032)	
Food share							-0.065
							(0.040)
Age (in months)	-0.075***	-0.075***	-0.075***	-0.076***	-0.076***	-0.075***	-0.075***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Age squared	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child is female	0.040	0.042	0.041	0.039	0.038	0.039	0.040
	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)	(0.054)
Household size	-0.016	-0.021*	-0.019*	-0.023**	-0.021*	-0.018	-0.021*
	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Share of kids under 5	-0.362	-0.427*	-0.434*	-0.394	-0.380	-0.390	-0.384
	(0.255)	(0.255)	(0.255)	(0.254)	(0.254)	(0.254)	(0.254)
Characteristics of the HH Head							
Literate, or < 5 years of sch.	0.081	0.084	0.082	0.072	0.078	0.080	0.075
	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Height-for-age-z-scores						
completed [5-7] years of sch.	0.147*	0.147*	0.143*	0.141	0.135	0.139	0.132
	(0.087)	(0.087)	(0.087)	(0.086)	(0.087)	(0.086)	(0.087)
completed [8-10] years of sch.	0.054	0.059	0.054	0.044	0.047	0.042	0.045
	(0.104)	(0.105)	(0.104)	(0.105)	(0.104)	(0.105)	(0.105)
completed 11 + years of sch.	0.148	0.148	0.146	0.144	0.156	0.139	0.139
	(0.100)	(0.100)	(0.100)	(0.100)	(0.100)	(0.099)	(0.100)
Self-employed in agriculture	0.103*	0.116*	0.118*	0.121**	0.125**	0.120**	0.121**
	(0.061)	(0.061)	(0.061)	(0.061)	(0.061)	(0.061)	(0.061)
Ethnicity							
Brahman/Chhetri	-0.187	-0.173	-0.172	-0.172	-0.168	-0.169	-0.171
	(0.141)	(0.141)	(0.141)	(0.142)	(0.141)	(0.141)	(0.140)
Middle class	-0.493***	-0.455***	-0.448***	-0.455***	-0.452***	-0.445***	-0.462***
	(0.165)	(0.166)	(0.166)	(0.166)	(0.166)	(0.166)	(0.165)
Janajati	-0.201	-0.188	-0.190	-0.155	-0.156	-0.170	-0.171
	(0.145)	(0.145)	(0.145)	(0.147)	(0.146)	(0.145)	(0.145)
Dalit	-0.374**	-0.368**	-0.365**	-0.337**	-0.343**	-0.357**	-0.359**
	(0.155)	(0.155)	(0.155)	(0.157)	(0.156)	(0.155)	(0.155)
Others	-0.297	-0.256	-0.257	-0.260	-0.271	-0.239	-0.241
	(0.189)	(0.189)	(0.189)	(0.190)	(0.189)	(0.189)	(0.189)
Female-headed HH	0.093	0.085	0.087	0.102	0.099	0.091	0.081
	(0.070)	(0.071)	(0.070)	(0.070)	(0.070)	(0.070)	(0.071)
Mother's Education							
Literate, or < 5 years of sch.	0.103	0.106	0.097	0.093	0.091	0.105	0.106
	(0.083)	(0.083)	(0.083)	(0.082)	(0.083)	(0.082)	(0.082)
completed [5-7] years of sch.	0.163*	0.164*	0.154*	0.145*	0.143*	0.158*	0.155*
	(0.086)	(0.086)	(0.087)	(0.086)	(0.086)	(0.086)	(0.086)
completed [8-10] years of sch.	0.162	0.167	0.158	0.145	0.150	0.168	0.160
	(0.106)	(0.107)	(0.107)	(0.106)	(0.107)	(0.106)	(0.106)
completed 11 + years of sch.	0.364***	0.372***	0.364***	0.346***	0.356***	0.344***	0.352***
	(0.113)	(0.114)	(0.114)	(0.113)	(0.114)	(0.114)	(0.114)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Height-for-age-z-scores						
Within 30min of health post	0.055	0.069	0.072	0.065	0.062	0.067	0.065
	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)
Within 30min of hospital	-0.009	-0.017	-0.019	-0.014	-0.012	-0.015	-0.013
	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)
Within 30min of dirt road	0.004	0.012	0.008	0.020	0.007	0.028	0.022
	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)	(0.062)
Within 30min of paved road	0.214***	0.203***	0.200**	0.193**	0.187**	0.199**	0.184**
	(0.078)	(0.078)	(0.078)	(0.078)	(0.078)	(0.078)	(0.078)
Piped water in house	-0.030	-0.042	-0.046	-0.035	-0.026	-0.045	-0.038
	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)	(0.077)
Flush toilet	0.139*	0.133*	0.124	0.107	0.112	0.116	0.112
	(0.080)	(0.081)	(0.081)	(0.080)	(0.080)	(0.080)	(0.081)
Latrine	-0.012	-0.017	-0.023	-0.011	-0.008	-0.003	-0.008
	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)
Child exclusive-ly breastfed	0.153**	0.153**	0.152**	0.138**	0.137**	0.145**	0.148**
	(0.067)	(0.067)	(0.067)	(0.066)	(0.066)	(0.067)	(0.066)
Months breastfed	-0.007***	-0.007***	-0.007***	-0.006**	-0.006**	-0.007***	-0.007***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Complementary food	-0.017**	-0.017*	-0.017**	-0.016*	-0.016*	-0.016*	-0.017*
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Suffer from chronic illness	-0.561*	-0.584*	-0.584*	-0.497	-0.487	-0.482	-0.487
	(0.303)	(0.304)	(0.303)	(0.306)	(0.307)	(0.303)	(0.308)
Fell sick in the last 30 days	-0.044	-0.042	-0.041	-0.043	-0.041	-0.044	-0.040
	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)	(0.058)
Asset index 2	0.147*	0.167*	0.166*	0.152*	0.147*	0.165*	0.160*
	(0.087)	(0.087)	(0.087)	(0.088)	(0.088)	(0.087)	(0.088)
Asset index 3	0.252***	0.259***	0.256***	0.239**	0.233**	0.251***	0.250***
	(0.095)	(0.095)	(0.096)	(0.096)	(0.097)	(0.096)	(0.096)
Asset index 4	0.333***	0.355***	0.350***	0.323***	0.316***	0.337***	0.339***
	(0.105)	(0.105)	(0.105)	(0.107)	(0.108)	(0.107)	(0.108)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Height-for-age-z-scores						
Asset index 5 (Wealthiest)	0.530***	0.555***	0.544***	0.501***	0.503***	0.500***	0.518***
	(0.118)	(0.119)	(0.119)	(0.121)	(0.123)	(0.123)	(0.122)
Rural	-0.325***	-0.328***	-0.323***	-0.295***	-0.297***	-0.292***	-0.296***
	(0.096)	(0.097)	(0.097)	(0.098)	(0.097)	(0.098)	(0.099)
Eastern	0.242***	0.258***	0.261***	0.271***	0.261***	0.267***	0.274***
	(0.087)	(0.087)	(0.087)	(0.087)	(0.087)	(0.087)	(0.087)
Central	0.127	0.139*	0.137*	0.161**	0.152*	0.136*	0.136*
	(0.079)	(0.079)	(0.079)	(0.079)	(0.079)	(0.079)	(0.080)
Mid-Western	0.010	0.016	0.020	0.048	0.033	0.021	0.014
	(0.093)	(0.095)	(0.094)	(0.094)	(0.094)	(0.094)	(0.094)
Far Western	0.033	0.040	0.048	0.049	0.052	0.059	0.038
	(0.112)	(0.115)	(0.114)	(0.112)	(0.112)	(0.112)	(0.113)
Constant	-0.385	-0.393	-0.388	-0.387	-0.385	-0.434*	-0.394
	(0.259)	(0.260)	(0.259)	(0.259)	(0.258)	(0.259)	(0.260)
Observations	2,462	2,462	2,462	2,474	2,474	2,474	2,474
R-squared	0.226	0.224	0.224	0.226	0.226	0.225	0.224

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in the total food expenditure, FCS is the food consumption score and DDS is the household level dietary diversity score, PC consumption is the per capita consumption, and Food share is the share of food expenditure on total expenditure.

Table F7: Relationship between food security measures and weight-for-age z-scores (Nepal): Expanded Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Weight-for-age z-scores						
Per capita kcal	0.019						
	(0.022)						
1-SSR		0.017					
		(0.029)					
1 – SSEXR			0.057**				
			(0.026)				
FCS				0.068**			
				(0.027)			
DDS					0.029		
					(0.026)		
PC consumption						0.139***	
						(0.036)	
Food share							-0.075**
							(0.032)
Age (in months)	-0.014**	-0.014**	-0.014**	-0.013**	-0.013**	-0.013**	-0.013**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Age squared	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Child is female	-0.010	-0.010	-0.012	-0.015	-0.016	-0.012	-0.012
	(0.044)	(0.044)	(0.044)	(0.044)	(0.044)	(0.043)	(0.044)
Household size	-0.018**	-0.018**	-0.017*	-0.022**	-0.020**	-0.016*	-0.021**
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Share of kids under 5	0.048	0.023	0.012	0.050	0.048	0.076	0.067
	(0.199)	(0.200)	(0.199)	(0.199)	(0.199)	(0.198)	(0.199)
Characteristics of the HH Head							
Literate, or < 5 years of sch.	0.032	0.031	0.028	0.010	0.014	0.014	0.009
	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.061)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Weight-for-age z-scores						
completed [5-7] years of sch.	0.103	0.100	0.094	0.086	0.087	0.075	0.074
	(0.070)	(0.070)	(0.070)	(0.070)	(0.070)	(0.070)	(0.070)
completed [8-10] years of sch.	0.026	0.024	0.016	0.001	0.008	-0.021	-0.005
	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)	(0.083)
completed 11 + years of sch.	0.031	0.027	0.024	0.008	0.016	-0.011	-0.003
	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)	(0.088)	(0.088)
Self-employed in agriculture	0.026	0.029	0.033	0.034	0.034	0.037	0.036
	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
Ethnicity							
Brahman/Chhetri	-0.612***	-0.608***	-0.606***	-0.597***	-0.596***	-0.590***	-0.595***
	(0.116)	(0.116)	(0.116)	(0.116)	(0.116)	(0.115)	(0.116)
Middle class	-0.869***	-0.857***	-0.847***	-0.868***	-0.872***	-0.836***	-0.870***
	(0.133)	(0.133)	(0.133)	(0.133)	(0.133)	(0.132)	(0.132)
Janajati	-0.495***	-0.490***	-0.493***	-0.479***	-0.487***	-0.479***	-0.486***
	(0.118)	(0.118)	(0.118)	(0.118)	(0.118)	(0.117)	(0.118)
Dalit	-0.731***	-0.725***	-0.718***	-0.714***	-0.728***	-0.714***	-0.725***
	(0.127)	(0.127)	(0.127)	(0.128)	(0.127)	(0.126)	(0.127)
Others	-0.818***	-0.806***	-0.807***	-0.821***	-0.822***	-0.790***	-0.801***
	(0.143)	(0.143)	(0.143)	(0.143)	(0.143)	(0.143)	(0.143)
Female-headed HH	0.103*	0.099*	0.102*	0.105*	0.102*	0.092*	0.084
	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.055)	(0.056)
Mother's Education							
Literate, or < 5 years of sch.	0.167**	0.164**	0.152**	0.163**	0.167**	0.168**	0.170***
	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)	(0.066)
completed [5-7] years of sch.	0.230***	0.227***	0.212***	0.244***	0.251***	0.245***	0.246***
	(0.069)	(0.069)	(0.070)	(0.071)	(0.071)	(0.070)	(0.071)
completed [8-10] years of sch.	0.251***	0.249***	0.236***	0.238***	0.249***	0.252***	0.244***
	(0.084)	(0.084)	(0.084)	(0.084)	(0.084)	(0.083)	(0.083)
completed 11 + years fo sch.	0.462***	0.458***	0.445***	0.439***	0.455***	0.399***	0.432***
	(0.092)	(0.092)	(0.092)	(0.091)	(0.092)	(0.093)	(0.092)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Weight-for-age z-scores						
Within 30min of health post	-0.020	-0.017	-0.013	-0.022	-0.024	-0.017	-0.021
	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)
Within 30min of hospital	0.110*	0.107*	0.105	0.111*	0.113*	0.105	0.110*
	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)
Within 30min of dirt road	-0.060	-0.058	-0.064	-0.071	-0.076	-0.056	-0.069
	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)	(0.051)
Within 30min of paved road	-0.073	-0.076	-0.080	-0.085	-0.088	-0.074	-0.096
	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)
Piped water in house	0.046	0.041	0.035	0.033	0.039	0.007	0.026
	(0.066)	(0.066)	(0.066)	(0.065)	(0.065)	(0.066)	(0.065)
Flush toilet	0.187***	0.183***	0.170***	0.162**	0.175***	0.147**	0.155**
	(0.064)	(0.065)	(0.064)	(0.065)	(0.065)	(0.064)	(0.065)
Latrine	0.047	0.044	0.035	0.040	0.044	0.040	0.038
	(0.063)	(0.063)	(0.063)	(0.064)	(0.064)	(0.063)	(0.064)
Child exclusive-ly breastfed	0.032	0.032	0.030	0.032	0.035	0.036	0.041
	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)
Months breastfed	-0.002	-0.002	-0.001	-0.002	-0.002	-0.002	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Complementary food	-0.013*	-0.013*	-0.013*	-0.014**	-0.014**	-0.014**	-0.014**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Suffer from chronic illness	-0.440*	-0.445*	-0.442*	-0.405*	-0.394	-0.407*	-0.408
	(0.252)	(0.252)	(0.252)	(0.245)	(0.246)	(0.243)	(0.248)
Fell sick in the last 30 days	-0.073	-0.073	-0.071	-0.073	-0.071	-0.079*	-0.072
	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)
Asset index 2	-0.009	-0.005	-0.007	-0.030	-0.026	-0.027	-0.029
	(0.070)	(0.070)	(0.070)	(0.071)	(0.071)	(0.070)	(0.071)
Asset index 3	0.022	0.023	0.019	-0.004	0.004	-0.012	-0.003
	(0.076)	(0.076)	(0.076)	(0.077)	(0.078)	(0.076)	(0.077)
Asset index 4	0.093	0.095	0.086	0.064	0.079	0.040	0.062
	(0.084)	(0.085)	(0.084)	(0.086)	(0.087)	(0.086)	(0.086)

