Are improvements in agricultural production equally beneficial for household food security and children's nutrition? Evidence from Ethiopia

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Abstract

Ethiopia and its food security situation have been widely studied as Ethiopia remains one of the most food insecure countries in the world—38% of Ethiopian children are undernourished. Despite its long history, research on the effectiveness of various agricultural activities for food security and nutrition has produced inconclusive results. This study provides new insight by combining household measures of food security with children's height-for-age z-scores to analyze how agricultural practices simultaneously impact households and children. The results indicate that agricultural activities can be beneficial for household-level food security, but the effects of agricultural activities on children's nutrition are less clear. Annual rainfall, the share of harvest sold, and the share of harvest used for household consumption are the most impactful measures for household food security and, possibly, for children's nutrition. It is possible that intra-household dynamics and resource allocation prevent the benefits of agriculture from reaching children. Future research will explore these relationships in more detail.

State of food security in Ethiopia

- *Ethiopia has one of the largest populations of undernourished children in the world*

Ethiopia and its food security situation have been widely studied as Ethiopia remains one of the most food insecure countries in the world—38% of Ethiopian children under age five are stunted, or too short for their age (Devereux & Sussex, 2000; Lewis, 2017). Several factors prevent Ethiopia from achieving food security: weather/climate variability, low rates of technology adoption, environmental degradation, population growth, and structural and infrastructural peculiarities (Demeke, Guta, Ferede, & ABABA, 2004). Agriculture employs 80% of the Ethiopians (Demeke et al., 2004; Mohamed, 2017), most of whom reside in rural areas where the average size of a household's land holding is 1.38 ha. Land scarcity prevents households from achieving food self-sufficiency, which is further exacerbated by the growing population. Ethiopia has not been able to match the volume of its food production to population growth since the 1980s, with the number of starving people remaining constant even as agricultural production has been increasing (Demeke et al., 2004; Devereux & Sussex, 2000; Feleke, Kilmer, & Gladwin, 2005).

- *Food security in Ethiopia is challenged by climatic shocks and low inputs*

Recurring droughts further aggravate food insecurity: Ethiopia's rainfed agriculture is vulnerable to droughts; low mechanization and irrigation, as well as the limited use of inputs contribute to crop failure in the face of droughts. Ethiopia has experienced multiple droughts in the last decades, which severely limited food availability. The 2015-16 drought led to the loss of 50 to 90% (depending on the crop) of crop production (FAO, 2017). Below-average rains in 2017 left 5.6 million people requiring emergency food assistance (FAO, 2017; FEWSNET, 2016). Poor rainfall in the first half of 2017 negatively affected wheat, teff, and maize—staple crops in the Ethiopian diet—with losses of area and yield up to 60% in the most-affected areas. Reported strategies to cope with food shortages include skipping meals, selling assets, and displacement, all of which exacerbate the food security crisis and turn it into a livelihood crisis in Ethiopia (FAO, 2017). The droughts have also gotten worse—there has been a steady increase in the proportion of Ethiopian population affect by the drought since 1997 (Demeke et al., 2004). Recurring droughts not only affect immediate food availability and cause transitory food insecurity, but have long-term implications in the form of chronic food insecurity and health issues. This slows down drought recovery because 1) undernourished or inadequately fed farmers cannot perform labor-intensive work to their full potential (Asenso-Okyere, Chiang, Thangata, Andam, & Mekonnen, 2011a, 2011b; Mekonnen & Gerber, 2017; Mohamed, 2017); 2) the uncertainty about future yields and the onset of the next drought makes farmers reluctant to use and invest in agricultural inputs such as fertilizers (Davenport, Funk, & Galu, 2018; Devereux & Maxwell, 2001; Devereux & Sussex, 2000). Should Ethiopia be able to reduce its yield gaps by half (difference between actual and potential yields), it could achieve self-sufficiency in producing cereals for a population of 174 million people, which is Ethiopia's projected population by 2050, on the same arable area the country has now (Lewis, 2017; Tesfaye, 2015).

