Does Women's Time on the Farm Affect Children's Nutritional Status? Evidence from Tanzania

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By

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Abstract

The time allocation between reproductive and productive work in agriculture has implications for nutrition (Stevano et al., 2019). Spending many hours on the farm reduces the time available for engaging in domestic nutrition-improving chores. This study seeks to examine the effect of hours women worked on farms on the nutritional status (height for age and weight for age) of children. The study uses three waves of the Tanzania National Panel survey data. We estimate a random effects instrumental variable estimation technique. The results show that women who work long hours on the farm increases the likelihood of children being stunted and underweight. The study recommends policies that can help reduce hours worked by women on farms. Women can be encouraged to form work groups that they can use for their agricultural activities. The local government can also invest in farm machinery that women can hire at subsidized prices.

Key Words: *Agriculture, Time, Women, Nutrition, Tanzania*

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1. Introduction

The important role of women in agricultural production, even more so food production, is well documented in the literature (Ashby et al., 2008; SOFA Team and C. Doss, 2011; Johnston et al., 2018; Satyavathi et al. 2010). In developing countries, 40% of the agricultural labour force consists of women, which is higher in sub-Saharan Africa (SSA) at 50% and over 50% in Eastern Africa (SOFA Team and C. Doss., 2011). Further, while in SSA men spend an average of 371 minutes per day engaged in agricultural work, women spend 467 minutes (Blackden and Wodon, 2006). Women also disproportionately bear the burden of unpaid work (FAO, 2016). They are solely responsible for child bearing and primarily responsible for nurturing the children and for household management and maintenance (Grassiet al., 2015).

Women, especially of reproductive age, are confronted with the inescapable reality of the dual responsibility of nurturing and caring for their children and engaging in productive activities (Leslie, 1988; Rao et al., 2019). While both men and women have multiple roles and responsibilities, men's roles are performed sequentially while those of women are performed simultaneously and this forces women to make difficult tradeoffs (Blackden and Wodon, 2006). Rural women in developing countries are especially disadvantaged. The tasks they engage in mostly add up to 16 hours a day (The World Bank, 2008).

Time allocation between reproductive and productive work in agriculture has implications for nutrition (Stevano et al., 2019). Spending many hours on the farm reduces the time for engaging in domestic nutrition-improving chores. Women may have less time to: breastfeed children, purchase and prepare nutritious and healthy meals, prepare food in hygienic environments, boil water, frequently clean children and their playing environments, and acquire water from the safest water source (Komatsu et al., 2018; Rao et al., 2019; Ruel et al., 2018)

Malnutrition, especially stunting and underweight, is more prevalent in rural areas (Smith et al., 2004). Smith et al. (2004) found that child malnutrition is lower in urban areas because urban children profit from better nourished mothers, better feeding practices, greater use of adults as substitute caretakers and higher use of curative and preventive care. Inadequate care and feeding practices, including inadequate breastfeeding, remains one of the important underlying causes of malnutrition by either directly causing malnutrition or indirectly through its effect on disease and dietary intake (UNICEF, 2015). Rural families in low-income countries rely on family, friends and relatives to provide child care, which is not always reliable (Smith and Tickamyer, 2011).

2. Literature review

It is important to understand how women's time burden in agricultural work affects the nutritional status of the children. While many studies exist that link the mother's employment to nutrition (Abbi et al., 1991; Blau et al., 1996; Diiro et al., 2017; Eshete et al., 2017; Glick and Sahn, 1998; Johnston et al., 2018), only a few link women's time in agricultural work to nutrition (Johnston et al., 2018; Komatsu et al., 2018; Paolisso et al., 2002; Quisumbing et al., 2013; Rao et al., 2019; Ruel et al., 2018). Quisumbing et al. (2013) found that an increase in time in dairy farm activities led to a decrease in time adult women devoted to household activities in Bangladesh. In Nepal, a vegetable and fruit cash crop programme led to an increase in time spent on agricultural production, but decreased the time both men and women devoted to care for preschool children, especially in households with only one preschool child.

