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The Effects of Household Shocks on Child Nutrition Status in Tanzania

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Abstract

The main objective of this paper is to examine the effects of household shocks on the nutrition status of children between 0–59 months in Tanzania. The study employed the national panel survey data of Tanzania collected in three waves: 2008/09, 2010/11, and 2012/13. The study used the panel random-effects probit model to estimate the effects of household shocks on child nutrition status, measured by binary variables: stunting, wasting, and underweight. Findings indicated that weather shocks increase the probability of a child being stunted and underweight. Moreover, the results revealed that food price rise shocks and the death of a family member increase the probability of child-stunting. In addition, the findings indicated that food assistance reduces the probability of a child being stunted and underweight. These findings suggest the need for the government to improve food assistance programs to reach many people, especially the poor and marginalized households in a period of shocks. In addition, agricultural policies that aim at increasing productivity, such as irrigation schemes, should also be enhanced to enable food availability in the country; and protect children from malnutrition even after the occurrence of shocks.

Keywords: *malnutrition, household shocks, panel data, probit model, Tanzania.*

1. Introduction

Malnutrition in younger children below five years remains a significant growth and health challenge globally (Groot et al., 2017). It is estimated that 22.9 percent of younger children below five years globally are stunted, 7.5 percent are wasted, and 5.6 percent are overweight (WHO et al., 2018). In Sub-Saharan African (SSA) countries, nearly 40 percent of pre-school children are stunted, a rate which is higher than in other regions of the world (Akombi et al., 2017). Furthermore, 45 percent of pre-school deaths in SSA are associated with chronic malnutrition, including stunting and underweight (Mikalitsa, 2015). This problem is also higher in Tanzania, especially to its younger population aged 0–59 months, in both its rural and urban populations. Recent malnutrition statistics in

Tanzania indicated that 34 percent of children under-five are stunted, 14 percent are underweight, and 5 percent are wasted (NBS, 2016). This rate is still high despite efforts made by the Ministry of Health and Social Welfare (MoHSW) to reduce the rate of stunting and underweight of children below five years to 27 and 11 percent, respectively, in the year 2015 (URT, 2012). This paper aims to examine the effects of household shocks on the nutrition status of younger children below five years of age (0–59 months) in Tanzania. The study also investigates whether food assistance mitigates the effects of household shocks, and thus improves children's nutrition.

According to Chen et al. (2006) and Deaton and Paxson (1998), there is a strong relationship between household wealth and children's health status. It is also evident that a wide range of household shocks that face poor households in their day-to-day lives also affect children's nutrition outcomes. Household shocks normally disrupt the incomes of poor households with constrained resources, and those with lower opportunities for doing diversification (Dhanaraj et al., 2019). Since in less developing countries (LDCs) the formal credit and insurance market is relatively thin—and sometimes incomplete—poor families are forced to rely on informal coping strategies, which are not all effective (Baez, 2007; Galiano & Vera-hernández, 2008). These strategies include reducing expenditure on food consumption, relocation of children's time, marrying-off young girls, drawing from past savings, borrowing, and withdrawing young children from school. Given this situation, household shocks might have the potential of affecting investment in children's nutrition outcomes (Alderman, 2009). Therefore, overcoming childhood malnutrition in less developing countries like Tanzania is among the important policy question to be addressed.

Children under five years are said to be especially more vulnerable to household shocks and malnutrition, which affect their health and growth (Carter & Maluccio, 2003; Martorell et al., 1994; Pongou et al., 2005). These children are more vulnerable to household shocks especially from year one to three (Alderman & Hoddinott, 2006; Omitsu & Yamano, 2006). This is because these children have the highest growth rate in infancy, hence household shocks have a higher potential of causing poor health and growth retardation (Omitsu & Yamano, 2006). In addition, younger children have higher dietary requirements compared to their adult counterparts, which make them be more vulnerable to diseases such as malnutrition (Omitsu & Yamano, 2006). Also, children under five years have a low ability to make their ends meet (Martorell, 1999): their ends or wants are known by their caretakers, hence they may be more vulnerable to poor health care practices (Martorell, 1999). These children's needs from parents and caretakers include investing in their health by providing quality food and good medication. Thus, failure to invest in the health of children at the right time might affect children's health in the long-run, as well as their future labour market outcomes (Rossel, 2008).