- *Agriculture has the potential to improve the food security situation in Ethiopia, but the evidence about its benefits has been inconclusive*

Improved agricultural production has the potential to improve and protect the populations from shocks on the markets and in the environment. Despite its long history, research on the effectiveness of various agricultural activities for food security and nutrition has produced inconclusive results. While the link between agriculture and nutrition may seem straightforward (Berti, Krasevec, & FitzGerald, 2004), reviews of the existing evidence on the effectiveness of agricultural interventions range in their assessments from "impossible to evaluate given the state of evidence" (Masset, Haddad, Cornelius, & Isaza-Castro, 2012) to weak and mixed (Berti et al., 2004; Girard, Self, McAuliffe, & Olude, 2012; Haddad, 2013; Masset et al., 2012; Webb & Kennedy, 2014) to small and positive (Carletto, Corral, & Guelfi, 2016; von Braun & Kennedy, 1986; Wood, Nelson, Kilic, & Murray, 2013). What remains uncontested is the immense potential agriculture has for improving food security and, consequently, nutrition outcomes. After all, growth in the agricultural sector has been proven to be the most effective way to combat poverty, especially for the poorest people – a 1% growth in GDP originated in agriculture leads to a 6% increase in overall income for the poorest 10% of the population (Castañeda et al., 2018; Christiaensen, Demery, & Kuhl, 2011; Christiaensen & Martin, 2018; WB, 2008).

In the pursuit to achieve food security and optimal nutrition, efforts should not be solely concentrated on agriculture (Haddad, 2013; Jonsson, 2010). Evidence suggests that even if the carefully designed nutrition interventions in agriculture outlined by Bhutta et al. (2013) are fully implemented in countries with the highest burden of undernourished children, the prevalence of stunting will only decrease by 20%, which means that agricultural interventions are just one out of many viable strategies to fight undernutrition. Factors such as mother's health, household environment, and others determine whether or not a child is stunted, and agriculture has traditionally explained a small fraction of child undernutrition (Shively & Sununtnasuk, 2015). As such, the absence of statistically significant results in this line of research should not be equated with the absence of effect. Data constraints often present a challenge when working with socioeconomic and agricultural surveys collected in low resource settings (Burchi & De Muro, 2016): smaller than desired sample sizes and missing data can contribute to the underestimation of observed effects and render them as not statistically significant.

The commonly agreed upon pathways through which agriculture affects food security can be summarized as follows: 1) greater income generated from improved farm productivity leads to better nutrition; 2) lower food prices make access to food less expensive; 3) increased food production in a household means more food for own consumption; 4) the empowerment of women (greater control of income, decision-making power, access to credit) tends to improve household food security and child nutrition (Haddad, 2002, 2013; Ruel, Alderman, & Maternal Child Nutr Study, 2013).

Contributions of this study

Many studies of agriculture-food security or agriculture-nutrition conducted by economists, sociologists, and geographers rely on cross-sectional data, which can uncover nuanced relationships but do not allow one to draw causal conclusions. Many of the public health studies, on the other hand, prefer randomized control trials (RCTs) for their ability to assess causal pathways. However, the RCTs are usually conducted over a small geographic area and thus cannot be generalized to the entire country. This study aims to find the middle ground and bring the disciplines closer by, among other things, conducting a longitudinal analysis of food security and child health using several panels of data at the national level. As such, this research is positioned to answer the following research questions:

1. *How do changes in households' agricultural production between 2013 and 2015 affect household food security and children's nutritional outcomes?*
2. *How do these changes relate to the changes in household food security status and children nutritional status?*

The second contribution of this research is in simultaneously incorporating the time-varying measures of household-level food security and children's nutritional outcomes and analyzing how they change in relation to changes in agricultural activities. This setup allows for a more detailed understanding of how changes in agricultural activities and production over time impact a household's overall food security status while also affecting children's nutrition. While grounded in the sustainable livelihoods framework, this approach borrows from the capability approach and extends the analysis of food security as a function of access and availability to include utilization. Household-level food security is not a prerequisite for optimal nutritional outcomes in children: undernourished children can reside in food secure households, just like well-undernourished children can be found in food insecure households (Humphries et al., 2015). However, how these patterns vary with time has not been investigated in previous research. Therefore, one of the goals of this study is to understand the co-existence of food insecurity and child undernutrition as they relate to the trends in household's agricultural activities. This goal can be expressed with this research question:

3. *How do households' agricultural activities simultaneously relate to children's nutritional outcomes and household food security status?*