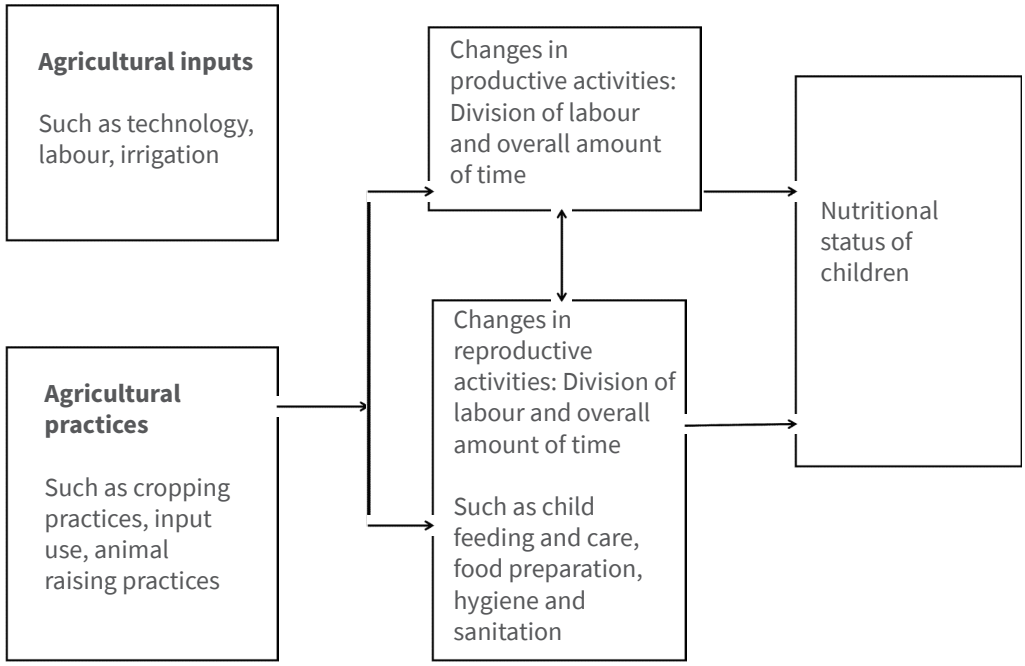
More recently, Komatsu et al. (2018) examined the effect of women's time in domestic and agricultural work on women's and children's dietary diversity in Bangladesh, Nepal, Ghana, Mozambique and Cambodia. They find that the more time women allocate to domestic work and cooking, the more diverse their diets. The results for Mozambique indicate that the effect of women's time spent in agriculture on nutrition varies by socioeconomic status. Hence it can be concluded that the effect of women's time spent on nutrition varies by socioeconomic status and context.

Johnston et al. (2018), Rao et al. (2019 and Ruel et al. (2018) conducted systematic reviews of the literature linking agriculture and nutrition. Ruel et al. (2018) found that nutritional-sensitive agricultural programmes improved many nutritional outcomes of mothers and children, especially if such programmes empowered women and included components of nutrition and health behaviour change communication. Johnston et al. (2018) and Rao et al. (2019) found that the impact of women's work on the farm on nutrition is complex and that there is no consensus on the impact, and that context really matters. That differences across farming systems relating to gender aspects of division of labour, or "labour market arrangements", affect the way women's agricultural work affects nutrition (Rao et al., 2019).

Previous studies suggested that the context matters in understanding the relationship between women's work in agriculture and nutrition. Evidence from SSA on how women's time in agricultural work affects nutritional status of children is scarce. Yet, agriculture is the mainstay of most rural women in SSA. Using data from Tanzania, this study will answer the following research question: What is the effect of hours women worked on the farm on children's nutritional status?

Figure 1 provides the conceptual framework. Agricultural inputs such as technology and labour affect the agricultural practices, which affects the productive and reproductive activities and hence the time allocated to these activities. In the framework, there is a simultaneous relationship between time in productive and time in reproductive activities. Increasing time in productive work is expected to reduce time allocated to reproductive work affecting child feeding and care, food preparation and hygiene and sanitation, which affect child nutrition.

Figure 1: Conceptual framework



Source: Adapted from Johnston et al., 2018.

3. Methodology

To estimate the effect of hours women work on farms on the nutritional status of children, we estimate the following nutritional production function, given as:

$$N_{iht} = \alpha_h + \beta_1 L + \beta_2 X_{iht} + \varepsilon_{iht} \quad (1)$$

where N is the nutrition indicator for child *i* from household *h* in year *t*. *L* is the total number of hours worked by a woman on the farm. β_1 is the nutrition elasticity with respect to women's hours in agriculture.