Household shocks are shown to have negative effects on children's health and nutrition outcomes. For example, household shocks induced by weather shocks affect children's health through supply disruptions, which might result into hunger, and hence cause child malnutrition (Kousky, 2016). On the other hand, a food price increase lowers the purchasing power of net buyers (Martin & Ivanic, 2016). Poor households might reduce expenditure on food consumption as well as medical care because of a rise in food prices, a situation that can result in poor health outcomes (Arndt et al., 2016). Moreover, death shocks significantly affect the nutrition status of children, especially when the death involves a parent or a household member who was taking care of children by providing food and other healthcare services, such as medication (Halmdienst & Winter-ebmer, 2014). Further, severe water shortages can result in drought and loss of food, which might lead to hunger and hence malnutrition (Tarrass & Benjelloun, 2012a).

Children who suffered from malnutrition at their early life stages because of various household shocks are more likely to have a slow growth rate (Dercon & Hoddinott, 2003). They also tend to have poor cognitive development, and sometimes may develop mental health problems (Johnston et al., 1987; Singhal, 2019). Mental health might be a result of stressful shocks such as parental death, displacement, violence, as well as hunger (Tarrass & Benjelloun, 2012a). These negative effects of shocks have been shown to operate through nutrition outcomes of children who are exposed to those shocks (Nsabimana & Mensah, 2020). Nevertheless, social assistance programs, such as food assistance, have been identified as an intervention used in offsetting the effects of shocks on younger children's malnutrition (Yamano et al., 2005). Despite this, there is limited empirical evidence on the effects of household shocks on child nutrition status in Tanzania, where there is limited access to safety nets, as well as limited credit and insurance markets (Sarris et al., 2006).

This paper contributes to the growing body of literature on the effects of shocks on children's nutrition outcomes (Bonjean et al., 2012; Dercon & Hoddinott, 2003; Edoka, 2013; Omitsu & Yamano, 2006; Rossel, 2008; Yamano et al., 2005). For example, using data from Vietnam, (Edoka, 2013) shows that exposure to children on small weather shocks has negative effects on child nutrition status. Similarly, Dercon and Hoddinott (2003) revealed the positive correlation between droughts and child-stunting in Zimbabwe. In Nicaragua, Omitsu and Yamano (2006) revealed a higher likelihood of exposure to Hurricane Mitch shocks on child-stunting. Further, Akresh et al. (2011) also found that exposure to civil wars affects the nutrition status of younger children in Rwanda. Again, in Peru, Rossel (2008) revealed a positive association between climatic shocks and child-stunting. Also, in Tanzania, Nsabimana and Mensah (2020) found a positive association between weather shocks and child-stunting. This literature did not incorporate the role of food assistance as a safety net employed in offsetting the effects of household shocks and children's malnutrition. The current study fills the existing gap in the literature by incorporating the role of food assistance as a safety net in reducing the effects of shocks and child malnutrition, of which previous studies did not incorporate.

The organization of the rest of the study is as follows. Section 2 presents the conceptual framework; section 3 discusses the methods of the study; section 4 shows the findings of the study; section 5 presents the discussion of the results; and section 6 presents the conclusion and policy implications of the study.

2. Conceptual Framework

The conceptual framework is drawn from previous studies that link household shocks and child nutrition outcomes (Hoddinott & Kinsey, 2001; Pitt & Rosenzweig, 1985; Rossel, 2008). The model is derived by assuming the following utility function:

$$U_t = f(H_t^i, C_t^r, C_{t,}^v L_{t,}^i Z_t)$$
for the members of the household $i = 1$ to N (1)

The utility function is the function of private and public goods consumed (C_t^r and C_t^v), household member's health status (H_t^i), the time used for leisure (L_t^i), and household norms and tastes (Z_t). r *and* v shows the public and private goods, respectively; and C represents household consumption.

To maximize utility, a household is faced with two constraints: budget constraints and health production function. The production function for children's health is a function of various inputs that can be combined to produce children's health and health environmental goods. Health environment goods consist of goods that affect a child's utility and health directly. The determinants of a child's malnutrition are health services within the community, households, and the child's health input (Edoka, 2013; Martorell, 1999; UNICEF, 1990). The inputs are such as caretakers' resources. Parents also demand child health inputs as they affect their utility indirectly via their effects on children's health. Thus, the health status of a member of a household i is determined by the consumption of both public and private goods; the health status of a member of a household that depends on the education of the head of the household ($E_t^\emptyset$), child's education (E_t^i), leisure at time t(L_t^i), time that is devoted to child healthcare practices (TH_t^i), the surrounding environment (θ_t^i), and individual's endowments (ε^i).