Data, Methods, and Measures

Data

This study relies on the 2013-2014 and 2015-2016 waves of the Ethiopian Socioeconomic Survey (ESS) collected in a collaborative effort by the World Bank Living Standards Measurement Study (LSMS) and the Central Statistics Agency of Ethiopia (CSA). The Ethiopian LSMS was conducted by the World Bank within its Integrated Surveys of Agriculture (ISA). The surveys are nationally representative and include about 4,000 households that were tracked between the waves. They include data on demographic characteristics and such domains as health, agriculture, time use and labor, food security and shocks, and banking and credit. Relevant to this study are the sections on health, food security and shocks, and agriculture. Food security and shocks were assessed by asking respondents about their food spending, consumption, whether households experienced food shortages and/or environmental shocks, and what implications those shocks had for income, assets, food stocks, and food production. The LSMS-ISA data are distinct in that they take place-specific agricultural context in account by collecting agricultural data twice, before planting and after harvest. As a result, the survey collects detailed data on crop-specific harvests and cultivated area, harvest labor and crop disposition. These data are supplemented by the Enumeration Area (EA) location data provided with displacement: in public files locations of EAs are displaced up to 2 km in urban areas, up to 5 km in rural areas, and a 1% random sample of points is displaced up to 10 km. It should be noted that the study had initially planned to also use the first wave of the Rural Socioeconomic Survey (2011-2012), but due to the inconsistencies in individual ID's across the first and subsequent waves, the linking could not be performed. After removing cases with apparent errors in child anthropometric measurements and birth dates (such as when a child's age decreased in the subsequent wave), the final sample included 2363 households from wave 3 of the survey and 715 children followed from wave 2 to wave 3.

Methods and Measures

This study is interested in investigating two outcomes: 1) child stunting, measured by children's height-for-age z-scores for children under five years of age; 2) household-level food security, measured by whether a household experienced food shortages in the last 12 months. A child is stunted if their height-for-age z-score (HAZ) is more than two standard deviations below the WHO Child Growth Standards median (WHO, 2017). Stunting is indicative of chronic undernutrition and is caused by mother's poor diet during pregnancy, failure to receive proper nutrition for an extended period of time, and can be aggravated by repeated infections (Dorelien, 2015; IFPRI, 2016).

The explanatory variables used in this paper represent a mix of 1) socioeconomic and demographic characteristics such as household head's sex, age, household size and dependency ratio, and household resources such as floor type and toilet type, use of credit and rural/urban residence; 2) total agricultural production by the household (metric tons), total area cultivated by the household (hectares), rate of inorganic fertilizer use per area (kg/ha), the percentage of harvest used for domestic consumption, the percentage of harvest for sale, number of livestock (cow, oxen, goats, and sheep), and annual rainfall.

The results presented here focus on modeling the following: 1) households' transitions in and out of food security between 2013 and 2015; 2) children's growth trajectories as measured by continuous changes in height-for-age z-scores; 3) children's transition in and out of stunting; 4) simultaneous household food security status and children stunting status.

The outcome variable representing *a change in household food security status* takes on the following values:

- '0' if a household was food secure/food insecure in both wave 2 (2013) and wave 3 (2015) (no change in food security status)
- '1' if a household transitioned from being food secure in 2013 to food insecure in 2015 (negative change)
- '-1' if a household was food insecure in 2013 but became food secure in 2015 (positive change).

The continuous outcome variable for a change in HAZ was constructed by subtracting a child's HAZ in wave 3 from their HAZ in wave 2. The categorical variable indicating *a change in a child's stunting status* between wave 2 and wave 3 takes on the following values:

- '0' if a child was not stunted in both wave 2 and wave 3
- '1' if a child was stunted in both wave 2 and wave 3
- '2' if a child was stunted in wave 2 but became non-stunted in wave 3
- '3' if a child was not stunted in wave 2 but became stunted in wave 3.

Finally, the study also investigates the effect of agricultural production on the joint household food security status and child stunting status. As explained above, a household is considered food insecure if a household member reported experiencing a situation within the last twelve months when there was not enough food for the entire household. The outcome indicator variable of the joint food security and stunting status was constructed based on the data in wave 3 (2015-2016) of the survey and takes on the following values:

- '0' if a household is food secure and a child is not stunted
- '1' if a household is food insecure and a child is stunted
- '2' if a household is food secure but the child is stunted
- '3' if a household is food insecure but the child is not stunted.