In estimating these relationships, one may encounter the problem of reverse causality. While hours worked on a farm may affect the nutritional status of children, poor nutritional status among children may cause them to be sickly, requiring a woman to reduce their time spent on the farm to care for the children. This reverse causality causes L to be correlated with the error term leading to endogeneity (Wooldridge, 2010). This study will estimate a panel data regression with an instrumental variable. We will use a Hausman test to determine whether to use the fixed effects instrumental variable (FEIV) or the random effects instrumental variable (REIV). An instrumental variable estimation requires valid instruments. This study uses average hours women work on the farm in each cluster as an instrumental variable. This variable is expected to be highly correlated with the hours women work on a farm, but not correlated with children's nutritional status.

4. Data

This study will use the Tanzania National Panel Survey (NPS) (waves 1-4) conducted in 2008/9, 2010/11, 2012/13 and 2014/15 by the Tanzania National Bureau of Statistics (NBS). NPS is part of the Living Standards Measurement Study - Integrated Surveys on Agriculture (LSMS-ISA) project. The panel surveys are nationally representative, collecting household level information on agricultural production, socioeconomic characteristics, non-farm income generating activities and consumption. The first wave (NPS 2008/09) of the NPS was carried out from October 2008 to October 2009. A total of 3,265 households were sampled and interviewed. The second wave (NPS 2010/11) was carried out from October 2010 to November 2011. This wave tracked 97% of the original households. A total of 3,772 households were tracked and interviewed.

The third wave (NPS 2012/13) began in October 2012 and ended in November 2012. The sample of tracked households was 5,010, with 96% of the original households tracked. The increase in number of households over the years was mainly due to household members leaving their original households to start their own households mainly due to marriage or some household members moving with other households (NPS, 2014). The fourth wave (2014/15) was implemented between October 2014 and November 2015. The sample design in the 4th wave was different from that used in the 1st to 3rd waves. In the fourth wave, a nationally representative sub-sample was drawn from the original NPS sample, referred to as the extended panel. In addition, a new sample to represent national and sub-national domains was drawn, which is referred to as the refresh panel (NPS, 2017). In total, 784 households were interviewed under the extended panel and 3,352 households were interviewed under the refresh panel. Due to the refreshing of the sample, it is not possible to know what proportion of households in the 3rd wave were tracked and interviewed in the 4th wave. Given that only 784 households from previous waves were interviewed, this study will not use wave 4 but only waves 1 to 3.

In the data, households provided information on consumption over the previous week. This information will be used to generate a household diet diversity score. The data also collected information on irrigation and contract farming, as well as anthropometric data for children.

5. Results

Variable definitions

Table 1 presents the definition of variables included in the model.

Table 1: Variable definitions

Variable	Variable definition
Stunted	A binary variable taking a value of 1 if a child is stunted, 0 otherwise
Underweight	A binary variable taking a value of 1 if a child is underweight, 0 otherwise
Hours worked by women on farm in previous 7 days	Number of hours worked by either female household head or spouse on farm, per week
Female highest education	Number of years of education attained by highest schooled female in household
Age	Age in years
Child Sex	Binary variable taking a value of 1 if child is male, 0 otherwise
Head sex	Binary variable taking a value of 1 if household head is male, 0 otherwise
Married head	Binary variable taking a value of 1 if household head is married, 0 otherwise
Head years of education	Number of years of education attained by household head

Descriptive statistics

Table 2 presents the descriptive statistics on child nutrition. In 2008/9, 41% of children below 5 years were stunted. The prevalence of stunting then marginally decreased to 38% in 2011/12 before rising to 40% in 2012/13. The proportion of underweight children reduced from 19% in 2008/9 to 12% in 2012/13.

Large variations in child nutrition can be seen between rural and urban areas. Rural areas have a higher share of stunted and underweight children. However, the gap between rural and urban proportions decline as we move from 2008/9 to 2012/13. For example, in 2012/13, 41% of rural and 35% of urban children were stunted, a difference of 6%. In 2008/9, 44% of rural children and 34% of urban children were stunted, a difference of 10%, as can be seen in Table 3.