The health production function is represented by:

$$H_t^i = f(C_t^r, C_t^v, E_t^\emptyset, E_t^i, L_t^i, TH_t^i, \theta_t^i, \varepsilon^i) \qquad (2)$$

Furthermore, goods consumed include food nutrients intake and other goods that are related to health such as medicines. These goods are expected to affect a child's health positively. In addition, the time that is devoted to health care practices and the environment that surrounds individuals also determine children's health. These endowments include the sex, age, or genetic characteristics of households (Edoka, 2013). The capital stocks (K_t) are determined by aids or assistance (such as food assistance) received by a household ($f\_Assistance_t$), the income of a household in the period t,(W_t), and a vector of public and private goods consumed ($C_t^r + C_{t,}^v$), respectively. It is also a function of vector prices of both private goods (P_t^v) and public goods consumed (P_t^r). It is given by equation (3):

$$K_t = f\_Assistant_t + W_t - P_t^v C_{t,}^v - P_t^r C_t^r \qquad (3)$$

According to literature (Baez, 2007; Edoka, 2013), household shocks are often associated with welfare loss, especially when a household had already faced huge constraints in its budget. This situation in turn affects the nutrition of children when a household does not have risk-coping mechanisms to cope with shocks. In this case, the wealth of a household is determined by a household's technology $(tech_{t)}$, a household's wage (Y_t), time devoted to leisure and health (L_t and TH_t), output price vectors (P_t), household shocks $(SHOCK_{t)}$, and individual characteristics (Œµ^i). Therefore, the income of a household is represented by the following equation:

$$W_t = f(tech_t, K_t, Y_t, TH_t, P_t, SHOCK_t, L_t, \varepsilon^i) \quad (4)$$

Maximizing a household's intertemporal utility function (1), subject to heath production function and budget constraints (2)-(4), we have a health function that only depends on exogenous variables, as represented below:

$$H_t^i = f(E_t^{\emptyset}, E_t^i, \theta_t, \varepsilon^i, TH_t, tech_t, Y_t, SHOCK_t, P_t^v, P_t^r, Z_t) \quad (5)$$

Where, H represents children's Height-for-Age Z-score (HAZ); Weight-for-Age Z-score (WAZ); and Weight-for-Height Z-score (WHZ), as indicators of the nutrition status of younger children. Equation (5) is used in the analysis in this paper.

3. Methods

3.1 Data

This paper employed three waves (2008/09, 2010/11, and 2012/13) of the National Panel Survey data of Tanzania (NPS). The three waves have been used since the fourth and fifth waves draw their sample from a different master sample plan, as compared to the previous three waves of the NPS. Hence, having unique identifications for all households in all waves was not possible. The NPS is a part of the living standards measurement study conducted by the National Bureau of Statistics of Tanzania, in collaboration with the World Bank. It is a representative of Tanzania Mainland and Zanzibar. Wave 1 took place from 2008 October to September 2009; the second wave ran from the year 2010 October to 2011 September; and wave three took place from 2012 October to 2013 September. The initial samples for waves one, two, and three were 3,265, 3924, and 5,015, respectively.

A total number of 3088 households were re-interviewed in all three waves. This is because in order to have a panel data, households or individual have to be re-interviewed over a period of time. The attrition rate was 5.4 percent in all five years, which is low when compared to other studies that use panel surveys in poor nations, which is around 7.5–8 percent (Outes-Leon & Sanchez, 2008). The NPS also provided information on age, education, and anthropometric measures (including height, weight, and body circumferences). This information was used in the computation of the nutrition status of children. The NPS also contained information on food assistance, which includes free maize that is distributed to households by the government and non-governmental organizations (NGOs). During the survey, households were asked if they received any food assistance from the government and NGOs. Their response was supposed to be '*Yes*' or '*No*'. This information was used to determine whether the distribution of free food in Tanzania offsets the effects of household shocks, and whether it reduces child malnutrition.