Multinomial logistic regressions were used to model transitions in and out of stunting and food security as well as the joint household food security status and child stunting status. In their non-exponentiated form, the multinomial models estimate 1) the log odds of a child/household falling into one of the four categories of health/food security given agricultural production and socio-demographic variables, 2) the log odds of a child AND child's household falling into one of the categories of joint child stunting status and household food security status described above. These models also account for region fixed effects.

It is known that children under the age of two old may exhibit different patterns of growth compared to children older than two years old, so it would make sense to fit separate models for these two groups of children. Due to an already small sample size, I refrained from splitting the sample into two smaller sub-samples.

Results

In the 2015-16 wave of the survey, 20% of households reported experiencing concerns that they may not have enough food for the household in the last 7 days. In the last 12 months, as many as 26% of households reported experiencing food shortages. Among the reasons reported for food shortages, dwindled food reserves due to droughts are reported as the most important reason by as many as 40% of the households. With regards to stunting, the most recent wave of the survey included 2,886 children under the age of five, 41% of whom (1,189 children) were stunted. The observed prevalence of stunting is considered very high according to the WHO classification of malnutrition prevalence ranges (de Onis & Blössner, 1997).

The analysis in this paper proceeded as follows. First, I used a logistic regression to estimate the odds of a household being food secure given various agricultural activities, while also controlling for household socioeconomic and demographic characteristics. This baseline model was estimated using wave 3 of the LSMS data to demonstrate the potential expected relationship between households' agricultural activities and food security. The outcome variable equaled '1' if a household reported experiencing food shortages within the last 12 months, '0' otherwise. Another baseline model represented a linear regression modeling the effect of the same sociodemographic and agricultural variables on the continuous measure of child's height-for-age z-score. As can be seen from Table 1, households that sell more of their harvest, own more livestock, as well as have a higher crop diversity and cultivated area are more likely to be food secure, which is in line with expectations and previous research. Two significant associations emerged from the linear analysis of children's HAZ, as shown in table 2. An increase in annual rainfall is positively associated with HAZ, which is a relationship one would expect given how much Ethiopian agriculture depends on rainfall for moisture. The negative effect of chemical fertilizer use is more difficult to explain and needs further investigation.

Table 1. Results from a logistic regression estimating household-level food security

Variable name	Odds	p-value
Household head age	1.004	0.17
Household head sex (female)	1.415	0.005 **
Household size	1.019	0.481
Household dependency ratio	1.273	<0.0001 ***
Floor (finished floor)	0.455	0.020 *
Toilet (flush toilet)	0.001	0.961
Credit borrowing (yes)	2.011	<0.0001 ***
Agricultural production (tons)	0.954	0.185
Fertilizer use (chemical fertilizer, kg/ha)	1.00	0.523
Cultivated area (ha)	0.926	0.082 .
Crop diversity (number of cultivated crops)	0.973	0.094 .
Number of livestock	0.964	<0.0001 ***
% harvest for domestic consumption	1.218	0.563
% harvest for sale	0.401	0.037 *
Annual rainfall (mm)	0.999	0.001 **
Rural residence	0.649	0.11
AIC: 2497		
N=2363		

The model controls for region fixed effects

Table 2. Results from a linear regression estimating children's height-for-age z-scores

Variable name	Estimate	p-value
Household head age	-0.002	0.724
Household head sex (female)	-0.069	0.735
Household size	0.059	0.119
Household dependency ratio	0.039	0.644
Floor (finished floor)	0.075	0.847
Toilet (flush toilet)	0.012	0.561
Credit borrowing (yes)	0.078	0.585
Agricultural production (tons)	0.005	0.73
Fertilizer use (chemical fertilizer, kg/ha)	-0.0001	0.089 **
Cultivated area (ha)	0.0008	0.938
Crop diversity (number of cultivated crops)	-0.013	0.543
Number of livestock	0.003	0.651
% harvest for domestic consumption	0.038	0.937
% harvest for sale	0.252	0.672
Annual rainfall (mm)	0.0005	0.001 **
Rural residence	0.576	0.116
N=1037		

The model controls for region fixed effects.