Table 2: Child anthropometrics by year

	2008/9		2011/12		2012/13	
	Mean	SD	Mean	SD	Mean	SD
Stunting dummy	0.41	0.49	0.38	0.48	0.40	0.49
Underweight dummy	0.19	0.39	0.13	0.34	0.12	0.32
	3270		2707		2098	

Table 3: Child anthropometrics by area of residence

	2008/9				2011/12				2012/13			
	Rural		Rural		Rural		Urban		Rural		Urban	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Stunted	0.44	0.50	0.34	0.47	0.39	0.49	0.31	0.46	0.41	0.49	0.35	0.48
Underweight	0.21	0.41	0.14	0.35	0.15	0.35	0.09	0.29	0.12	0.32	0.10	0.31
N	1538		559		2104		607		2460		818	

Table 4 presents the descriptive statistics. The average wealth index is 3, and has remained constant over the years. Slightly less than half of children are male, and the average age of children declined slowly from 3 in 2008/9 to 2 in 2012/13. The average household size remained approximately constant at 7 years over the years. The average number of years attained by the highest schooled female in a household was 8 in 2008/9, growing to 9 in 2012/13. The number of years of schooling attained by the household head remained constant at 8 over the years. The majority of household heads were male, at 80%, with an average age of 47 years. The share of married household heads declined from 96% in 2008/9 to 79% in 2012/13. The average number of hours women worked in agricultural activities increases from 13 in 2008/9 to 27 in 2011/12, before declining to 20 in 2012/13.

Table 4: Descriptive statistics

	2008/9		2011/12			
	Mean	SD	Mean	SD	Mean	SD
Wealth index	3.00	1.41	2.93	1.43	2.96	1.43
Child age	2.51	1.69	2.46	1.73	2.37	1.71
Child sex	0.48	0.50	0.48	0.50	0.49	0.50
Household size	6.75	3.81	7.09	4.39	7.04	4.34
Rural dummy	0.66	0.47	0.71	0.45	0.69	0.46
Female highest education	7.79	5.04	8.20	5.12	8.70	5.11
Age of household head	47.08	14.40	47.73	14.66	47.71	14.97
Sex of household head	0.80	0.40	0.79	0.41	0.79	0.41
Education of household head in years	7.68	5.40	7.58	5.44	7.79	5.57
Married household head	0.96	0.59	0.80	0.40	0.79	0.40
Hours women worked on farm	13.18	17.05	26.93	16.20	20.37	18.44
N	16709		20562		25412	

In Table 5, we see a significant difference in the hours women worked on the farm against children who are stunted/underweight and those not stunted/underweight. For stunted children, women in those households worked an average of 17 hours on the farm compared to 14 for non-stunted children. The difference is statistically significant. For underweight children, women worked an average of 17 hours on the farm compared to 15 hours for children who are not underweight.

Table 5: Mean hours worked on the farm by children nutritional status, SD in brackets

	Not stunted	Stunted	Diff	Not underweight	Underweight	Diff
Hours worked by women per week on the farm	13.68	16.57	***	14.54	16.97	***
	(17.56)	(18.07)		(17.80)	(18.53)	

Effect of women's time in farming on children's nutritional status

A Hausman test was carried out to determine whether to estimate a random or fixed effects model. The results indicated that we do not reject the null hypothesis as the difference in coefficients is not systematic. Therefore, we use a random effects model to estimate the effects of women's time on the farm on children's nutritional status. Not only can women's time on the farm affect children's nutritional status, but also when children are in poor nutritional status they may be sicklier causing a woman to work less on the farm. Due to this reverse causality, we also estimate an instrumental variable random effects model to control for potential endogeneity of women's time. Table 6 presents the random effects and the instrumental variable random effects model results. The instrumental variable used was average time worked by women on the farm in the cluster. This variable is expected to be highly correlated with women's time on the farm but not with nutritional status of the children.

The results indicate a positive and significant relationship between time women worked on the farm and children's nutritional status. The longer the time women worked on the farm, the higher the chance of children being stunted and underweight. The instrumental variable estimation results also confirm these findings of a positive and significant relationship. The effect is slightly higher in the instrumental variable regressions. The findings in this study suggest that if women spend longer hours on the farm, they reduce the time for engaging in nutrition-promoting household chores such as preparing nutritious food for the children, feeding the children, maintaining a hygienic environment and even taking them for preventive and curative care. This finding is in line with Komatsu et al., 2018 who found that in Mozambique, working long hours in agriculture is negatively associated with women's dietary diversity score in non-poor women and hence may affect the nutritional status of children. The findings also confirm the findings by (Paolisso et al., 2002) who found that more time spent on agricultural work led to less care given to preschool children. Similar

to Quisumbing et al. (2013) this study suggests that an increase in time in agricultural production reduces the time devoted to domestic work.