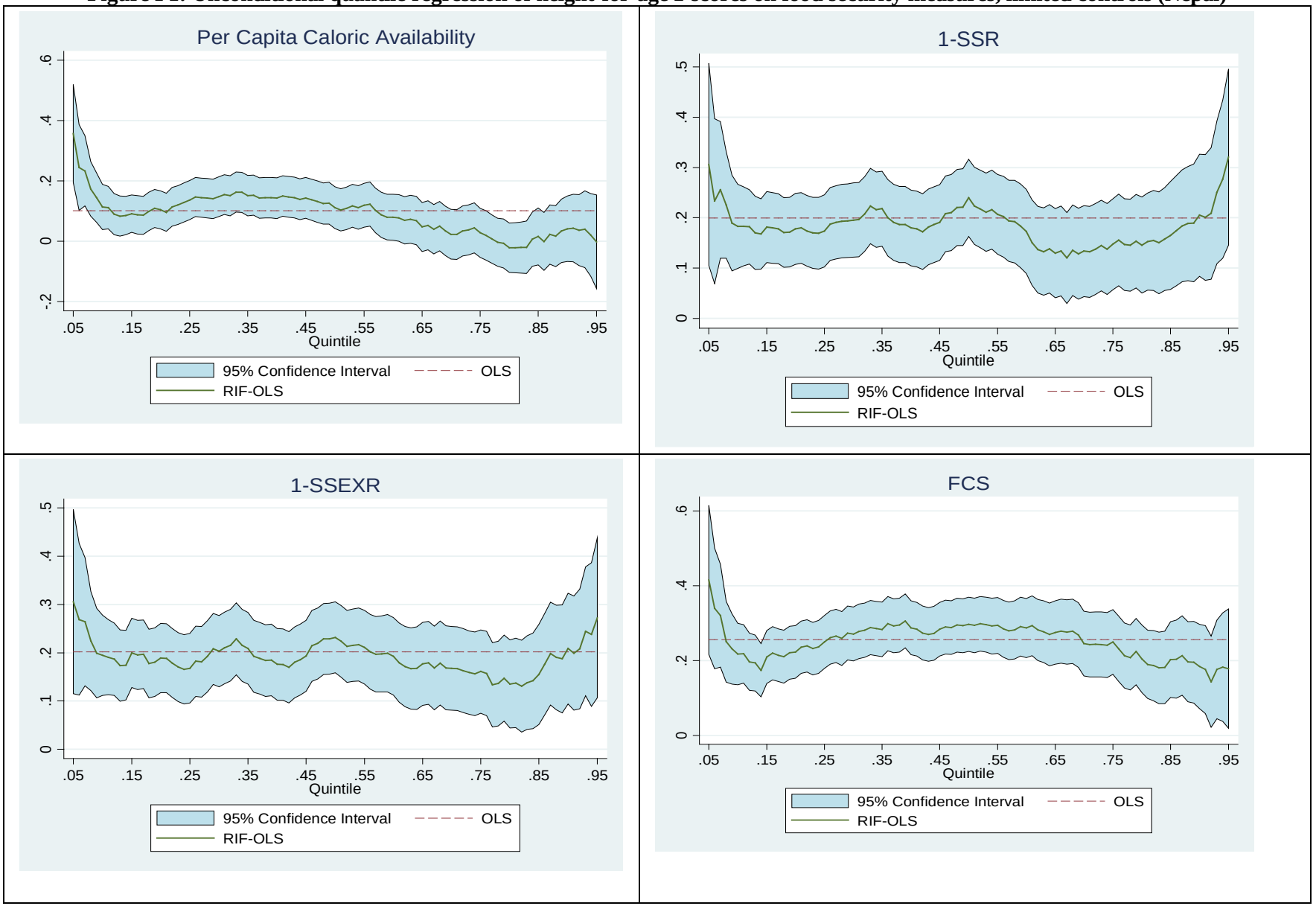
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Weight-for-age z-scores						
Asset index 5 (Wealthiest)	0.184*	0.184*	0.166*	0.143	0.169*	0.065	0.131
	(0.095)	(0.096)	(0.096)	(0.098)	(0.098)	(0.100)	(0.100)
Rural	-0.165**	-0.162**	-0.155*	-0.140*	-0.154*	-0.097	-0.126
	(0.079)	(0.080)	(0.079)	(0.080)	(0.080)	(0.082)	(0.081)
Eastern	0.061	0.067	0.071	0.094	0.089	0.091	0.099
	(0.072)	(0.072)	(0.072)	(0.073)	(0.073)	(0.073)	(0.073)
Central	0.017	0.019	0.016	0.038	0.031	-0.000	0.012
	(0.067)	(0.067)	(0.067)	(0.067)	(0.067)	(0.067)	(0.068)
Mid Western	-0.107	-0.100	-0.094	-0.098	-0.111	-0.126*	-0.129*
	(0.076)	(0.077)	(0.076)	(0.076)	(0.076)	(0.076)	(0.077)
Far Western	-0.082	-0.075	-0.063	-0.089	-0.089	-0.066	-0.100
	(0.087)	(0.088)	(0.088)	(0.087)	(0.087)	(0.087)	(0.087)
Constant	-0.480**	-0.483**	-0.476**	-0.447**	-0.457**	-0.497**	-0.440**
	(0.198)	(0.198)	(0.198)	(0.198)	(0.199)	(0.197)	(0.199)
Observations	2,481	2,481	2,481	2,493	2,493	2,493	2,493
R-squared	0.168	0.168	0.169	0.171	0.169	0.176	0.171

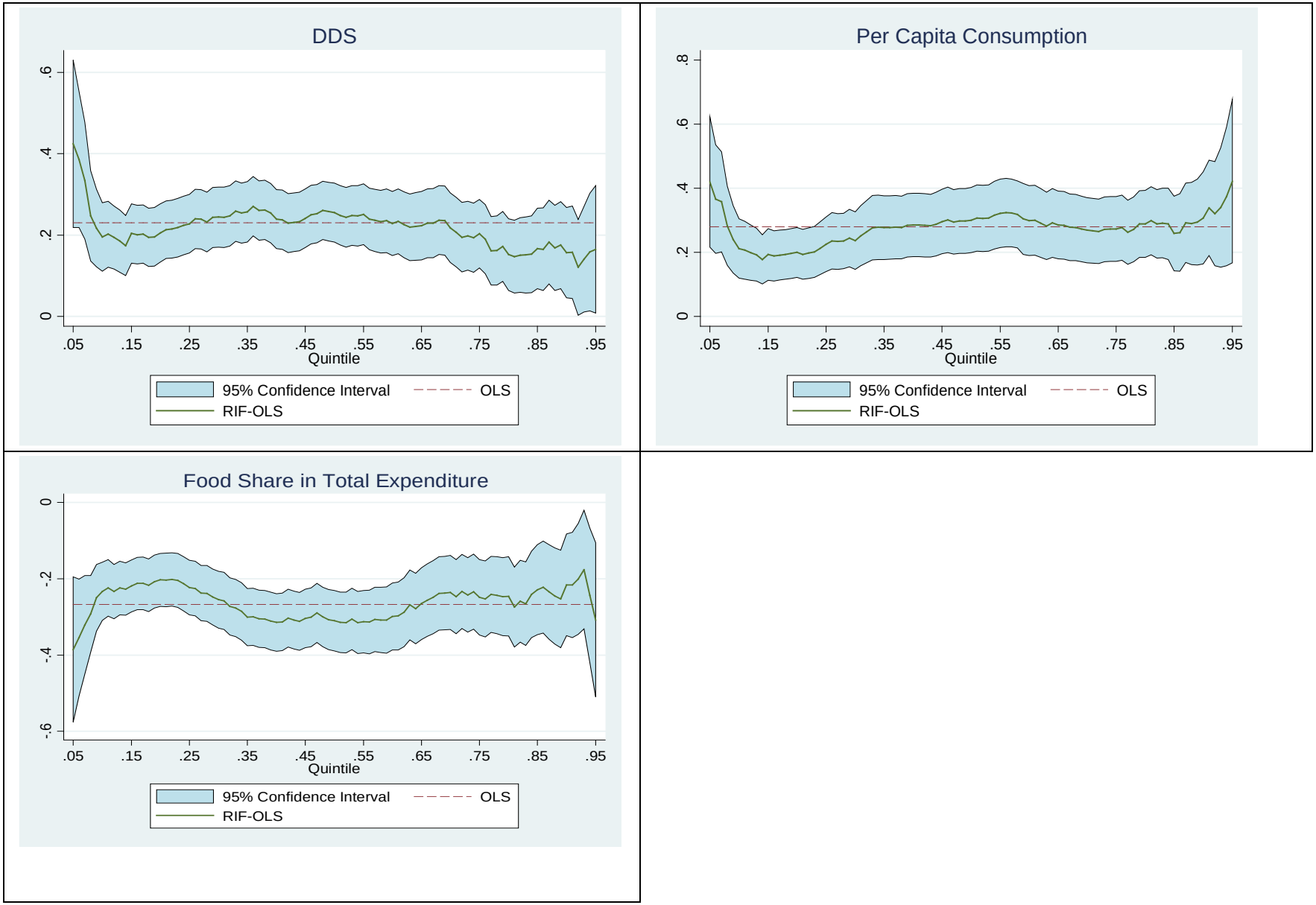
Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in the total food expenditure, FCS is the food consumption score and DDS is the household level dietary diversity score, PC consumption is the per capita consumption, and Food share is the share of food expenditure on total expenditure.

Figure F1: Unconditional quantile regression of height-for-age z-scores on food security measures, limited controls (Nepal)




DDS
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.05
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.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS
Per Capita Consumption
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.4
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.8
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS
Food Share in Total Expenditure
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-.4
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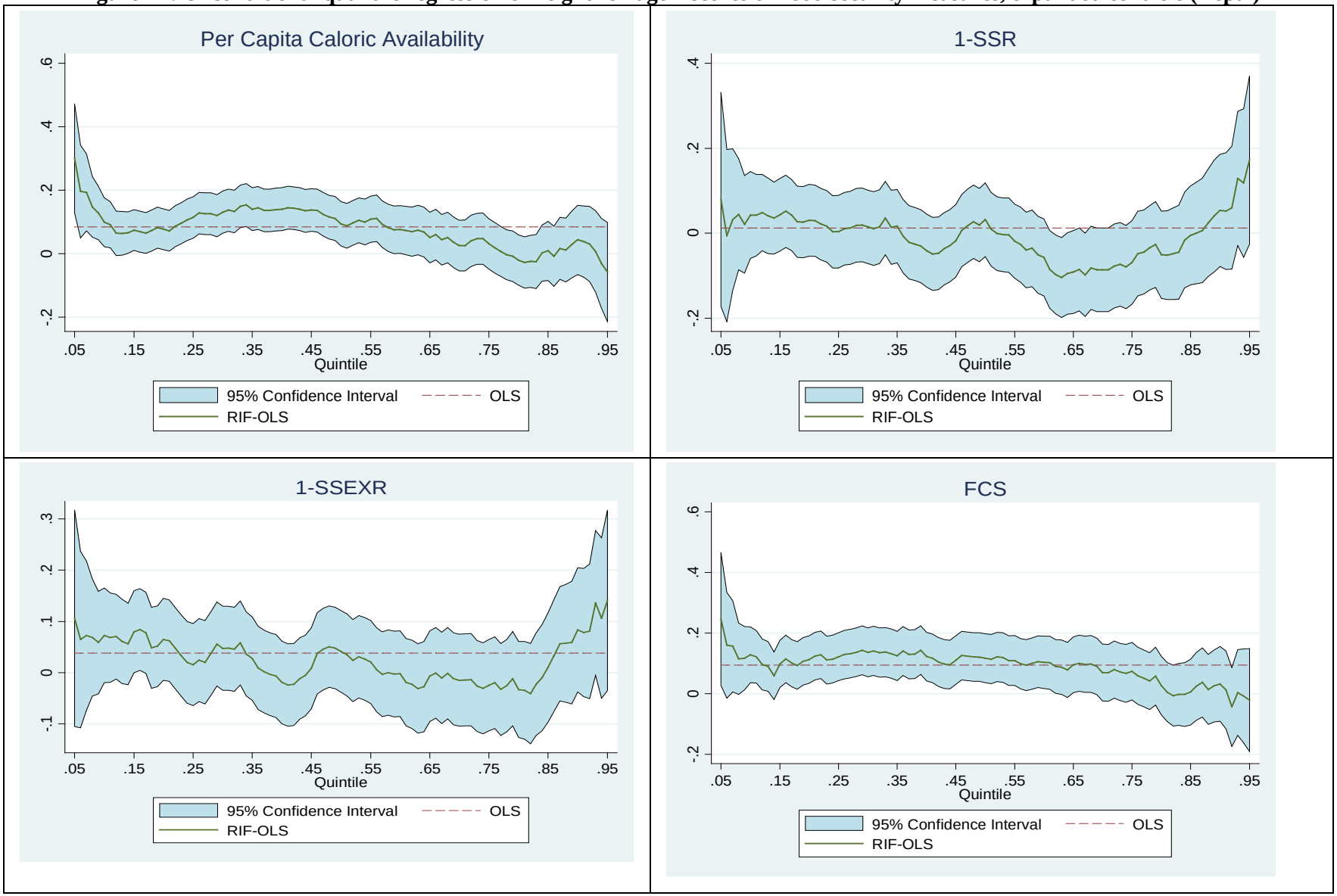
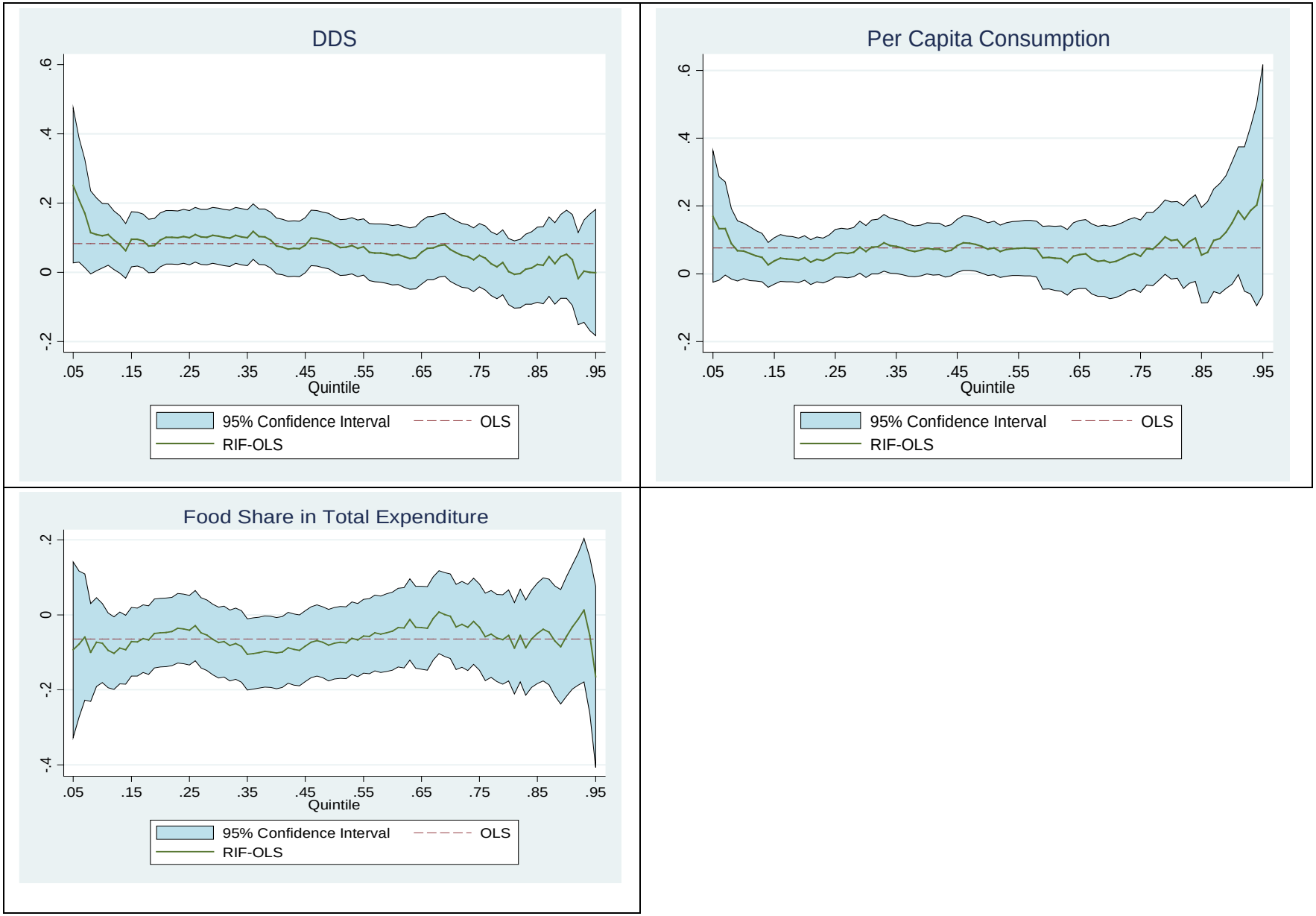
Quintile
95% Confidence Interval
OLS
RIF-OLS

Figure F2: Unconditional quantile regression of height-for-age z-scores on food security measures, expanded controls (Nepal)




DDS
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Quintile
95% Confidence Interval
OLS
RIF-OLS
Per Capita Consumption
-.2
0
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.55
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.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS
Food Share in Total Expenditure
-.4
-.2
0
.2
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.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS

APPENDIX G: PAKISTAN

Table G1: Nutritional Indicators, by region

	Mean HAZ	Stunting incidence	Mean WAZ	Underweight incidence
All	-2.42	0.63	-1.54	0.41
Urban	-2.29	0.62	-1.59	0.40
Rural	-2.46	0.64	-1.53	0.41
by Province				
Punjab	-2.29	0.61	-1.15	0.30
Sindh	-2.61	0.68	-2.27	0.58
Khyber Pkahtoon Khaw	-2.98	0.72	-0.78	0.24
Balochistan	-1.31	0.45	-0.92	0.30

Table G2: Nutritional Indicators, by gender and age group

Age in months	Boys		Girls	
	Mean HAZ	Stunting incidence	Mean HAZ	Stunting incidence
0-5	-2.11	0.60	-2.3	0.58
6-11	-2.43	0.59	-2.52	0.72
12-23	-2.72	0.73	-2.23	0.62
24-35	-2.59	0.65	-2.70	0.67
36-47	-2.33	0.60	-2.52	0.64
48-60	-2.30	0.60	-2.22	0.61

Table G3: Descriptive Statistics of Key Variables (Pakistan)