This study used an individual as the unit of analysis. This is because the study focused on younger children within households. In constructing an individual-level panel dataset, the first stage was to restrict the age for all individuals with five years and below (0–59 months). This was done by following each cross-section unit of all individuals with age 0–59 months in all three waves (2008/09, 2010/11, and 2012/13). Initially, the NPS had 16,708 observations in wave1, 20,559 in wave 2, and 25,412 in wave 3. After the age restriction, the study remained with 3,027 observations in wave 1; 3,718 in wave 2, and 4,595 in wave 3. Thereafter, the researchers calculated the HAZ, WAZ, and WHZ values. To ensure the extreme z-scores did not distort or harm the analysis, the WHO provided the guidelines on the z-scores that qualify as outliers (WHO, 2011). Thus, HAZ, WAZ, and WHZ scores for a child that are greater than 6 or less than -6 were eliminated from the sample (WHO, 2011). Then, the study appended the data set in all waves, and had 9,193 observations. The main aim was to have a panel dataset: hence, from the sample of 9,193, the study then tracked individuals who appeared in at least two waves. This process made a loss of 4,557 observations that appear in only one wave. After this process, the study remained with a sample size of 4,636 observations, which has been used in the main analysis.

3.2 The Outcome Variable

The main outcome variable of this paper is the nutrition status of younger children aged 0–59 months; measured by stunting, underweight and wasting. Anthropometric information on each child was used to compute the nutrition status using the WHO standardized procedures (WHO, 2011). The anthropometric measures for younger children included height, length, weight, and head circumference (Leroy, 2011; WHO, 2011). The common indices that are used in measuring children's growth/health status are weight-for-age, height-for-age, and weight-for-height. These growth indicators are expressed in terms of z-scores, which are the standard deviations relative to the median obtained from the WHO reference population (WHO, 2011). The height-for-age is a linear growth that indicates one's past or previous nutrition status; weight-for-age indicates child undernutrition (Rossel, 2008; WHO, 2011); while weight-for-height indicates wasting, and is associated with actual loss of body weight. This study computed the index of child nutrition status using the following expression adopted also by Nsabimana and Mensah (2020).

$$Zscore = \frac{H_{i-}K}{K_{sd}} \qquad (6)$$

Where $Zscore$ indicated standard deviation, which shows the nutrition outcome indicators (WAZ, WHZ, and HAZ); H_i showed the observed measure value of an individual i; K represents the median value of referenced population for similar age or height or weight, and K_{sd} indicates the standard deviation (SD) of the referenced population (Nsabimana & Mensah, 2020).

The expression derives the indexes which are height-for-age z-scores (HAZ), weight-for-age z-scores (WAZ), and weight-for-height z-scores (WHZ). This study, therefore, constructed the binary indicators for HAZ, WHZ, and WAZ values for child stunting, wasting, and underweight. Therefore, a child is regarded to be stunted, underweighted, and wasted if the height-for-age z-scores (HAZ), weight-for-age z-score (WAZ), and weight-for-height z-score (WHZ) is $<$ -2 standard deviation, and 0 if otherwise.

3.3 Explanatory Variables

The paper's main explanatory variable is household shocks (i.e., food price rise shocks, weather shocks, death shocks, and severe water shortage). The study measured the household shocks as a vector of dummy variables, which takes the value of 1 if a household has experienced those events in the past two years before the survey date, and 0 if otherwise. The other explanatory variables are used as control variables.

3.3.1 Shock Definition

Shock is defined as an unexpected and adverse event that causes loss in the income of the household, decrease in household consumption, and loss in the households' assets (Dercon et al., 2005). Household shocks should also be regarded as any adverse and or unexpected events that affect the welfare of the households as defined by Dercon et al. (2005). The Tanzanian National Panel Survey questionnaire had a section on "*Recent Shocks to Household Welfare.*" The section focused on shocks that households had experienced in the past five years, including the timing of the shock. For each shock reported, the survey collected information regarding the scope and widespread of the shock. Specifically, the first question in the survey was: "*Over the past five years, was your household severely affected negatively by the following events/shocks?*" The shocks and unexpected events were listed, including drought/floods, crop shocks (diseases/crop pests), business failure, loss of salaried employment, rise in food prices, severe water shortages, loss of land, severe illness/accidents involving household members, death of a household member, death of parents, separation of families, imprisonment, theft, huge rise in input prices, a large fall in sales prices, and loss of livestock. The second question in the survey was "*When did this shock occur?*" The year and month of the occurrence of the shock were recorded. These questions helped in identifying the relevant shocks each year, and were used in generating the shock variables in 2 years before the survey date. Shocks were generated in two years before the survey date to focus more on recent shocks. This limited the shock to those that occurred between two waves of the survey.

