Food Security Metrics: the understudied role of stability and its implications for resilience

One understudied aspect of food security is food stability.  Food security varies substantially throughout the year.  Particularly in countries with a single primary growing season, food security can drop dramatically during the lean season. Large changes in food security over time can lead to bad nutrition and health outcomes, as well as household stress and lower productive investments (Kennedy et al 1992; Pinstrup-Andersen 2009). The degree to which households are affected by swings in food security over time varies by location, whether the household is rural versus urban and other factors that may capture household resilience.  In this paper, we study how different food security measures vary throughout the season.  We identify which measures are more sensitive to intra-annual variation and relate the variation in these measures to long-run metrics of nutrition.

Food security cannot be observed directly and instead is captured using various proxy measures, such as caloric consumption, dietary diversity, food security scores, food expenditures and the Coping Strategies Index and its shorter counterpart, the reduced Coping Strategies Index (CSI and rCSI).  Longer run food insecurity are captured using anthropometric measures such as stunting and wasting.  Different food security measures capture different aspects of food insecurity, such as diet quantity (rCSI), diet quality (HDDS) and utilization (wasting).  A general consensus from previous studies is that no single measures completely depicts all the aspects of food security. Although these proxy measures are in general correlated, the correlations vary from relatively weak to relatively strong (Maxwell et al., 2014; Vaitla et al., 2015). This is an indication that different measures are capturing different aspects of food security such as quantity (RCSI) and a dietary diversity (HDDS and FCS) (Vaitla et al 2017).

Less is known about how these measures capture intra-year variability, household demographics, market access and household assets.  In this paper, we build on their work and explore both if and how these measures capture intra-year variation in food security, and which are more sensitive to factors such as market access and household level characteristics.

Our ability to capture these intra-annual variations is limited by the lack of temporally fine-grained food security data.  Even when data are collected over different seasons, they are often for different households, raising the question as to whether the differences we observe over time are due to seasonal variation or changes in the sample.  Very rarely do we observe food security measures for the same households over time.  However, recent LSMS panel data collect various measures of food security for the same household over several years and their sampling design is geared to be nationally representative each month.  We use these geocoded LSMS data collected monthly over several years in four sub-Saharan African countries (Malawi, Ethiopia, Tanzania and Uganda) to make the results meaningful for other countries in the area.  We then use these metrics of instability to predict longer run measures of food security and nutrition such as stunting and wasting.

Methods

The strength of correlations between measures and variables of interest was assessed using Spearman’s r, which is often used to measure bivariate relationship between variables.  Food security measures data comes from the Living Standards Measurement Study (LSMS) survey (Malawi 2010, 2013 and 2015; Ethiopia 2004, 2006 and 2008; Uganda 2009, 2010, 2011 and 2013; Tanzania 2010, 2011, 2012 and 2013). A higher value of household dietary diversity score (HDDS) and food consumption score (FCS) means more food secure a household is. Positive correlation is expected for FCS, HDDS and asset related variables. Negative correlation is expected for FCS, HDDS and market price and market thinness. A higher value of the reduced coping strategies index (rCSI) means less food secure.  Therefore, the relationship should be the inverse of those described above.

Further, we use cluster (village) level fixed effect models to regress the food security measures on the market access, household assets, month dummies and other variables of interest, after controlling for the local weather shocks, price weighted total food expenditure and geography related variables. In order to better capture the intra-year variability, we try to use local market price data on a variety of food crops that are available in the market in different month. For example, HDDS is better in April because pumpkins, rape greens and other low-calorie but high nutrition and high diversity crops are becoming available either on farm or in the local markets. Lastly, we predict out-of-sample food security, medium to long term nutrition variables (such as wasting and stunting) based on our best model, making use of machine learning methods such as LASSO and Random Forest.

Results

Initial results using the Malawi 2010 data indicate that all three diet-based measures of food security vary greatly by month, showing a pronounced lean season in March/April.  We find that rCSI seems to lag the dietary diversity measures by a month and rCSI appears to be more sensitive to inter-annual variation. Urban areas are more food secure than rural area across all three measures and all twelve months but is captured more by the dietary quality based measures (HDDS and FCS) than the quantity based measure (rCSI). This is partially because of the lack of availability of a large range of different kinds food in rural areas. A higher market price and more missings in the price data are associated negatively with the food security measures and especially so for the rCSI measure. Asset related variables and cell phone ownership are positively correlated with food security, and the coefficients are bigger on HDDS and FCS compared to rCSI.

References

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