Variable	Mean	Std. Dev.	Min	Max
Z-scores				
HAZ	-2.43	2.29	-6	6
WAZ	-1.52	2.03	-5.98	5.78
Food Security Measures				
Per capita kcal	2731.44	1563.09	360.36	20766.51
1-SSR	0.50	0.17	0.04	0.99
1-SSEXR	0.77	0.16	0.133	1
DDS	9.14	1.44	3	12
PC expenditure	2431.16	1647.19	295.8	35901.3
Food share	0.62	0.15	0	1
Child is female	0.47	0.50	0	1
Child age (in months)	27.28	17.27	0	59
Age squared	1042.14	977.20	0	3481
Household size	10.01	5.61	2	43
Mother is literate	0.20	0.40	0	1
Father is literate	0.43	0.50	0	1
Distance to health facility	14.15	22.16	0	180
Source of drinking water (tap = 1)	0.40	0.49	0	1
No Toilet Facility	0.27	0.44	0	1
Latrine	0.19	0.39	0	1
Flush Toilet	0.54	0.50	0	1
Structure of the House				
Kacha	0.33	0.47	0	1
Pacca	0.43	0.50	0	1
Mixed	0.24	0.43	0	1
Asset index 1 (poorest)	0.23	0.42	0	1
Asset index 2	0.17	0.38	0	1
Asset index 3	0.21	0.41	0	1
Asset index 4	0.20	0.40	0	1
Asset index 5	0.19	0.39	0	1
No illness	0.75	0.43	0	1
Child has suffered from Diarrhea	0.10	0.31	0	1
Other illness	0.15	0.35	0	1

Variable	Mean	Std. Dev.	Min	Max
Region				
Urban	0.26	0.44	0	1
Punjab	0.40	0.49	0	1
Sindh	0.37	0.48	0	1
Khyber Pkahtoon Khaw	0.09	0.29	0	1
Balochistan	0.13	0.34	0	1

Source: Authors' calculations

Table G4: Relationship between food security measures and height-for-age z-scores (Pakistan): Limited Controls Version

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Height-for-age z-scores					
Per capita kcal	0.040					
	(0.043)					
1-SSR		0.072				
		(0.050)				
1 - SSEXR			0.065			
			(0.050)			
DDS				0.115**		
				(0.053)		
PC expenditure					0.051	
					(0.048)	
Food share						-0.024
						(0.047)
Rural	-0.149	-0.122	-0.16	-0.122	-0.148	-0.155
	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)
Punjab	-0.997***	-0.976***	-1.005***	-1.010***	-1.004***	-1.006***
	(0.250)	(0.250)	(0.250)	(0.251)	(0.251)	(0.251)
Sindh	-1.300***	-1.242***	-1.271***	-1.304***	-1.285***	-1.293***
	(0.254)	(0.257)	(0.254)	(0.254)	(0.254)	(0.254)
Khyber Pkahtoon Khaw	-1.664***	-1.613***	-1.659***	-1.730***	-1.674***	-1.669***
	(0.290)	(0.291)	(0.289)	(0.293)	(0.292)	(0.292)
Constant	-1.203***	-1.256***	-1.203***	-1.208***	-1.204***	-1.197***
	(0.254)	(0.255)	(0.253)	(0.254)	(0.254)	(0.254)
Observations	2,098	2,098	2,098	2,098	2,097	2,097
R-squared	0.025	0.026	0.026	0.028	0.026	0.025

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in total food expenditure, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure in total expenditure.

Table G5: Relationship between food security measures and weight-for-age z-scores (Pakistan): Limited Controls Version

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Weight-for-age z-scores					
Per capita kcal	-0.002					
	(0.033)					
1-SSR		0.026				
		(0.038)				
1 - SSEXR			0.007			
			(0.036)			
DDS				-0.035		
				(0.036)		
PC expenditure					-0.006	
					(0.042)	
Food share						0.003
						(0.037)
Rural	0.123	0.132	0.122	0.113	0.123	0.124
	(0.083)	(0.084)	(0.083)	(0.083)	(0.083)	(0.083)
Punjab	-0.242*	-0.234*	-0.242*	-0.234*	-0.242*	-0.241*
	(0.141)	(0.142)	(0.141)	(0.141)	(0.141)	(0.142)
Sindh	-1.370***	-1.351***	-1.367***	-1.360***	-1.367***	-1.366***
	(0.141)	(0.144)	(0.141)	(0.141)	(0.140)	(0.140)
Khyber Pkahtoon Khaw	0.128	0.143	0.127	0.154	0.129	0.129
	(0.166)	(0.167)	(0.165)	(0.169)	(0.167)	(0.168)
Constant	-0.999***	-1.017***	-0.999***	-1.002***	-0.998***	-1.000***
	(0.144)	(0.146)	(0.143)	(0.143)	(0.143)	(0.144)
Observations	2,775	2,775	2,775	2,775	2,766	2,766
R-squared	0.097	0.097	0.097	0.098	0.096	0.096

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in total food expenditure, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure in total expenditure.

Table G6: Relationship between food security measures and height-for-age z-scores (Pakistan): Expanded Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Height-for-age z-scores					
Per capita kcal	0.023					
	(0.049)					
1-SSR		0.056				
		(0.056)				
1 - SSEXR			0.043			
			(0.059)			
DDS				0.068		
				(0.072)		
PC expenditure					0.043	
					(0.061)	
Food share						-0.040
						(0.053)
Child is female	0.073	0.075	0.071	0.079	0.074	0.069
	(0.109)	(0.109)	(0.109)	(0.109)	(0.109)	(0.110)
Age (in months)	-0.023	-0.023	-0.023	-0.023	-0.023	-0.023
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
Age squared	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HH size	-0.003	-0.002	-0.004	-0.004	-0.002	-0.004
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Mother is literate	0.083	0.082	0.082	0.078	0.080	0.089
	(0.148)	(0.147)	(0.147)	(0.147)	(0.148)	(0.148)
Father is literate	0.122	0.121	0.123	0.117	0.119	0.118
	(0.122)	(0.122)	(0.122)	(0.122)	(0.122)	(0.122)
Distance to health service	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Main source of drinking water (tap=1)	-0.097	-0.107	-0.100	-0.087	-0.100	-0.105
	(0.136)	(0.136)	(0.136)	(0.136)	(0.137)	(0.136)
Sanitation facility (reference category: No toilet)						
Latrine	0.082	0.087	0.086	0.050	0.076	0.078
	(0.196)	(0.196)	(0.197)	(0.197)	(0.196)	(0.196)
Flush toilet	-0.078	-0.077	-0.076	-0.090	-0.083	-0.083
	(0.158)	(0.158)	(0.158)	(0.158)	(0.158)	(0.158)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Height-for-age z-scores					
Structure of house (reference category: Kacha)						
Pacca	-0.033	-0.040	-0.032	-0.036	-0.032	-0.036
	(0.151)	(0.151)	(0.151)	(0.151)	(0.151)	(0.151)
Mixed	-0.070	-0.063	-0.065	-0.063	-0.067	-0.071
	(0.143)	(0.142)	(0.142)	(0.142)	(0.142)	(0.142)
Asset index (reference category: poorest)						
Asset index 2	0.166	0.155	0.164	0.151	0.162	0.173
	(0.193)	(0.194)	(0.194)	(0.193)	(0.193)	(0.193)
Asset index 3	0.056	0.044	0.043	0.033	0.050	0.059
	(0.177)	(0.177)	(0.178)	(0.179)	(0.177)	(0.176)
Asset index 4	0.047	0.016	0.032	0.004	0.034	0.056
	(0.189)	(0.193)	(0.192)	(0.199)	(0.191)	(0.189)
Asset index 5 (wealthiest)	0.265	0.231	0.252	0.217	0.234	0.273
	(0.226)	(0.227)	(0.227)	(0.241)	(0.235)	(0.224)
Child suffered from diarrhea	-0.084	-0.084	-0.083	-0.094	-0.083	-0.081
	(0.216)	(0.216)	(0.216)	(0.216)	(0.216)	(0.216)
Other illness	-0.443***	-0.440***	-0.443***	-0.439***	-0.448***	-0.445***
	(0.132)	(0.132)	(0.132)	(0.132)	(0.132)	(0.132)
Rural	-0.109	-0.093	-0.117	-0.090	-0.108	-0.114
	(0.154)	(0.154)	(0.152)	(0.154)	(0.153)	(0.153)
Punjab	-1.080***	-1.068***	-1.090***	-1.092***	-1.088***	-1.096***
	(0.279)	(0.279)	(0.281)	(0.280)	(0.280)	(0.281)
Sindh	-1.388***	-1.365***	-1.382***	-1.384***	-1.391***	-1.393***
	(0.294)	(0.295)	(0.294)	(0.295)	(0.295)	(0.296)
Khyber Pkahtoon Khaw	-1.715***	-1.675***	-1.710***	-1.733***	-1.720***	-1.734***
	(0.319)	(0.320)	(0.319)	(0.322)	(0.320)	(0.323)
Constant	-0.883**	-0.907**	-0.859**	-0.843**	-0.869**	-0.861**
	(0.419)	(0.419)	(0.421)	(0.422)	(0.420)	(0.423)
Observations	1,648	1,648	1,648	1,648	1,648	1,648
R-squared	0.039	0.039	0.039	0.040	0.039	0.039

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in total food expenditure, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure in total expenditure.

Table G7: Relationship between food security measures and weight-for-age z-scores (Pakistan): Expanded Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Weight-for-age z-scores					
Per capita kcal	0.002					
	(0.036)					
1-SSR		-0.012				
		(0.044)				
1 - SSEXR			0.005			
			(0.044)			
DDS				-0.054		
				(0.046)		
Per capita expenditure					-0.004	
					(0.052)	
Food share						0.036
						(0.042)
Child is female	0.236***	0.236***	0.236***	0.232***	0.237***	0.239***
	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)	(0.081)
Age (in months)	0.026**	0.026**	0.026**	0.026**	0.026**	0.026**
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Age squared	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
HH size	-0.005	-0.005	-0.005	-0.004	-0.002	-0.002
	(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)
Mother is literate	0.139	0.141	0.139	0.149	0.141	0.139
	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)
Father is literate	-0.209**	-0.208**	-0.209**	-0.208**	-0.204**	-0.197**
	(0.091)	(0.091)	(0.091)	(0.091)	(0.091)	(0.092)
Distance to health service	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Main source of drinking water (tap=1)	0.035	0.037	0.035	0.026	0.031	0.038
	(0.100)	(0.101)	(0.100)	(0.100)	(0.101)	(0.100)
Sanitation facility (reference category: No toilet)						
Latrine	0.003	0.002	0.003	0.030	0.000	0.000
	(0.134)	(0.133)	(0.133)	(0.135)	(0.133)	(0.133)
Flush toilet	0.060	0.059	0.060	0.067	0.070	0.071
	(0.124)	(0.124)	(0.124)	(0.124)	(0.124)	(0.124)

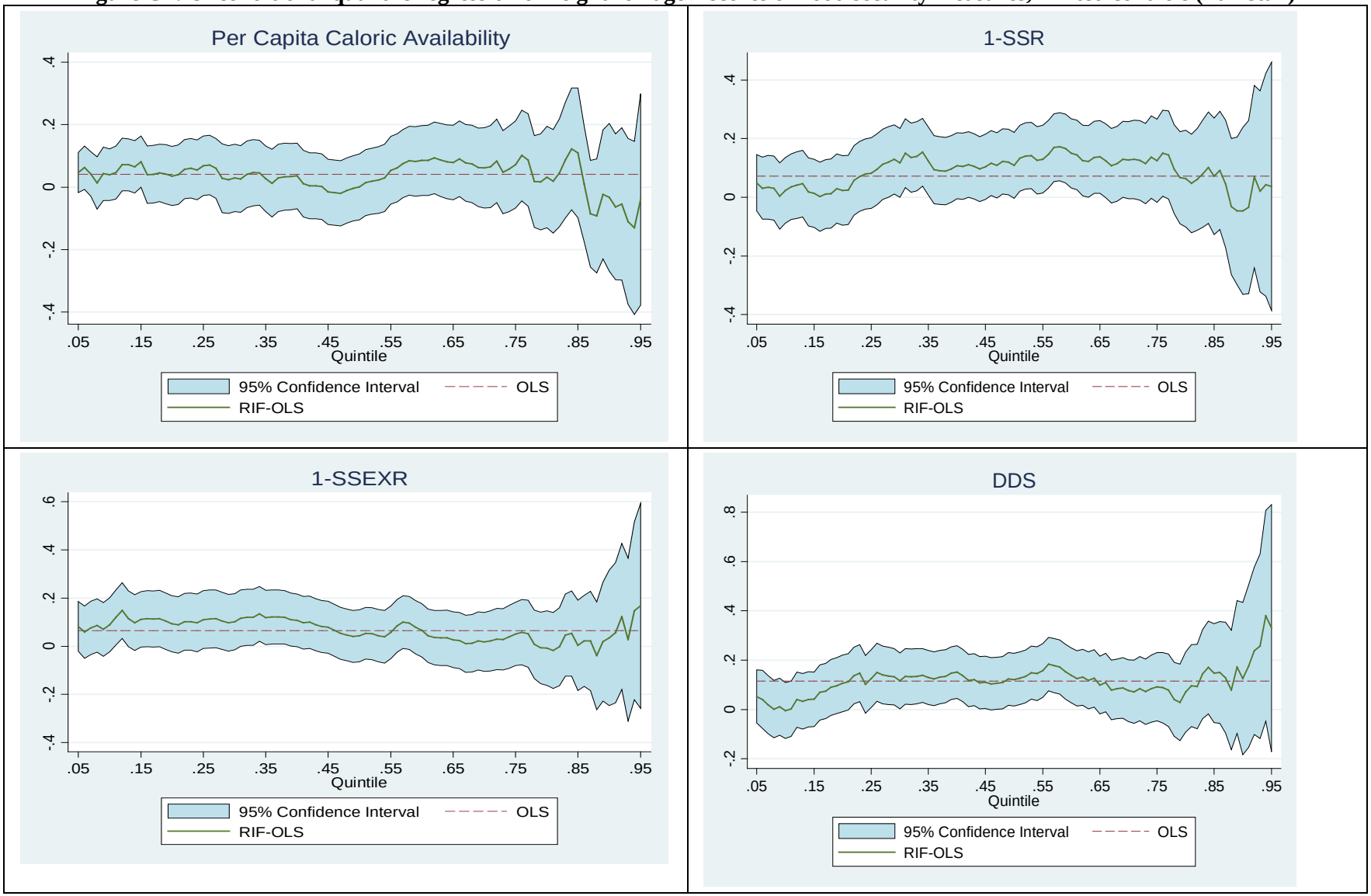
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Weight-for-age z-scores					
Structure of house (reference category: Kacha)						
Pacca	0.111	0.112	0.111	0.111	0.119	0.120
	(0.113)	(0.113)	(0.113)	(0.113)	(0.113)	(0.114)
Mixed	-0.067	-0.067	-0.067	-0.071	-0.066	-0.063
	(0.110)	(0.110)	(0.110)	(0.110)	(0.110)	(0.111)
Asset index (reference category: poorest)						
Asset index 2	-0.076	-0.073	-0.076	-0.057	-0.063	-0.065
	(0.133)	(0.132)	(0.132)	(0.133)	(0.133)	(0.133)
Asset index 3	0.112	0.117	0.110	0.137	0.108	0.109
	(0.139)	(0.138)	(0.139)	(0.139)	(0.139)	(0.138)
Asset index 4	0.122	0.130	0.119	0.167	0.115	0.111
	(0.152)	(0.152)	(0.151)	(0.154)	(0.153)	(0.152)
Asset index 5 (wealthiest)	0.155	0.167	0.152	0.210	0.150	0.153
	(0.170)	(0.169)	(0.169)	(0.171)	(0.177)	(0.167)
Child suffered from diarrhea	-0.308**	-0.307**	-0.308**	-0.302**	-0.307**	-0.307**
	(0.142)	(0.142)	(0.142)	(0.142)	(0.142)	(0.142)
Other illness	-0.228**	-0.227**	-0.228**	-0.230**	-0.223**	-0.221**
	(0.108)	(0.108)	(0.108)	(0.108)	(0.108)	(0.108)
rural or urban	0.218**	0.215**	0.217**	0.203*	0.220**	0.227**
	(0.108)	(0.109)	(0.108)	(0.108)	(0.108)	(0.108)
Punjab	-0.323*	-0.326*	-0.323*	-0.305	-0.324*	-0.312*
	(0.186)	(0.187)	(0.187)	(0.187)	(0.187)	(0.187)
Sindh	-1.310***	-1.315***	-1.309***	-1.297***	-1.314***	-1.307***
	(0.205)	(0.205)	(0.204)	(0.204)	(0.204)	(0.204)
Khyber Pkahtoon Khaw	0.126	0.118	0.128	0.152	0.119	0.139
	(0.212)	(0.215)	(0.212)	(0.214)	(0.213)	(0.213)
Constant	-1.489***	-1.485***	-1.487***	-1.538***	-1.521***	-1.543***
	(0.288)	(0.287)	(0.288)	(0.291)	(0.289)	(0.289)
Observations	2,182	2,182	2,182	2,182	2,175	2,175
R-squared	0.110	0.110	0.110	0.111	0.109	0.109

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the caloric share of non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in total food expenditure, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure in total expenditure.