Households' transitions in and out of food security

In this step, I relied on multinomial logistic regressions to estimate households' transitions in and out of food security. The outcome variable represents a change in a household food security status, which takes on a value of '0' if a household was food secure/food insecure in both wave 2 (2013) and wave 3 (2015) (no change); '1' if a household transitioned from being food secure in 2013 to food insecure in 2015 (negative change); and '-1' if a household was food insecure in 2013 but became food secure in 2015 (positive change). According to table 2, we observed that households that increased the share of domestic consumption of their crops from 2013 to 2015 were many times more likely to be food secure relative to the reference category of households that became food secure in 2015. At the same time, an increase in the share of harvest sold for households that became food insecure in 2015 is associated with a 90% decrease in the odds of being food insecure relative to the households that became food secure in 2015. This may be indicative of that fact households that are at risk of becoming food insecure are forced to sell a larger share of their harvest. For both groups, an increase in rainfall between 2013-2015 is associated with a decrease in the odds of being food insecure. This is an expected finding given Ethiopia's high dependency on rainfall for agriculture and very low prevalence of irrigation.

Table 3. Results from multinomial logistic regressions estimating households' transitions in and out of food security between wave 2 (2013) and wave 3 (2015) of the LSMS data

	(0) food secure in wave 2 and wave 3 (no change in food security status)			(1) food secure in wave 2 but food insecure in wave 3 (negative change in food security status)		
	b	p	sig	b	p	sig
Change in agricultural production (kg)	1.056	0.505		0.991	0.914	
Change in % of harvest for domestic consumption	10.986	0.016	*	0.886	0.902	
Change in % of harvest sold	5.085	0.174		0.109	0.028	*
Change in the number of livestock	0.996	0.923		1.008	0.869	
Change in rainfall (mm)	0.998	0.063	*	0.998	0.096	*
AIC=312.9						
N=2090						

Coefficients presented are odds ratios. Reference category is households that were food insecure in 2013 but became food secure in 2015. This model is adjusted for all the variables listed in Table 1; the coefficients are not shown here to preserve space. The model controls for region fixed effects.

Continuous change in HAZ from wave 2 to wave 3 and changes in agricultural production

Over the course of their life, children can experience changes in their growth trajectory: periods of accelerated growth exhibited in increases in weight and height or periods of slow growth and weight loss. In the next step of the analysis I investigated how changes in household agricultural production impact the direction of children's linear growth as demonstrated by changes in the continuous measure of children's height-for-age z-scores. To answer that question, I estimated a linear regression where the outcome variables is the difference between a child's height-for-age z-score in 2015 and 2013. Similar to the results in Table 2, I observe few statistically significant associations between a continuous measure of HAZ and agricultural variables. An increase in rainfall exhibited a positive association with children's linear growth adjusted for all the other covariates (Table 4).

Table 4. Results from linear regressions estimating changes in children's height-for-age between wave 2 (2013) and wave 3 (2015) of the LSMS data

	Changes in HAZ		
	b	p	sig
Change in agricultural production (kg)	0.025	0.485	
Change in % of harvest for domestic consumption	0.153	0.770	
Change in % of harvest sold	0.857	0.189	
Change in the number of livestock	-0.005	0.645	
Change in rainfall (mm)	0.0009	0.026	*
R^2 =0.022			
N=715			

This model is adjusted for all the variables listed in Table 1; the coefficients are not shown here to preserve space. The model controls for region fixed effects.

Children's growth trajectories

According to the data, the following changes to children's nutritional status were observed between 2013 and 2015:

- 290 children were not stunted in 2013 and 2015;
- 104 children were stunted in both 2013 and 2013;
- 154 children were stunted in 2013 but became non-stunted in 2015;
- 167 children were non-stunted in 2013 but became stunted in 2015.

Table 5 contains results from multinomial logistic regressions estimating the impact of the changes in agricultural production from wave 2 to wave 3 on the indicator variable of child's stunting trajectory in waves 2 and 3 of the survey. As can be seen from the results, the relative risks ratios for the changes in household agricultural production for different trajectories are very close to zero, meaning that these changes in agricultural production had the same (not significant) effect on the probability of a child being stunted in both waves relative to the probability of being not stunted in both waves.