Income as proxied by wealth index reduces the likelihood of children being stunted. Children from households with a high income are less likely to be stunted and underweight. Similarly, women who come from high income households are less likely to work long hours on the farm. The likelihood of stunting and underweight in children under 5 years reduces with age. Older children are less likely to be stunted and underweight. The findings in Table 6 also show that male children are less likely to be stunted than their female counterparts.

Female education plays a role in reducing the chance of child stunting. An increase in the years of education of females in a household is associated with a reduction in the probability of children being stunted. Children from households where the household head is married are less likely to be stunted than those from households where the head is not married. Further, an increase in the age of the household head reduces the chances of child stunting. A positive and significant relationship is observed between years of education of household head and probability of a child being underweight. An increase in years of education of a household head is associated with a reduction in the probability of a child being underweight.

Table 6: Women's time on the farm and children's nutritional status

	Stunted		Underweight		First-stage regression
	RE	IVRE	RE	IVRE	RE
	1	2	3	4	5
Hours worked on farm by women	0.001***	0.001**	0.005***	0.002***	
	[0.000]	[0.000]	[0.001]	[0.000]	
Wealth index	-0.025***	-0.020***	-0.016**	-0.015***	-0.456**
	[0.006]	[0.004]	[0.006]	[0.004]	[0.187]
Age of child	-0.043***	-0.037***	-0.043***	-0.036***	0.094
	[0.005]	[0.003]	[0.005]	[0.003]	[0.124]
Sex of child	-0.019	-0.024***	-0.021	-0.026***	0.263
	[0.013]	[0.009]	[0.013]	[0.009]	[0.410]
Household size	-0.002	0.00001	-0.003*	0.00001	0.026
	[0.001]	[0.001]	[0.001]	[0.001]	[0.046]
Highest female education	-0.004**	-0.001	-0.004**	-0.001	-0.003
	[0.002]	[0.001]	[0.002]	[0.001]	[0.052]
Age of household head	-0.001*	0.0001	-0.001**	0.0001	0.062***
	[0.001]	[0.000]	[0.001]	[0.000]	[0.017]
Male household head	-0.053*	-0.002	-0.05	0.00001	0.816
	[0.031]	[0.022]	[0.031]	[0.022]	[0.944]

continued next page

Table 6 Continued

	Stunted		Underweight		First-stage regression
	RE	IVRE	RE	IVRE	RE
	1	2	3	4	5
Years of education of household head	0.00001	-0.002*	0.0001	-0.002*	0.107**
	[0.002]	[0.001]	[0.002]	[0.001]	[0.053]
Married head	-0.084**	0.001	-0.094***	-0.004	2.231**
	[0.035]	[0.025]	[0.036]	[0.025]	[1.089]
Year 2010/11	-0.033*	-0.072***	-0.071***	-0.092***	-0.426
	[0.018]	[0.013]	[0.019]	[0.013]	[0.596]
Year 2012/13	-0.02	-0.092***	-0.039**	-0.102***	-0.813*
	[0.015]	[0.011]	[0.016]	[0.011]	[0.486]
Mother lives in the household dummy	0.02	0.007	0.014	0.004	-0.135
	[0.026]	[0.019]	[0.026]	[0.019]	[0.772]
Instrumental variable					
Average hours spent by women on the farm in the cluster					1.024***
					[0.021]
Constant	0.811***	0.392***	0.753***	0.361***	-6.390**
	[0.083]	[0.058]	[0.084]	[0.059]	[2.578]
Observations	5,632	5,840	5,632	5,840	7,849

Standard errors in brackets *** p<0.01, ** p<0.05, * p<0.1

6. Conclusion and policy implications

This study sought to examine the effect of hours women worked on farms on the nutritional status of children. Child nutritional status is measured by height for age (stunted) and weight for age (underweight). This study estimated an instrumental variable random effects model. The study used data from three waves of the Tanzania National Panel Survey. The results show that women working long hours on the farm increase the chance of their children being stunted and being underweight.

Labour-saving technologies can reduce the time and effort required to undertake some activities (FAO, 2019). This study therefore recommends policies that can help reduce the hours women work on the farm as this can be traded off with time they would have spent undertaking nutritional promoting activities with negative consequences for children's nutritional status.

Women can be encouraged to form work groups that they can use for their agricultural activities. For example, they could work on each other's farms in turn, and this would reduce the total amount of time each day that they work on the farm. The local government can also invest in labour-saving machinery like tractors, shellers and harvesters that women can hire at a subsidized price, which could go a long way in helping reduce the hours they work on the farm.

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