Figure G1: Unconditional quantile regression of height-for-age z-scores on food security measures, limited controls (Pakistan)



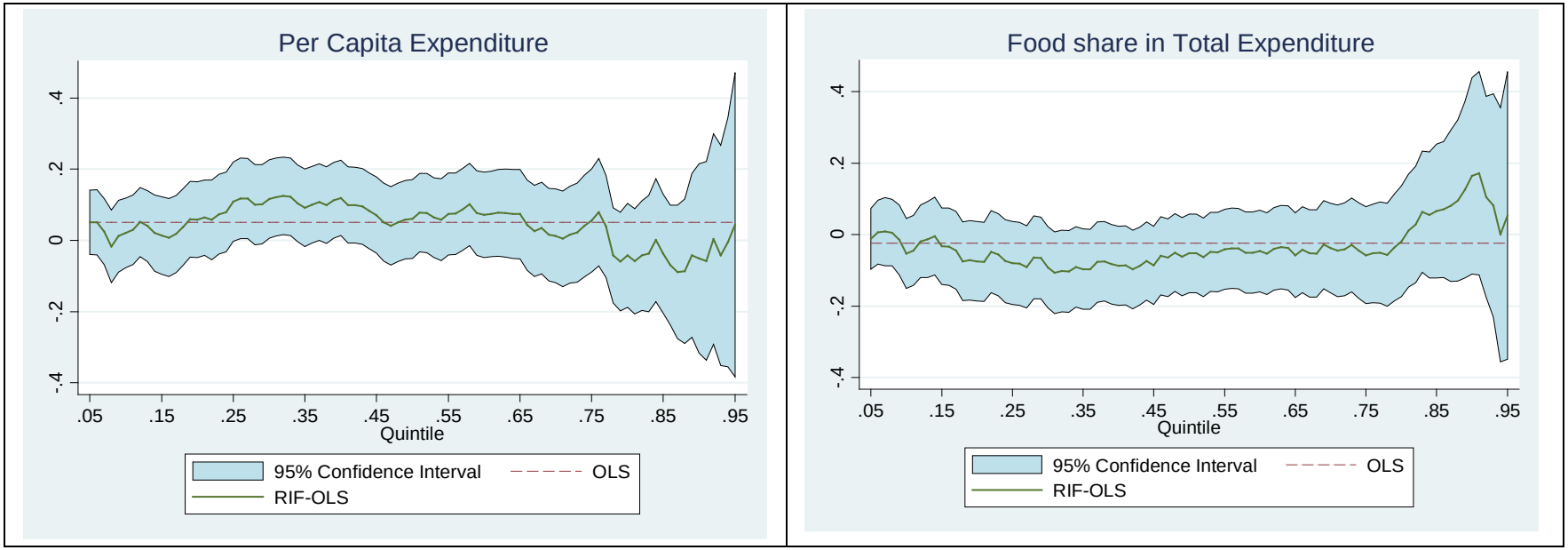
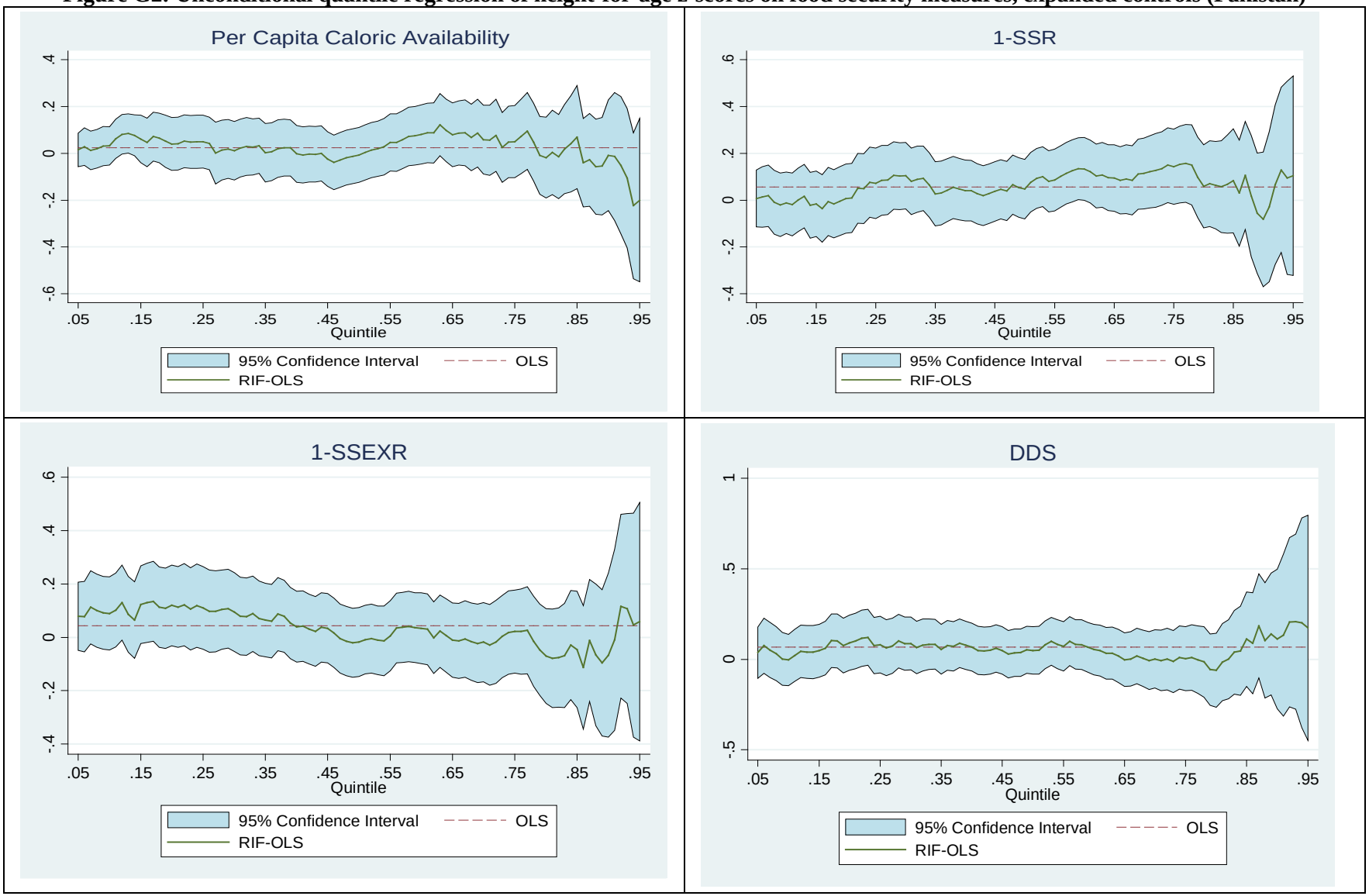

Per Capita Expenditure
-.4
-.2
0
.2
.4
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS
Food share in Total Expenditure
-.4
-.2
0
.2
.4
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS

Figure G2: Unconditional quantile regression of height-for-age z-scores on food security measures, expanded controls (Pakistan)




Per Capita Expenditure
.5
0
-.5
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS
Food share in Total Expenditure
.5
0
-.5
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS

APPENDIX H: TANZANIA

Table H1: Nutritional Indicators, by region

	Mean HAZ	Stunting incidence	Mean WAZ	Underweight incidence
All	-1.60	0.42	-0.86	0.15
Urban	-1.23	0.31	-0.73	0.13
Rural	-1.75	0.47	-0.91	0.16
by Region				
Dodoma	-2.02	0.61	-1.29	0.18
Arusha	-1.67	0.50	-0.89	0.18
Kilimanjaro	-1.13	0.23	-0.75	0.04
Tanga	-1.57	0.46	-0.78	0.16
Morogoro	-1.44	0.38	-0.84	0.13
Pwani	-1.39	0.39	-0.83	0.13
Dar es Salaam	-1.30	0.34	-0.53	0.09
Lindi	-1.73	0.46	-0.73	0.11
Mtwara	-1.84	0.38	-1.03	0.15
Ruvuma	-2.22	0.63	-1.29	0.26
Iringa	-2.19	0.64	-0.90	0.11
Mbeya	-1.92	0.52	-0.83	0.13
Singida	-1.61	0.31	-1.16	0.16
Tabora	-1.26	0.36	-0.67	0.10
Rukwa	-1.99	0.59	-0.99	0.20
Kigoma	-2.04	0.54	-1.26	0.25
Shinyanga	-1.42	0.35	-0.69	0.10
Kagera	-2.07	0.56	-1.17	0.24
Mwanza	-1.12	0.22	-0.51	0.11
Mara	-1.38	0.26	-0.62	0.08
Manyara	-1.22	0.38	-0.84	0.17
Mjini/Magharibi Unguja	-1.26	0.29	-1.14	0.24
Kaskazini pemba	-1.56	0.33	-0.34	0.06
Kusini Pemba	-0.99	0.33	-1.13	0.17

Table H2: Nutritional Indicators, by age and gender

Age in months	Boys		Girls	
	Mean HAZ	Stunting incidence	Mean HAZ	Stunting incidence
0-5	-1.09	0.26	-0.66	0.22
6-11	-1.53	0.39	-1.01	0.23
12-23	-1.80	0.56	-1.65	0.47
24-35	-1.86	0.58	-1.76	0.47
36-47	-1.79	0.45	-1.67	0.37
48-60	-1.49	0.36	-1.66	0.40

Table H3: Descriptive Statistics of Key Variables (Tanzania)

Variable	Obs	Mean	Std. Dev.	Min	Max
Z-Scores					
HAZ	1099	-1.60	1.45	-5.39	4.08
WAZ	1117	-0.86	1.16	-5.93	2.87
Food Security Measures					
PC kcal	1126	1307.29	859.13	2.6	5453
1-SSR	1126	0.94	0.03	0.86	1
1-SSEXR	1124	0.61	0.23	0	1
DDS	1126	8.41	1.97	1	12
PC expenditure	1122	1755.04	1192.53	94.66	10823
Food share	1122	0.83	0.12	0.26	1.00
Child is female	1126	0.52	0.50	0	1
Age (in months)	1126	30.76	17.21	0.99	62.95
Age squared	1126	1242.29	1079.49	0.97	3962.53
HH size	1126	7.17	4.61	2	46
Share of kids under 5	1126	0.31	0.12	0.05	1
Female-headed HH	1126	0.18	0.39	0	1
HH head Education					
No schooling	1113	0.18	0.39	0	1
Some primary education	1113	0.67	0.47	0	1
Completed primary education	1113	0.01	0.10	0	1
Some secondary education	1113	0.09	0.29	0	1
Completed secondary education	1113	0.02	0.15	0	1
More than Secondary education	1113	0.02	0.13	0	1
Mother's Education					
No schooling	1122	0.20	0.40	0	1
Some primary education	1122	0.65	0.48	0	1
Completed primary education	1122	0.04	0.19	0	1
Some secondary education	1122	0.09	0.28	0	1
Completed secondary education	1122	0.01	0.10	0	1
More than Secondary education	1122	0.01	0.10	0	1
Piped water	1126	0.07	0.26	0	1
Flush toilet	1126	0.06	0.24	0	1
Latrine	1126	0.77	0.42	0	1
No toilet	1126	0.11	0.32	0	1
Asset index					
Asset index 1(poorest)	1124	0.32	0.47	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
Asset index 2	1124	0.42	0.49	0	1
Asset index 3	1124	0.26	0.44	0	1
Rural	1126	0.70	0.46	0	1
Dodoma	1126	0.03	0.17	0	1
Arusha	1126	0.03	0.18	0	1
Kilimanjar	1126	0.02	0.14	0	1
Tanga	1126	0.04	0.19	0	1
Morogoro	1126	0.03	0.18	0	1
Pwani	1126	0.02	0.14	0	1
Daressalaa	1126	0.11	0.31	0	1
Lindi	1126	0.03	0.18	0	1
Mtwara	1126	0.04	0.20	0	1
Ruvuma	1126	0.05	0.21	0	1
Iringa	1126	0.04	0.20	0	1
Mbeya	1126	0.05	0.22	0	1
Singida	1126	0.02	0.13	0	1
Tabora	1126	0.06	0.24	0	1
Rukwa	1126	0.04	0.21	0	1
Kigoma	1126	0.04	0.20	0	1
Shinyanga	1126	0.07	0.25	0	1
Kagera	1126	0.05	0.22	0	1
Mwanza	1126	0.06	0.23	0	1
Mara	1126	0.03	0.17	0	1
Manyara	1126	0.04	0.19	0	1
Kaskaziniu	1126	0.00	0.04	0	1
Kusiniungu	1126	0.07	0.25	0	1
Mjinimagha	1126	0.01	0.11	0	1
Kaskazinip	1126	0.01	0.10	0	1

Source: Authors' calculations

Table H4: Relationship between food security measures and height-for-age z-scores (Tanzania): Limited Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Height-for-age z-scores					
Per capita kcal	-0.004					
	(0.053)					
1-SSR		0.005				
		(0.047)				
1-SSEXR			0.049			
			(0.046)			
DDS				0.147***		
				(0.045)		
PC expenditure					-0.002	
					(0.054)	
Food share						-0.149***
						(0.046)
Rural	-0.522***	-0.519***	-0.513***	-0.431***	-0.524***	-0.452***
	(0.135)	(0.129)	(0.131)	(0.133)	(0.135)	(0.132)
Dodoma	-0.549	-0.550	-0.553	-0.443	-0.546	-0.511
	(0.591)	(0.589)	(0.585)	(0.567)	(0.593)	(0.574)
Arusha	-0.222	-0.221	-0.188	-0.218	-0.199	-0.198
	(0.618)	(0.616)	(0.614)	(0.599)	(0.623)	(0.605)
Kilimanjaro	0.201	0.206	0.236	0.170	0.202	0.145
	(0.614)	(0.614)	(0.605)	(0.594)	(0.615)	(0.599)
Tanga	-0.108	-0.109	-0.098	-0.151	-0.108	-0.107
	(0.611)	(0.601)	(0.596)	(0.588)	(0.609)	(0.583)
Morogoro	0.035	0.037	0.041	0.013	0.036	0.037
	(0.608)	(0.606)	(0.598)	(0.585)	(0.610)	(0.588)
Pwani	-0.092	-0.092	-0.093	-0.077	-0.094	-0.132
	(0.670)	(0.660)	(0.653)	(0.639)	(0.661)	(0.646)
Dar es salaam	-0.193	-0.194	-0.201	-0.255	-0.193	-0.282
	(0.574)	(0.567)	(0.563)	(0.551)	(0.579)	(0.555)
Lindi	-0.301	-0.301	-0.274	-0.207	-0.300	-0.284
	(0.605)	(0.600)	(0.594)	(0.579)	(0.604)	(0.586)
Mtwara	-0.405	-0.406	-0.387	-0.381	-0.405	-0.381
	(0.592)	(0.584)	(0.576)	(0.563)	(0.591)	(0.567)
Ruvuma	-0.752	-0.750	-0.733	-0.714	-0.751	-0.719
	(0.580)	(0.578)	(0.570)	(0.557)	(0.579)	(0.561)
Iringa	-0.796	-0.795	-0.773	-0.799	-0.794	-0.795
	(0.584)	(0.582)	(0.575)	(0.562)	(0.587)	(0.567)
Mbeya	-0.430	-0.430	-0.411	-0.461	-0.428	-0.464
	(0.589)	(0.585)	(0.579)	(0.568)	(0.592)	(0.571)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Height-for-age z-scores					
Singida	-0.173	-0.175	-0.130	-0.086	-0.169	-0.128
	(0.599)	(0.598)	(0.591)	(0.579)	(0.603)	(0.585)
Tabora	0.198	0.199	0.232	0.219	0.226	0.130
	(0.592)	(0.592)	(0.587)	(0.574)	(0.593)	(0.578)
Rukwa	-0.533	-0.532	-0.504	-0.489	-0.531	-0.494
	(0.601)	(0.597)	(0.591)	(0.580)	(0.601)	(0.582)
Kigoma	-0.651	-0.648	-0.611	-0.613	-0.649	-0.668
	(0.584)	(0.583)	(0.575)	(0.564)	(0.584)	(0.570)
Shinyanga	0.071	0.072	0.098	0.104	0.074	0.077
	(0.587)	(0.586)	(0.579)	(0.567)	(0.587)	(0.572)
Kagera	-0.612	-0.609	-0.587	-0.638	-0.611	-0.629
	(0.583)	(0.580)	(0.572)	(0.560)	(0.582)	(0.564)
Mwanza	0.323	0.327	0.360	0.337	0.326	0.270
	(0.577)	(0.579)	(0.571)	(0.559)	(0.579)	(0.563)
Mara	-0.084	-0.080	-0.068	-0.077	-0.081	-0.180
	(0.594)	(0.594)	(0.587)	(0.578)	(0.596)	(0.583)
Manyara	0.260	0.262	0.289	0.331	0.322	0.298
	(0.622)	(0.621)	(0.613)	(0.601)	(0.629)	(0.611)
Kusini unguja	0.538	0.543	0.519	0.568	0.537	0.544
	(0.565)	(0.566)	(0.564)	(0.582)	(0.563)	(0.567)
Mjini/Magharbi unguja	-0.269	-0.268	-0.272	-0.246	-0.269	-0.325
	(0.571)	(0.570)	(0.566)	(0.552)	(0.571)	(0.556)
Kaskazini pemba	-0.561	-0.558	-0.574	-0.555	-0.561	-0.608
	(0.710)	(0.710)	(0.707)	(0.685)	(0.709)	(0.701)
Constant	-0.997*	-1.000*	-1.020*	-1.072**	-0.997*	-1.023*
	(0.546)	(0.546)	(0.539)	(0.524)	(0.547)	(0.530)
Observations	1,099	1,099	1,097	1,099	1,095	1,095
R-squared	0.077	0.077	0.079	0.085	0.078	0.087

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in the total food expenditure, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure on total expenditure.