Table 5. Results from multinomial logistic regressions estimating the effects of the changes in agricultural production from wave 2 to wave 3 on the children's growth trajectories

	(1) stunted in wave 2 and wave 3			(2) stunted in wave 2 but non-stunted in wave 3			(3) stunted in wave 2 and wave 3		
	b	p	sig	b	p	sig	b	p	sig
Change in agricultural production (kg)	1.085	0.595		0.977	0.888		0.9562	0.731	
Change in % of harvest for domestic consumption	7.554	0.309		17.702	0.091		0.0191	0.032	
Change in % of harvest sold	77.56	<0.001	***	109.20	<0.001	***	0.00	<0.001	***
Change in the number of livestock	0.908	0.433		1.024	0.793		1.167	0.349	
Change in rainfall (mm)	0.996	0.133		0.996	0.201		0.9993	0.749	
Model statistics									
AIC: 224.2									
N=715									

Note: The coefficients presented in the table represent relative risks ratios between the category indicated in the top column and reference category. The reference category is child not stunted in both wave 2 and wave 3. These models control for all the socio-demographic characteristics indicated in Table 4 but are not presented here to save space. The model controls for region fixed effects.

Analysis of the joint child stunting status and household food security status

This analysis (Table 6) focused on the indicator variable of a joint household food security and child stunting status. The outcome variable was constructed by combining the household food security status with a child stunting status. In wave 3 of the survey, there were:

- 445 healthy (non-stunted) children in food secure households;
- 152 stunted children in food insecure households;
- 282 stunted children in food secure households;
- 158 healthy children in food insecure households.

Table 6. Results from multinomial logistic regressions estimating child stunting status and household food security status.

	(1) Household food insecure, child stunted			(2) Household food secure, child stunted			(3) Household food insecure, child not stunted		
	b	p	sig	b	p	sig	b	p	sig
Agricultural production (metric tons)	0.993	0.662		0.975	0.371		0.819	0.371	
Fertilizer per area (kg/ha)	0.999	0.035	*	0.999	0.212		0.999	0.093	*
Cultivated area (ha)	1.084	0.228		1.026	0.745		1.079	0.261	
Crop diversity	1.09	0.004	**	1.084	0.013		1.073	0.045	.
Number of livestock	1.024	0.055	.	1.017	0.189		1.004	0.783	
% harvest for domestic consumption	0.388	< 0.0001	***	0.237	< 0.0001	***	0.920	0.62	
% harvest for sale	1.798	< 0.001	***	1.010	0.957		2.391	< 0.0001	***
Model statistics									
AIC: 1037									
N=2611									

Note: The coefficients presented in the table represent relative risks ratios between the category indicated in the top column and the reference category. The reference category is household food secure, child not stunted. These models control for all the socio-demographic characteristics indicated in Table 4 but the coefficients are not presented here to save space.

As can be seen from Table 6, an increase in the % of harvest used for domestic consumption decreases the risk of a household being food insecure and a household having a stunted child compared to the reference category, a food secure household with not stunted child, by roughly 60%. At the same time, an increase in domestic consumption decreases the risk of a household being food secure with a stunted child by 77% compared to a food secure household with no stunted children. On the other hand, an increase in the % of harvest sold increases the risk of a household being food insecure with a stunted child by 80% relative to the reference category. In addition, an increase in % of harvest sold increases the risk of a household being food secure but with a stunted child, by 1%. The increased consumption of harvested crops within households may be indicative of a good harvest and improved food security situation. On the other hand, an increase in the share of the harvest that households sell may indicate that they are forced to sell their harvest to generate income for other needs, which diminishes their food reserves and contributes to food insecurity. It is also notable that the models show an effect of agricultural variables for food secure households with a stunted child. This means that as households remain food secure according to the self-reported measure of food availability in the last 12 months, children's health can deteriorate. Whereas a household may consider itself food secure, the underlying changes in the amount of food consumed by different members may be happening, that contribute to child health. Children are more vulnerable to food insecurity and malnutrition and are more likely to be affected by even small changes in the amount of food consumed that would not be visible to the adults, which can explain why an adult household member reports no instances of food insecurity all the while there is a stunted child in the household.

Overall, these results indicate that agricultural activities can be beneficial for household-level food security, but the effect of an increase in agricultural production on children's nutrition is more elusive and warrants further investigation. The results reveal that annual rainfall, the share of harvest sold, and the share of harvest used for household consumption are the most impactful measures for household food security and, possibly to a lesser extent, to children's nutrition. It is possible that intra-household dynamics and resource allocation play a role in preventing the benefits of agriculture from reaching households' most vulnerable members, children. In the next steps, I am going to explain in detail the observed relationships while paying particular attention to explaining the differences in the observed effects of agricultural activities on household food security vs. children's nutrition.

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