Table H5: Relationship between food security measures and weight-for-age z-scores (Tanzania): Limited Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Weight-for-age z-scores					
Per capita kcal	-0.017					
	(0.041)					
1-SSR		0.049				
		(0.038)				
1-SSEXR			0.089**			
			(0.037)			
DDS				0.142***		
				(0.037)		
PC expenditure					0.045	
					(0.041)	
Food share						-0.098***
						(0.038)
Rural	-0.244**	-0.230**	-0.217**	-0.148	-0.204*	-0.189*
	(0.109)	(0.105)	(0.106)	(0.107)	(0.109)	(0.106)
Dodoma	0.064	0.062	0.051	0.156	0.024	0.087
	(0.396)	(0.392)	(0.392)	(0.387)	(0.395)	(0.386)
Arusha	0.451	0.472	0.484	0.448	0.425	0.463
	(0.392)	(0.387)	(0.389)	(0.381)	(0.394)	(0.387)
Kilimanjaro	0.546	0.609	0.599	0.502	0.496	0.503
	(0.393)	(0.389)	(0.385)	(0.381)	(0.391)	(0.385)
Tanga	0.576	0.599	0.580	0.520	0.499	0.560
	(0.414)	(0.408)	(0.407)	(0.404)	(0.411)	(0.400)
Morogoro	0.526	0.570	0.523	0.491	0.443	0.512
	(0.397)	(0.394)	(0.392)	(0.387)	(0.399)	(0.388)
Pwani	0.459	0.488	0.445	0.458	0.409	0.415
	(0.423)	(0.413)	(0.415)	(0.410)	(0.417)	(0.414)
Dar es salaam	0.673*	0.681**	0.647*	0.601*	0.580	0.599*
	(0.354)	(0.346)	(0.346)	(0.340)	(0.358)	(0.344)
Lindi	0.611	0.626	0.649	0.696*	0.566	0.610
	(0.402)	(0.397)	(0.396)	(0.391)	(0.401)	(0.393)
Mtwara	0.316	0.341	0.335	0.324	0.236	0.315
	(0.385)	(0.379)	(0.378)	(0.372)	(0.384)	(0.373)
Ruvuma	0.065	0.108	0.089	0.092	0.016	0.076
	(0.374)	(0.371)	(0.369)	(0.362)	(0.372)	(0.365)
Iringa	0.424	0.452	0.460	0.413	0.367	0.418
	(0.370)	(0.366)	(0.365)	(0.360)	(0.370)	(0.361)
Mbeya	0.542	0.563	0.566	0.504	0.481	0.510

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Weight-for-age z-scores					
	(0.372)	(0.368)	(0.365)	(0.361)	(0.372)	(0.363)
Singida	0.173	0.156	0.247	0.255	0.130	0.201
	(0.412)	(0.410)	(0.408)	(0.401)	(0.413)	(0.405)
Tabora	0.675*	0.688*	0.690*	0.701*	0.645*	0.613
	(0.380)	(0.377)	(0.377)	(0.370)	(0.379)	(0.375)
Rukwa	0.375	0.397	0.418	0.407	0.330	0.393
	(0.381)	(0.377)	(0.376)	(0.372)	(0.379)	(0.372)
Kigoma	0.053	0.090	0.121	0.087	0.029	0.038
	(0.365)	(0.362)	(0.359)	(0.354)	(0.362)	(0.358)
Shinyanga	0.669*	0.687*	0.712**	0.699**	0.637*	0.671*
	(0.365)	(0.361)	(0.361)	(0.354)	(0.363)	(0.358)
Kagera	0.186	0.232	0.221	0.151	0.140	0.165
	(0.374)	(0.370)	(0.369)	(0.361)	(0.372)	(0.365)
Mwanza	0.821**	0.867**	0.884**	0.834**	0.804**	0.785**
	(0.362)	(0.360)	(0.358)	(0.352)	(0.359)	(0.355)
Mara	0.657*	0.703*	0.682*	0.662*	0.624*	0.592
	(0.375)	(0.374)	(0.372)	(0.368)	(0.374)	(0.372)
Manyara	0.510	0.540	0.556	0.571	0.559	0.575
	(0.383)	(0.380)	(0.378)	(0.372)	(0.381)	(0.375)
Kusini ungunja	1.235**	1.289**	1.197**	1.259***	1.228**	1.234**
	(0.569)	(0.570)	(0.544)	(0.480)	(0.544)	(0.531)
Mjini/ Magharibi ungunja	-0.007	0.006	-0.014	0.015	-0.013	-0.045
	(0.357)	(0.352)	(0.353)	(0.347)	(0.353)	(0.351)
Kaskazini pemba	0.791*	0.820*	0.766	0.796*	0.791*	0.759*
	(0.465)	(0.463)	(0.467)	(0.461)	(0.464)	(0.461)
Constant	-1.136***	-1.170***	-1.176***	-1.207***	-1.117***	-1.152***
	(0.329)	(0.326)	(0.325)	(0.318)	(0.326)	(0.321)
Observations	1,117	1,117	1,115	1,117	1,113	1,113
R-squared	0.054	0.056	0.059	0.066	0.055	0.060

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in the total food expenditure, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure on total expenditure.

Table H6: Relationship between food security measures and height-for-age z-scores (Tanzania): Expanded Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Height-for-age z-scores					
Per capita kcal	0.001					
	(0.058)					
1-SSR		-0.028				
		(0.048)				
1-SSEXR			-0.001			
			(0.048)			
DDS				0.067		
				(0.051)		
PC expenditure					-0.027	
					(0.059)	
Food share						-0.070
						(0.047)
Child is female	0.174**	0.172**	0.174**	0.175**	0.173**	0.171**
	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)	(0.085)
Age (in months)	-0.060***	-0.060***	-0.060***	-0.060***	-0.060***	-0.060***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)
Age squared	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household size	0.012	0.013	0.011	0.012	0.009	0.006
	(0.015)	(0.015)	(0.014)	(0.014)	(0.015)	(0.014)
Share of kids under 5	-0.193	-0.199	-0.190	-0.173	-0.168	-0.231
	(0.372)	(0.372)	(0.374)	(0.372)	(0.372)	(0.374)
Femal- headed HH	-0.186	-0.187	-0.188	-0.181	-0.190	-0.175
	(0.119)	(0.119)	(0.119)	(0.119)	(0.119)	(0.119)
HH Head's Education						
Did not finish Primary School	-0.065	-0.062	-0.063	-0.077	-0.060	-0.062
	(0.130)	(0.131)	(0.131)	(0.131)	(0.131)	(0.130)
Finished Primary School	-0.702**	-0.706**	-0.698**	-0.698**	-0.698**	-0.669**
	(0.313)	(0.311)	(0.314)	(0.324)	(0.311)	(0.311)
Did not finish Secondary School	0.076	0.078	0.076	0.056	0.082	0.083
	(0.237)	(0.235)	(0.235)	(0.236)	(0.236)	(0.235)
Finished Secondary School	-0.344	-0.344	-0.346	-0.370	-0.326	-0.363
	(0.305)	(0.304)	(0.305)	(0.306)	(0.309)	(0.304)
Higher than Secondary School	0.287	0.281	0.284	0.277	0.296	0.257
	(0.353)	(0.352)	(0.350)	(0.348)	(0.350)	(0.355)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Height-for-age z-scores					
Mother's Education						
Did not finish Primary School	0.026	0.024	0.027	0.019	0.026	0.024
	(0.114)	(0.115)	(0.115)	(0.114)	(0.115)	(0.115)
Finished Primary School	0.116	0.117	0.116	0.109	0.113	0.099
	(0.254)	(0.255)	(0.255)	(0.254)	(0.256)	(0.256)
Did not finish Secondary School	-0.052	-0.049	-0.053	-0.063	-0.048	-0.082
	(0.222)	(0.222)	(0.224)	(0.222)	(0.222)	(0.222)
Finished Secondary School	-0.195	-0.199	-0.194	-0.215	-0.194	-0.198
	(0.418)	(0.414)	(0.418)	(0.419)	(0.415)	(0.414)
Higher than Secondary School	0.901***	0.904***	0.905***	0.850**	0.909***	0.878**
	(0.339)	(0.339)	(0.339)	(0.343)	(0.339)	(0.343)
Piped water	0.059	0.062	0.059	0.054	0.066	0.027
	(0.247)	(0.245)	(0.248)	(0.247)	(0.247)	(0.248)
Latrine	-0.063	-0.063	-0.057	-0.044	-0.064	-0.052
	(0.193)	(0.195)	(0.197)	(0.197)	(0.196)	(0.195)
No toilet	-0.143	-0.137	-0.145	-0.114	-0.154	-0.124
	(0.242)	(0.244)	(0.245)	(0.246)	(0.245)	(0.244)
Asset index 2	0.267***	0.269***	0.263**	0.234**	0.270***	0.250**
	(0.102)	(0.102)	(0.102)	(0.105)	(0.103)	(0.103)
Asset index 3	0.487***	0.489***	0.487***	0.429**	0.498***	0.460***
	(0.178)	(0.175)	(0.175)	(0.182)	(0.177)	(0.177)
Rural	-0.344**	-0.349**	-0.351**	-0.341**	-0.358**	-0.332**
	(0.161)	(0.161)	(0.162)	(0.160)	(0.162)	(0.162)
Dodoma	-0.199	-0.186	-0.201	-0.170	-0.180	-0.226
	(0.596)	(0.598)	(0.599)	(0.591)	(0.598)	(0.595)
Arusha	0.018	0.011	0.050	0.016	0.068	0.016
	(0.620)	(0.620)	(0.622)	(0.616)	(0.623)	(0.620)
Kilimanjaro	0.338	0.309	0.335	0.329	0.355	0.282
	(0.612)	(0.613)	(0.610)	(0.609)	(0.614)	(0.610)
Tanga	0.207	0.196	0.208	0.169	0.242	0.167
	(0.605)	(0.595)	(0.597)	(0.599)	(0.602)	(0.593)
Morogoro	0.206	0.186	0.205	0.199	0.237	0.171
	(0.604)	(0.603)	(0.603)	(0.599)	(0.604)	(0.600)
Pwani	0.174	0.157	0.173	0.176	0.193	0.124
	(0.681)	(0.673)	(0.670)	(0.666)	(0.672)	(0.670)
Dar es salaam	-0.025	-0.029	-0.030	-0.042	0.011	-0.096
	(0.576)	(0.572)	(0.575)	(0.570)	(0.580)	(0.571)
Lindi	0.064	0.061	0.063	0.093	0.084	0.032
	(0.599)	(0.595)	(0.595)	(0.590)	(0.597)	(0.593)
Mtwara	-0.171	-0.181	-0.173	-0.164	-0.139	-0.194

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Height-for-age z-scores					
	(0.591)	(0.585)	(0.584)	(0.582)	(0.590)	(0.582)
Ruvuma	-0.450	-0.469	-0.452	-0.438	-0.430	-0.465
	(0.571)	(0.570)	(0.568)	(0.565)	(0.570)	(0.566)
Iringa	-0.697	-0.705	-0.699	-0.691	-0.674	-0.726
	(0.569)	(0.569)	(0.567)	(0.565)	(0.572)	(0.566)
Mbeya	-0.172	-0.177	-0.174	-0.184	-0.150	-0.222
	(0.589)	(0.589)	(0.588)	(0.586)	(0.591)	(0.588)
Singida	0.275	0.298	0.272	0.311	0.291	0.264
	(0.598)	(0.602)	(0.598)	(0.595)	(0.603)	(0.598)
Tabora	0.188	0.179	0.204	0.192	0.230	0.175
	(0.580)	(0.580)	(0.579)	(0.576)	(0.581)	(0.577)
Rukwa	-0.300	-0.306	-0.302	-0.291	-0.282	-0.317
	(0.600)	(0.599)	(0.597)	(0.595)	(0.600)	(0.595)
Kigoma	-0.360	-0.372	-0.363	-0.359	-0.349	-0.402
	(0.574)	(0.574)	(0.573)	(0.571)	(0.575)	(0.573)
Shinyanga	0.331	0.327	0.331	0.334	0.351	0.310
	(0.577)	(0.578)	(0.576)	(0.574)	(0.579)	(0.576)
Kagera	-0.438	-0.459	-0.438	-0.450	-0.421	-0.471
	(0.578)	(0.576)	(0.575)	(0.574)	(0.577)	(0.574)
Mwanza	0.469	0.451	0.468	0.470	0.482	0.427
	(0.571)	(0.573)	(0.570)	(0.568)	(0.572)	(0.570)
Mara	0.070	0.051	0.067	0.077	0.081	-0.007
	(0.597)	(0.598)	(0.598)	(0.596)	(0.599)	(0.600)
Manyara	0.671	0.665	0.674	0.674	0.692	0.622
	(0.616)	(0.616)	(0.616)	(0.614)	(0.618)	(0.616)
Kusini ungunja	0.899	0.872	0.893	0.912	0.887	0.901
	(0.933)	(0.934)	(0.935)	(0.956)	(0.928)	(0.947)
Mjini / Magharibi ungunja	-0.110	-0.111	-0.113	-0.094	-0.115	-0.136
	(0.569)	(0.571)	(0.571)	(0.566)	(0.570)	(0.567)
Kaskazini pemba	-0.385	-0.399	-0.389	-0.371	-0.398	-0.396
	(0.710)	(0.710)	(0.712)	(0.701)	(0.711)	(0.709)
Constant	-0.772	-0.772	-0.769	-0.761	-0.781	-0.689
	(0.674)	(0.675)	(0.674)	(0.673)	(0.674)	(0.674)
Observations	1,086	1,086	1,084	1,086	1,084	1,084
R-squared	0.143	0.143	0.143	0.144	0.143	0.145

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in the total food expenditure, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure on total expenditure.

Table H7: Relationship between food security measures and weight-for-age z-scores (Tanzania): Expanded Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Weight-for-age z-scores					
Per capita kcal	-0.034					
	(0.044)					
1-SSR		0.034				
		(0.039)				
1-SSEXR			0.033			
			(0.036)			
DDS				0.065		
				(0.041)		
PC expenditure					0.016	
					(0.047)	
Food share						-0.031
						(0.037)
Child is female	0.063	0.066	0.069	0.066	0.068	0.066
	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)	(0.068)
Age (in months)	-0.034***	-0.034***	-0.034***	-0.034***	-0.034***	-0.034***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Age squared	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household size	-0.000	0.000	0.001	0.003	0.004	0.000
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Share of kids under 5	-0.070	-0.085	-0.081	-0.075	-0.105	-0.112
	(0.292)	(0.290)	(0.291)	(0.290)	(0.293)	(0.290)
Female-headed HH	-0.154	-0.153	-0.155	-0.152	-0.155	-0.150
	(0.100)	(0.100)	(0.100)	(0.100)	(0.100)	(0.100)
HH Head's Education						
Did not finish Primary School	-0.104	-0.108	-0.108	-0.116	-0.108	-0.105
	(0.106)	(0.106)	(0.106)	(0.106)	(0.107)	(0.106)
Finished Primary School	-0.796**	-0.795**	-0.783**	-0.799**	-0.803**	-0.791**
	(0.346)	(0.344)	(0.353)	(0.353)	(0.348)	(0.347)
Did not finish Secondary School	-0.066	-0.075	-0.072	-0.094	-0.078	-0.072
	(0.171)	(0.170)	(0.170)	(0.170)	(0.171)	(0.170)
Finished Secondary School	-0.276	-0.287	-0.300	-0.316	-0.304	-0.300
	(0.250)	(0.247)	(0.246)	(0.247)	(0.253)	(0.247)
Higher than Secondary School	-0.147	-0.152	-0.161	-0.170	-0.169	-0.174
	(0.286)	(0.287)	(0.284)	(0.286)	(0.288)	(0.289)
Mother's Education						
Did not finish Primary School	-0.046	-0.048	-0.054	-0.058	-0.051	-0.053

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Weight-for-age z-scores					
	(0.094)	(0.094)	(0.094)	(0.094)	(0.094)	(0.094)
Finished Primary School	-0.067	-0.069	-0.072	-0.075	-0.066	-0.076
	(0.189)	(0.189)	(0.189)	(0.188)	(0.190)	(0.190)
Did not finish Secondary School	0.016	0.007	-0.004	-0.001	0.004	-0.005
	(0.176)	(0.176)	(0.178)	(0.175)	(0.176)	(0.177)
Finished Secondary School	0.279	0.287	0.274	0.263	0.281	0.280
	(0.359)	(0.365)	(0.362)	(0.361)	(0.361)	(0.359)
Higher than Secondary School	0.131	0.124	0.117	0.078	0.126	0.115
	(0.382)	(0.385)	(0.383)	(0.386)	(0.383)	(0.385)
Piped water	0.269	0.267	0.258	0.265	0.262	0.252
	(0.190)	(0.190)	(0.191)	(0.190)	(0.190)	(0.190)
Latrine	-0.066	-0.059	-0.047	-0.040	-0.050	-0.053
	(0.143)	(0.143)	(0.144)	(0.143)	(0.143)	(0.143)
No toilet	-0.117	-0.116	-0.099	-0.079	-0.099	-0.096
	(0.187)	(0.187)	(0.188)	(0.189)	(0.187)	(0.188)
Asset index 2	0.261***	0.251***	0.250***	0.221**	0.251***	0.250***
	(0.087)	(0.087)	(0.087)	(0.088)	(0.087)	(0.087)
Asset index 3	0.396***	0.382***	0.386***	0.325**	0.384***	0.378***
	(0.130)	(0.129)	(0.129)	(0.135)	(0.130)	(0.131)
Rural	-0.083	-0.068	-0.076	-0.072	-0.077	-0.072
	(0.121)	(0.120)	(0.121)	(0.120)	(0.121)	(0.120)
Dodoma	0.383	0.367	0.364	0.406	0.371	0.374
	(0.375)	(0.376)	(0.380)	(0.378)	(0.378)	(0.377)
Arusha	0.632*	0.633*	0.650*	0.625*	0.643*	0.639*
	(0.365)	(0.364)	(0.370)	(0.368)	(0.371)	(0.371)
Kilimanjaro	0.782**	0.809**	0.783**	0.764**	0.763**	0.753**
	(0.377)	(0.377)	(0.378)	(0.379)	(0.380)	(0.380)
Tanga	0.852**	0.832**	0.815**	0.782**	0.802**	0.805**
	(0.387)	(0.386)	(0.389)	(0.390)	(0.388)	(0.388)
Morogoro	0.670*	0.672*	0.641*	0.642*	0.632*	0.637*
	(0.369)	(0.370)	(0.373)	(0.372)	(0.375)	(0.373)
Pwani	0.611	0.594	0.564	0.573	0.561	0.551
	(0.410)	(0.403)	(0.408)	(0.406)	(0.407)	(0.410)
Dar es salaam	0.845**	0.824**	0.803**	0.805**	0.793**	0.789**
	(0.330)	(0.327)	(0.333)	(0.331)	(0.342)	(0.333)
Lindi	0.886**	0.871**	0.874**	0.898**	0.859**	0.858**
	(0.381)	(0.380)	(0.383)	(0.380)	(0.385)	(0.382)
Mtwara	0.549	0.531	0.519	0.525	0.501	0.512
	(0.363)	(0.360)	(0.363)	(0.363)	(0.368)	(0.363)
Ruvuma	0.400	0.405	0.385	0.395	0.374	0.381
	(0.349)	(0.349)	(0.351)	(0.350)	(0.352)	(0.350)

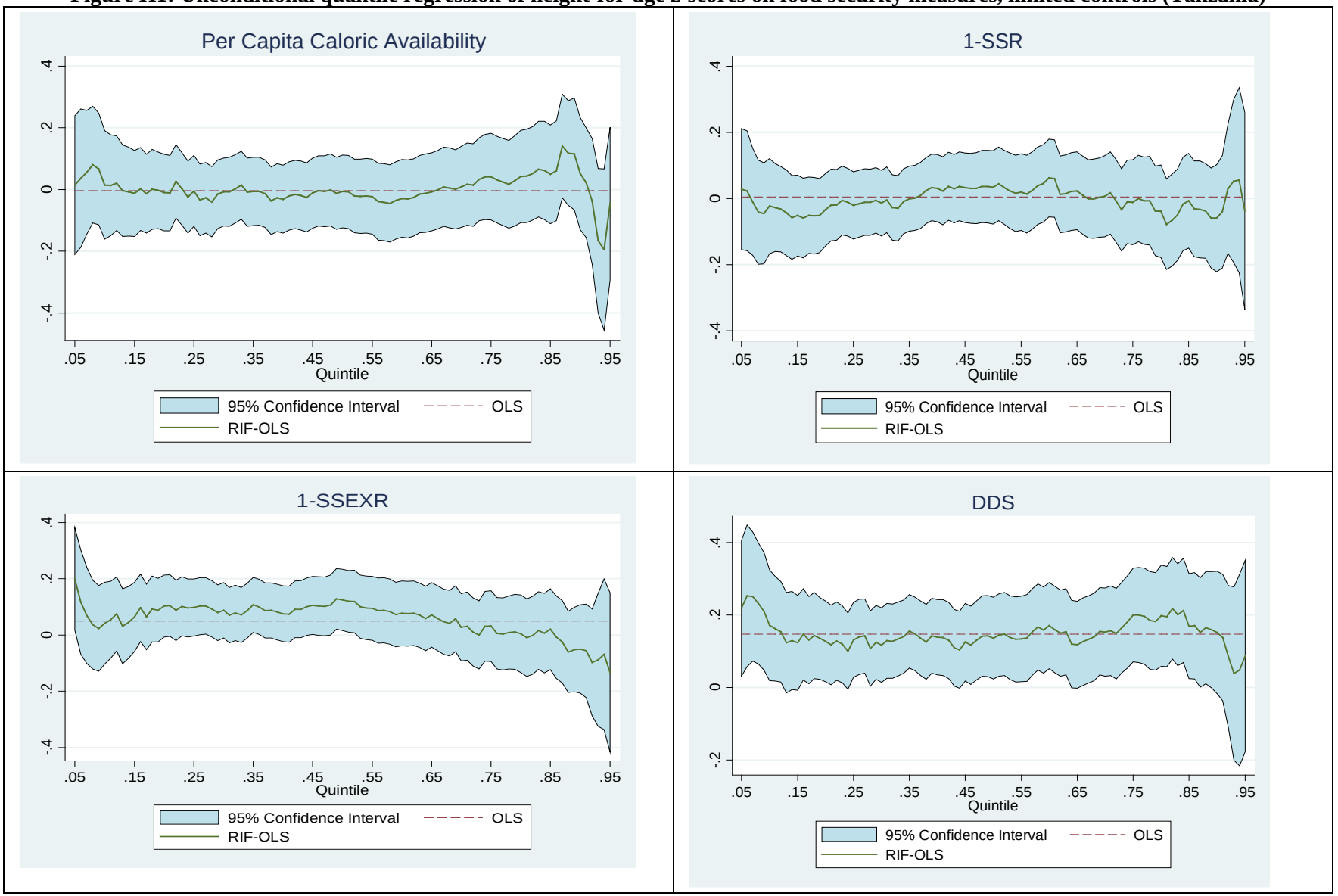
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Weight-for-age z-scores					
Iringa	0.550	0.552	0.548	0.548	0.529	0.532
	(0.343)	(0.342)	(0.346)	(0.346)	(0.348)	(0.346)
Mbeya	0.767**	0.763**	0.760**	0.746**	0.747**	0.740**
	(0.353)	(0.352)	(0.356)	(0.356)	(0.358)	(0.358)
Singida	0.559	0.543	0.590	0.608	0.565	0.573
	(0.413)	(0.412)	(0.414)	(0.411)	(0.416)	(0.414)
Tabora	0.784**	0.782**	0.763**	0.776**	0.746**	0.749**
	(0.339)	(0.338)	(0.342)	(0.341)	(0.344)	(0.342)
Rukwa	0.540	0.535	0.536	0.536	0.520	0.525
	(0.363)	(0.362)	(0.365)	(0.365)	(0.366)	(0.364)
Kigoma	0.303	0.311	0.309	0.297	0.290	0.281
	(0.337)	(0.336)	(0.339)	(0.339)	(0.339)	(0.341)
Shinyanga	0.884***	0.886***	0.889***	0.885***	0.873**	0.876**
	(0.337)	(0.336)	(0.340)	(0.339)	(0.341)	(0.340)
Kagera	0.336	0.346	0.327	0.309	0.313	0.309
	(0.347)	(0.347)	(0.350)	(0.349)	(0.350)	(0.350)
Mwanza	1.013***	1.035***	1.029***	1.015***	1.008***	0.998***
	(0.335)	(0.336)	(0.338)	(0.338)	(0.338)	(0.339)
Mara	0.806**	0.834**	0.809**	0.819**	0.804**	0.780**
	(0.356)	(0.357)	(0.359)	(0.359)	(0.358)	(0.363)
Manyara	0.867**	0.872**	0.869**	0.865**	0.858**	0.846**
	(0.353)	(0.354)	(0.357)	(0.356)	(0.357)	(0.359)
Kusini ungunja	1.279***	1.306***	1.254***	1.285***	1.278***	1.277***
	(0.365)	(0.364)	(0.369)	(0.366)	(0.366)	(0.365)
Mjini / Magharibi ungunja	0.001	0.008	0.001	0.023	0.008	-0.004
	(0.321)	(0.320)	(0.324)	(0.322)	(0.322)	(0.324)
Kaskazini pemba	0.788*	0.807*	0.780*	0.805*	0.795*	0.787*
	(0.448)	(0.450)	(0.453)	(0.449)	(0.450)	(0.450)
Constant	-0.861**	-0.861**	-0.858**	-0.850**	-0.853**	-0.824*
	(0.417)	(0.416)	(0.421)	(0.421)	(0.420)	(0.422)
Observations	1,101	1,101	1,099	1,101	1,099	1,099
R-squared	0.123	0.123	0.124	0.125	0.123	0.124

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Per capita kcal is the per capita caloric availability, 1-SSR is the share of calories derived from non-starchy staple food, 1-SSEXR is the expenditure share of non-starchy staple food in the total food expenditure, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure on total expenditure.

Figure H1: Unconditional quantile regression of height-for-age z-scores on food security measures, limited controls (Tanzania)



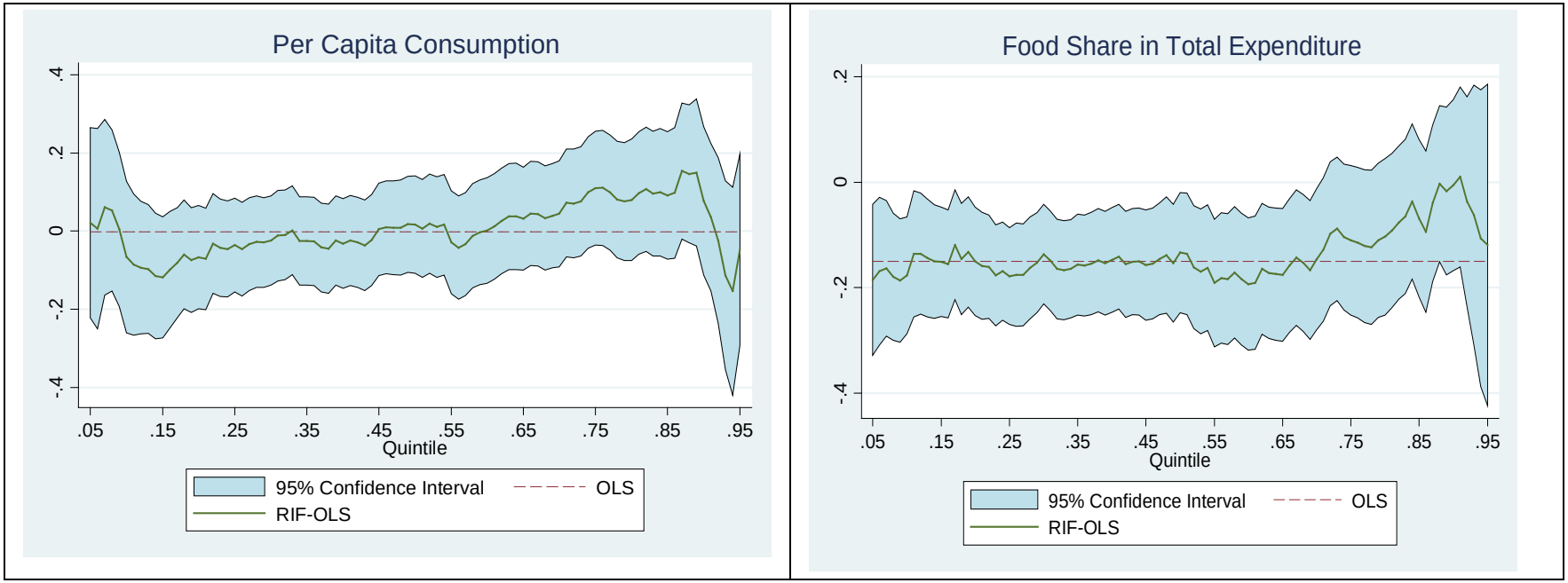
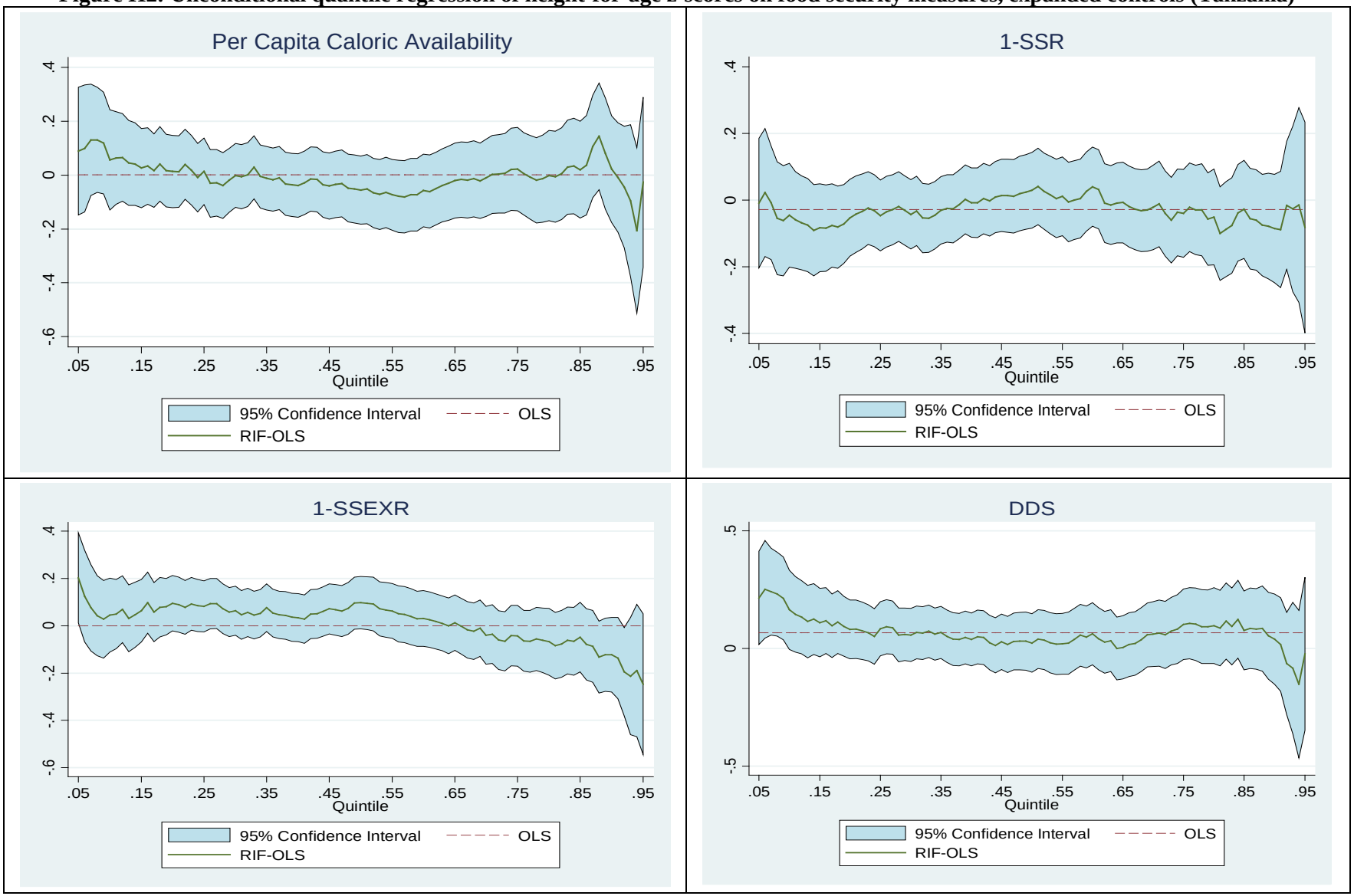
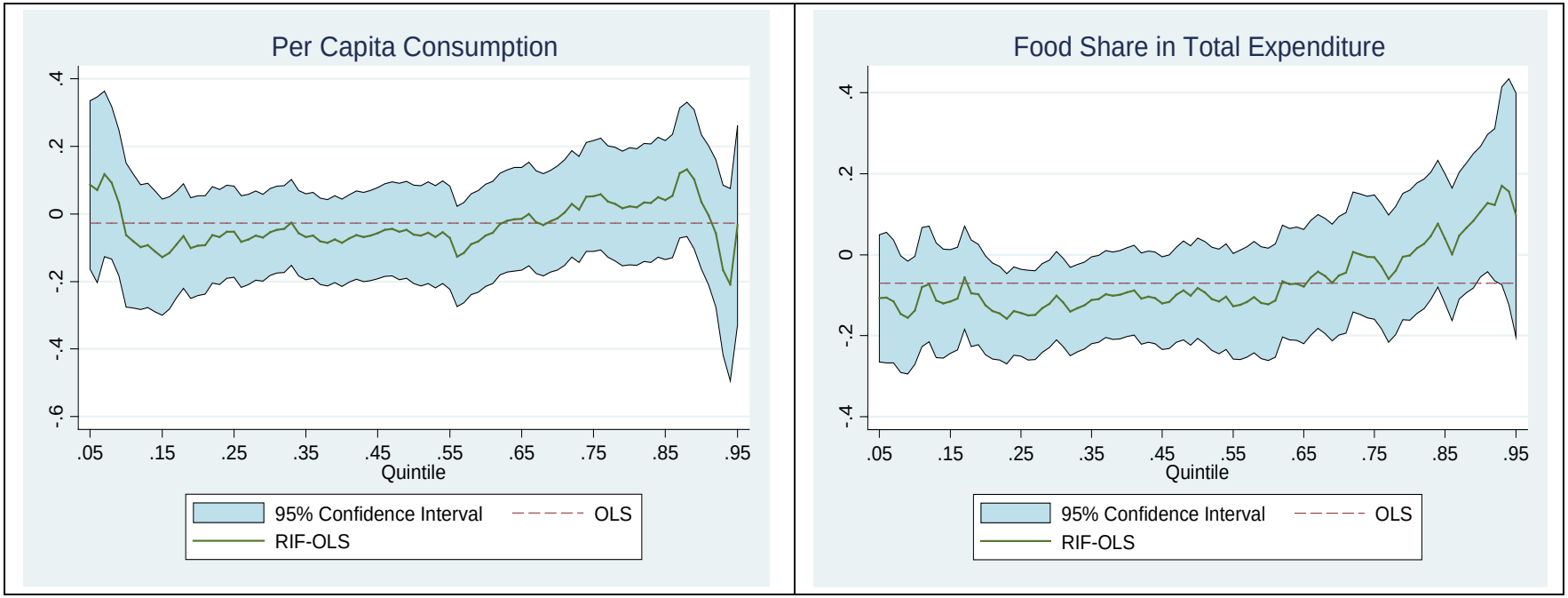

Per Capita Consumption
.4
.2
0
-.2
-.4
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS
Food Share in Total Expenditure
.2
0
-.2
-.4
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS

Figure H2: Unconditional quantile regression of height-for-age z-scores on food security measures, expanded controls (Tanzania)




Per Capita Consumption
.4
.2
0
-.2
-.4
-.6
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS
Food Share in Total Expenditure
.4
.2
0
-.2
-.4
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS

APPENDIX I: UGANDA

Table I1: Nutritional Indicators, by region

	Mean HAZ	Stunting incidence	Mean WAZ
All	-1.33	0.32	-0.8
Urban	-0.81	0.19	-0.43
Rural	-1.44	0.36	-0.88
by Region			
Kampala	-0.79	0.21	-0.47
Cetral	-1.30	0.30	-0.71
Eastern	-1.30	0.32	-0.79
Northern	-1.32	0.32	-0.94
Western	-1.52	0.39	-0.79

Table I1: Nutritional Indicators, by region

Age in months	Boys		Girls	
	Mean HAZ	Stunting incidence	Mean HAZ	Stunting incidence
0-5				
6-11	-0.65	0.25	-0.53	0.14
12-23	-1.39	0.38	-1.29	0.30
24-35	-1.57	0.40	-1.26	0.31
36-47	-1.46	0.32	-1.39	0.31
48-60	-1.44	0.35	-1.52	0.34

Table I3: Descriptive Statistics of Key Variables (Uganda)

Variable	Obs	Mean	Std. Dev.	Min	Max
Z-scores					
HAZ	2014	-1.33	1.67	-5.73	5.97
WAZ	2013	-0.80	1.26	-5.45	4.88
Food Security Measures					
1-SSEXR	2049	0.53	0.18	0.064	1
FCS	2048	54.47	18.96	0	112
DDS	2049	7.83	2.06	1	12
PC expenditure	2049	1170.04	699.22	113.35	9729.97
Food share	2049	0.72	0.13	0.31	0.996
Female	2053	0.50	0.50	0	1
Age (in months)	2053	31.78	15.07	5	59
Age squared	2053	1237.06	989.65	25	3481
HH Size	2049	7.46	3.10	2	23
Share of kids under 5	2049	0.28	0.12	0	1
Female-headed HH	2053	0.19	0.39	0	1
HH Head's Education					
No Formal Education	1956	0.13	0.34	0	1
Less than primary	1956	0.45	0.50	0	1
Completed primary	1956	0.26	0.44	0	1
Completed O-levels	1956	0.10	0.30	0	1
Completed A-levels	1956	0.01	0.10	0	1
Technical college/University	1956	0.05	0.22	0	1
Mother's Education					
No Formal Education	2051	0.24	0.43	0	1
Less than primary	2051	0.48	0.50	0	1
Completed primary	2051	0.20	0.40	0	1
Completed O-levels	2051	0.05	0.23	0	1
Completed A-levels	2051	0.01	0.09	0	1
Technical college/University	2051	0.02	0.13	0	1
Water source: Private connection to pipeline	2052	0.03	0.18	0	1
Flush toilet	2052	0.01	0.11	0	1
Latrine	2052	0.89	0.32	0	1
No toilet	2052	0.10	0.30	0	1
Asset index 1 (poorest)	2048	0.35	0.48	0	1
Asset index 2	2048	0.34	0.47	0	1

Variable	Obs	Mean	Std. Dev.	Min	Max
Asset index 3	2048	0.31	0.46	0	1
Ethnic Minority	2051	0.28	0.45	0	1
Rural	2053	0.81	0.39	0	1
Kampala	2053	0.04	0.21	0	1
Central	2053	0.23	0.42	0	1
Eastern	2053	0.26	0.44	0	1
Northern	2053	0.26	0.44	0	1
Western	2053	0.20	0.40	0	1

Source: Authors' calculations

Table I4: Relationship between food security measures and height-for-age z-scores (Uganda): Limited Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Height-for-age z-scores				
1-SSEXR	0.071*				
	(0.041)				
FCS		0.197***			
		(0.038)			
DDS			0.085**		
			(0.041)		
PC expenditure				0.139***	
				(0.041)	
Food Share					0.029
					(0.038)
Rural	-0.599***	-0.544***	-0.599***	-0.555***	-0.638***
	(0.106)	(0.104)	(0.106)	(0.106)	(0.102)
Kampala	0.127	0.069	0.092	0.038	0.178
	(0.223)	(0.220)	(0.225)	(0.228)	(0.223)
Central without Kampala	0.148	0.142	0.114	0.139	0.183
	(0.119)	(0.116)	(0.122)	(0.118)	(0.117)
Eastern	0.208*	0.193*	0.172	0.223**	0.246**
	(0.117)	(0.113)	(0.123)	(0.112)	(0.113)
Northern	0.135	0.245**	0.165	0.233**	0.202*
	(0.116)	(0.110)	(0.112)	(0.109)	(0.110)
Constant	-0.968***	-1.034***	-0.958***	-1.027***	-0.974***
	(0.121)	(0.121)	(0.121)	(0.122)	(0.122)
Observations	2,011	2,010	2,011	2,011	2,011
R-squared	0.026	0.038	0.027	0.030	0.025

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

1-SSEXR is the expenditure share of non-starchy staple food in total food expenditure, FCS is the food consumption score, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure in total expenditure.

Table I5: Relationship between food security measures and weight-for-age z-scores (Uganda): Limited Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Weight-for-age z-scores				
1-SSEXR	0.073**				
	(0.031)				
FCS		0.127***			
		(0.028)			
DDS			0.036		
			(0.031)		
PC expenditure				0.104***	
				(0.033)	
Food Share					-0.023
					(0.029)
Rural	-0.407***	-0.397***	-0.433***	-0.387***	-0.450***
	(0.077)	(0.074)	(0.077)	(0.078)	(0.075)
Kampala	-0.114	-0.139	-0.096	-0.166	-0.058
	(0.162)	(0.160)	(0.165)	(0.163)	(0.161)
Central without Kampala	0.024	0.029	0.031	0.024	0.059
	(0.085)	(0.084)	(0.088)	(0.083)	(0.083)
Eastern	-0.006	0.003	0.004	0.015	0.037
	(0.085)	(0.082)	(0.088)	(0.081)	(0.081)
Northern	-0.216**	-0.121	-0.163**	-0.126	-0.148*
	(0.085)	(0.080)	(0.081)	(0.079)	(0.080)
Constant	-0.407***	-0.441***	-0.405***	-0.450***	-0.412***
	(0.087)	(0.086)	(0.087)	(0.088)	(0.087)
Observations	2,009	2,008	2,009	2,009	2,009
R-squared	0.026	0.033	0.024	0.029	0.023

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

1-SSEXR is the expenditure share of non-starchy staple food in total food expenditure, FCS is the food consumption score, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure in total expenditure.

Table I6: Relationship between food security measures and height-for-age z-scores (Uganda): Expanded Controls Version

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Height-for-age z-scores				
1-SSEXR	0.036				
	(0.045)				
FCS		0.150***			
		(0.042)			
DDS			0.021		
			(0.049)		
PC expenditure				0.121**	
				(0.050)	
Food Share					0.005
					(0.041)
Child is female	0.124	0.113	0.124*	0.126*	0.123
	(0.075)	(0.075)	(0.075)	(0.075)	(0.075)
Age of Child (in months)	-0.065***	-0.065***	-0.065***	-0.065***	-0.065***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Age Squared	0.001***	0.001***	0.001***	0.001***	0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household size	0.014	0.009	0.012	0.022	0.011
	(0.014)	(0.013)	(0.013)	(0.014)	(0.014)
Share if kids under 5	-1.202***	-1.296***	-1.221***	-1.233***	-1.207***
	(0.367)	(0.367)	(0.367)	(0.365)	(0.366)
Female-headed HH	-0.082	-0.064	-0.084	-0.064	-0.082
	(0.101)	(0.101)	(0.102)	(0.102)	(0.101)
HH Head Education: Reference category - No formal education					
Less than primary	0.214	0.202	0.220*	0.239*	0.228*
	(0.130)	(0.128)	(0.130)	(0.128)	(0.128)
Completed primary	0.181	0.156	0.184	0.204	0.193
	(0.144)	(0.143)	(0.146)	(0.142)	(0.143)
Completed O-levels	0.173	0.131	0.180	0.196	0.191
	(0.173)	(0.172)	(0.175)	(0.170)	(0.172)
Completed A-levels	-0.138	-0.159	-0.130	-0.075	-0.130
	(0.313)	(0.310)	(0.314)	(0.318)	(0.314)
Technical college/University	0.434**	0.378*	0.440**	0.431**	0.455**
	(0.209)	(0.209)	(0.212)	(0.208)	(0.208)
Mother's Education					
Less than primary	-0.177*	-0.198*	-0.181*	-0.189*	-0.178*
	(0.104)	(0.103)	(0.104)	(0.104)	(0.105)
Completed primary	0.024	-0.011	0.023	0.003	0.029

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Height-for-age z-scores				
	(0.121)	(0.120)	(0.121)	(0.121)	(0.122)
Completed O-levels	0.123	0.050	0.123	0.093	0.129
	(0.183)	(0.181)	(0.183)	(0.184)	(0.184)
Completed A-levels	0.614**	0.613**	0.616**	0.601**	0.624**
	(0.291)	(0.289)	(0.291)	(0.283)	(0.291)
Technical college/University	0.259	0.186	0.261	0.210	0.270
	(0.328)	(0.326)	(0.329)	(0.334)	(0.328)
Water source: Private connection to pipeline	0.064	0.027	0.066	0.027	0.070
	(0.245)	(0.241)	(0.244)	(0.245)	(0.245)
Toilet Facility : Reference category - Flush toilet					
Latrine	-0.557**	-0.531**	-0.571**	-0.454*	-0.568**
	(0.247)	(0.243)	(0.247)	(0.261)	(0.249)
No toilet	-0.601**	-0.552*	-0.606**	-0.485	-0.612**
	(0.287)	(0.283)	(0.288)	(0.298)	(0.288)
Ethnic Minority	0.014	0.027	0.010	0.017	0.010
	(0.086)	(0.086)	(0.086)	(0.086)	(0.086)
Asset index: Reference category - poorest					
Asset index 2	0.027	-0.016	0.028	0.008	0.035
	(0.098)	(0.098)	(0.099)	(0.099)	(0.098)
Asset index 3	0.166	0.084	0.168	0.119	0.181
	(0.112)	(0.112)	(0.112)	(0.113)	(0.111)
Rural	-0.372***	-0.352***	-0.379***	-0.345***	-0.384***
	(0.115)	(0.113)	(0.115)	(0.116)	(0.114)
Kampala	0.118	0.099	0.118	0.043	0.136
	(0.225)	(0.223)	(0.227)	(0.232)	(0.224)
Central without Kampala	0.085	0.098	0.085	0.066	0.099
	(0.120)	(0.118)	(0.124)	(0.120)	(0.119)
Eastern	0.186	0.170	0.188	0.176	0.207*
	(0.121)	(0.116)	(0.130)	(0.116)	(0.116)
Northern	0.233*	0.277**	0.255**	0.284**	0.268**
	(0.125)	(0.117)	(0.123)	(0.116)	(0.117)
Constant	0.463	0.544	0.491	0.286	0.462
	(0.387)	(0.381)	(0.390)	(0.398)	(0.387)
Observations	1,908	1,906	1,908	1,908	1,908
R-squared	0.073	0.079	0.073	0.076	0.072

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

1-SSEXR is the expenditure share of non-starchy staple food in total food expenditure, FCS is the food consumption score, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure in total expenditure.

Table I7: Relationship between food security measures and weight-for-age z-scores (Uganda): Expanded Controls Version

	(1)	(2)	(3)	(4)	(5)
VARIABLES	Weight-for-age z-scores				
1-SSEXR	0.044				
	(0.034)				
FCS		0.084***			
		(0.031)			
DDS			-0.017		
			(0.036)		
PC expenditure				0.075*	
				(0.040)	
Food Share					-0.035
					(0.030)
Child is female	0.008	0.000	0.006	0.009	0.008
	(0.057)	(0.056)	(0.057)	(0.057)	(0.057)
Age of Child (in months)	-0.010	-0.009	-0.010	-0.010	-0.010
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Age Squared	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Household size	0.008	0.004	0.005	0.012	0.008
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Share if kids under 5	-0.601**	-0.655**	-0.591**	-0.612**	-0.595**
	(0.281)	(0.280)	(0.279)	(0.280)	(0.281)
Female-headed HH	0.006	0.021	0.008	0.018	0.005
	(0.079)	(0.079)	(0.079)	(0.080)	(0.079)
HH Head Education: Reference category - No formal education					
Less than primary	0.072	0.079	0.096	0.096	0.093
	(0.097)	(0.096)	(0.098)	(0.096)	(0.096)
Completed primary	0.136	0.132	0.157	0.156	0.151
	(0.109)	(0.109)	(0.110)	(0.108)	(0.108)
Completed O-levels	0.095	0.084	0.127	0.121	0.125
	(0.135)	(0.134)	(0.136)	(0.132)	(0.133)
Completed A-levels	-0.229	-0.238	-0.220	-0.187	-0.218
	(0.244)	(0.240)	(0.247)	(0.248)	(0.248)
Technical college/University	0.257	0.244	0.297*	0.268	0.290*
	(0.167)	(0.168)	(0.169)	(0.165)	(0.166)
Mother's Education					
Less than primary	-0.047	-0.060	-0.047	-0.055	-0.055
	(0.076)	(0.076)	(0.076)	(0.077)	(0.076)
Completed primary	0.058	0.045	0.068	0.048	0.054

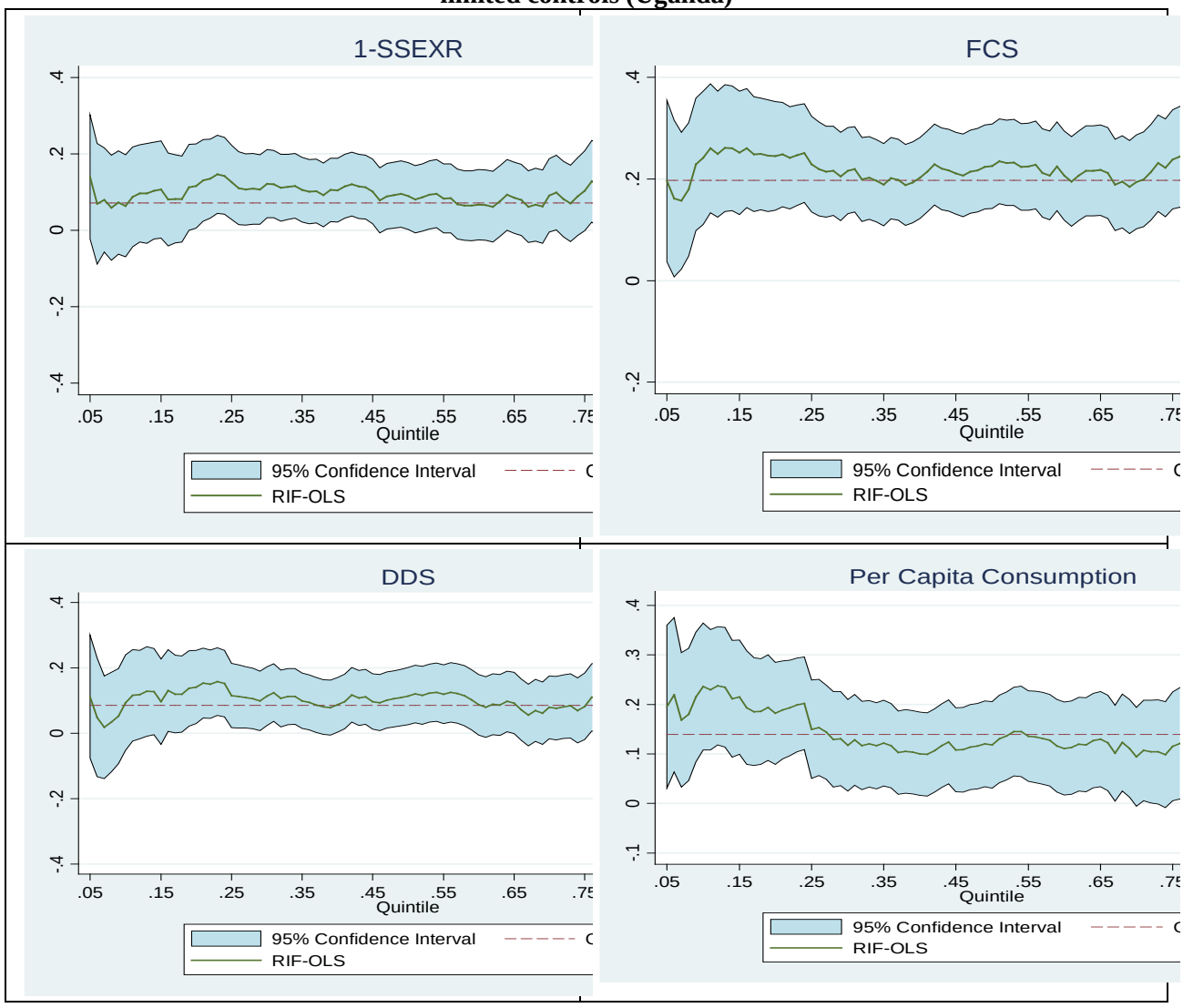
VARIABLES	(1)	(2)	(3)	(4)	(5)
	Weight-for-age z-scores				
	(0.090)	(0.089)	(0.091)	(0.091)	(0.091)
Completed O-levels	0.152	0.123	0.164	0.137	0.151
	(0.148)	(0.149)	(0.148)	(0.149)	(0.149)
Completed A-levels	0.423	0.432	0.442	0.423	0.430
	(0.290)	(0.285)	(0.289)	(0.288)	(0.287)
Technical college/University	0.577**	0.545**	0.598***	0.554**	0.587**
	(0.226)	(0.227)	(0.229)	(0.230)	(0.229)
Private connection to pipeline	0.164	0.140	0.175	0.145	0.176
	(0.192)	(0.191)	(0.192)	(0.192)	(0.192)
Toilet Facility : Reference category - Flush toilet					
Latrine	-0.603***	-0.601***	-0.619***	-0.548**	-0.637***
	(0.225)	(0.223)	(0.224)	(0.226)	(0.224)
No toilet	-0.552**	-0.540**	-0.575**	-0.490**	-0.585**
	(0.246)	(0.245)	(0.246)	(0.248)	(0.246)
Ethnic Minority	-0.155**	-0.151**	-0.159**	-0.155**	-0.157**
	(0.065)	(0.064)	(0.065)	(0.064)	(0.065)
Asset index: Reference category - poorest					
Asset index 2	0.114	0.091	0.128*	0.105	0.121*
	(0.072)	(0.073)	(0.073)	(0.073)	(0.073)
Asset index 3	0.063	0.022	0.091	0.042	0.077
	(0.081)	(0.082)	(0.082)	(0.083)	(0.080)
Rural	-0.272***	-0.280***	-0.291***	-0.264***	-0.289***
	(0.084)	(0.083)	(0.085)	(0.085)	(0.084)
Kampala	-0.217	-0.223	-0.183	-0.255	-0.200
	(0.161)	(0.160)	(0.164)	(0.164)	(0.160)
Central without Kampala	-0.043	-0.028	-0.015	-0.047	-0.028
	(0.088)	(0.088)	(0.091)	(0.088)	(0.087)
Eastern	-0.072	-0.063	-0.031	-0.067	-0.047
	(0.089)	(0.086)	(0.094)	(0.085)	(0.085)
Northern	-0.179*	-0.132	-0.127	-0.127	-0.139
	(0.092)	(0.085)	(0.088)	(0.085)	(0.085)
Constant	0.271	0.327	0.249	0.161	0.276
	(0.309)	(0.307)	(0.313)	(0.312)	(0.309)
Observations	1,908	1,906	1,908	1,908	1,908
R-squared	0.055	0.058	0.054	0.056	0.054

Source: Authors' calculations.

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

1-SSEXR is the expenditure share of non-starchy staple food in total food expenditure, FCS is the food consumption score, DDS is the household level dietary diversity score, PC expenditure is the per capita expenditure, and Food share is the share of food expenditure in total expenditure.

Figure I1: Unconditional quantile regression of height-for-age z-scores on food security measures, limited controls (Uganda)



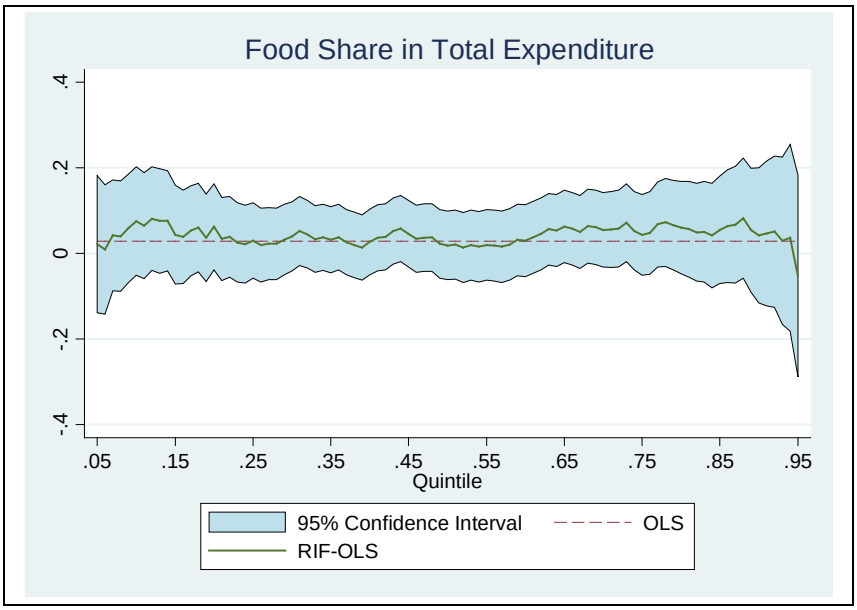
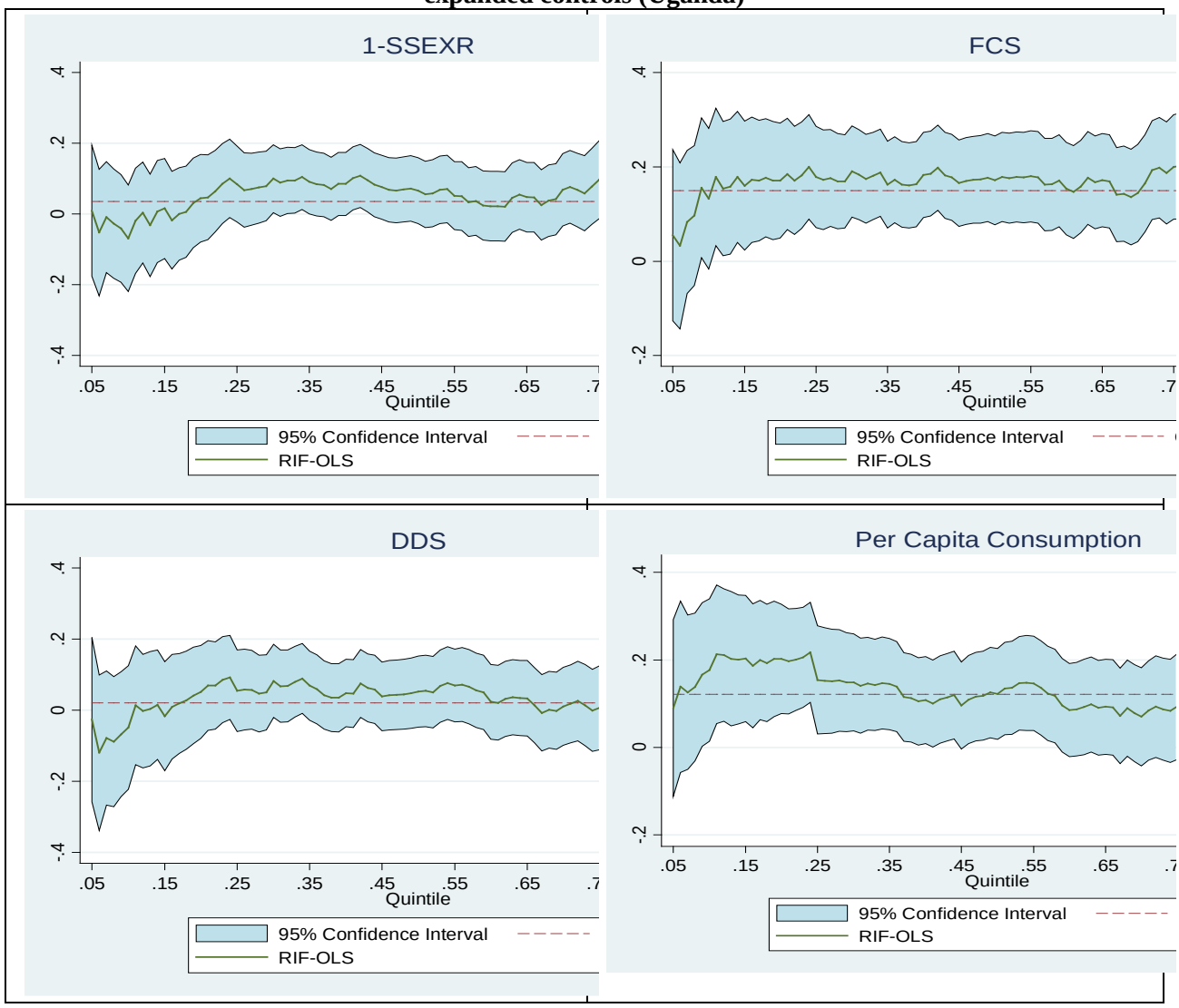
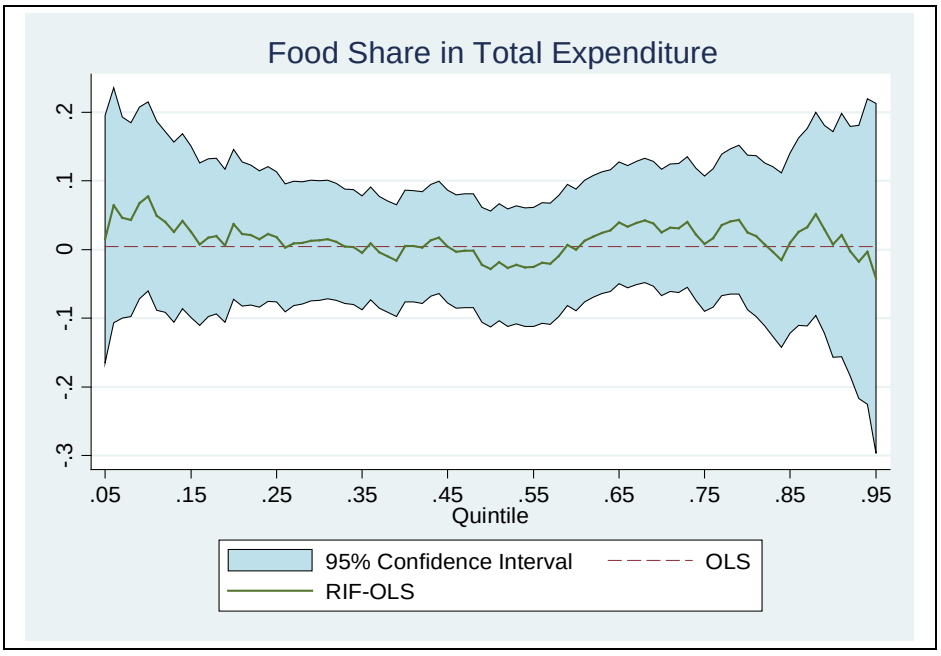

Food Share in Total Expenditure
.4
.2
0
-.2
-.4
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS

Figure I2: Unconditional quantile regression of height-for-age z-scores on food security measures, expanded controls (Uganda)




Food Share in Total Expenditure
.2
.1
0
-.1
-.2
-.3
.05
.15
.25
.35
.45
.55
.65
.75
.85
.95
Quintile
95% Confidence Interval
OLS
RIF-OLS