Other inquiries from the questionnaire were: "*Rank the three most significant/severe shocks you experience*d:" followed by: "*Did (the shock) cause a reduction in household income and/or assets*? Here, households/respondents answered by mentioning the most significant shocks that had severely affected their income and/or assets. From these two criteria, the first four significant household shocks (weather shocks, death shocks, food price rise shocks, and severe water shortage) were then selected. The selected shocks are significant and relevant in the Tanzanian context because the country's largest proportion of households—about 75 percent—live in rural areas, and depend on agricultural activities to earn their living (Chongela, 2015). Therefore, weather shocks largely affect people's livelihoods (Chongela, 2015). Additionally, due to the heavy dependence of many households on agricultural activities, the rise in food prices largely affects consumer's income by decreasing their purchasing power (Mbegalo, 2016). Moreover, almost 70 percent of the households in semi-arid areas like Dodoma and Shinyanga are far from water sources, and suffer from severe water shortages (Mkonda & He, 2018). Furthermore, death shock is also significant in Tanzania because of the limited social assistance programs that might protect the remaining members of a household after the death of the caretaker(s) (Gaydosh, 2015).

3.3.2 Control Variables

The age of a household head was measured in years, while a child's age was measured in months. The sex of a child and that of a household head were measured as a dichotomous variable, with a value of 1 if the child or the head of a household was male, and 0 if otherwise. Food assistance was measured as a dummy variable with a value of 1 if the household received food assistance from the government and/or NGOs in the last twelve months before the survey date; and 0 if otherwise. A household size measures the number of individuals belonging to a given household; while residence captures the location of a household, and is measured as a dichotomous variable with a value of 1 if a household lives in a rural area, and 0 if it live in an urban area. Access to safe water was measured as a dummy variable, indicating 1 if a household has access to safe and clean water, and 0 if otherwise. The education status of the head of a household was grouped into three categories: primary, secondary, and tertiary education; with the reference category being primary education. Hospitalization was also measured as a dummy variable that had the value of 1 if an individual in a household was hospitalized during the last 12 months before the survey date, and 0 if otherwise. This variable aimed to capture whether individuals in households had access to healthcare services.

3.4 Empirical Model

As an indicator of the health production of a child, the effects of household shocks on child nutrition is analysed by using the following econometric model in equation (7):

$$H_{ijt} = \beta_1 + \beta_2 Shock_{jt} + \beta_3 Food_{ASS_{jt}} + \beta_4 X_{ijt} + \mu_{ijt} \quad (7)$$

Where:

Subscripts i, j, and t represent the index for child, household, and time, respectively. The variable $\mathrm{H_{ijt}}$ is the dependent variable of this paper, which represents the nutrition status of a child i in a household j at time t. The dependent variable is a binary variable indicating 1 if a child is stunted, underweight, or wasted. $Shock_{jt}$ is the main explanatory variable, measuring the shocks of household j at time t. $Food\_ASS_{jt}$ represents a binary measure of food assistance that has been used as a safety net. X_{ijt} is a vector of household, child, and community characteristics, and Œº$_{ijt}$ is the idiosyncratic error term.

This paper used the panel random effects probit model. The use of this model was motivated by several advantages attached to it. Unlike other models such as the linear probability model (LPM), ordinary least square (OLS) and the fixed effects probit model (Bland & Cook, 2019), the random effect probit model is useful in analysing dependent variable outcomes in panel data with individual heterogeneity (Aldrich et al., 1984; Bland & Cook, 2019). Secondly, the model is best used when there are no omitted variables bias (Williams and Dame 2018). To choose between the random effects probit model and the random effect logit model, the study conducted the omitted variable test using the RESET test (Shukur & Mantalos, 2015). The null hypothesis from the RESET test states that the model is specified. Thus, the *p-value* of greater than 0.05 threshold indicates that a model is specified, hence the study fails to reject the null hypothesis (Shukur & Mantalos, 2015). This justifies the use of the random effect probit model.

4. Results

4.1 *Descriptive Statistics*

The statistics show that the mean values of HAZ, WAZ, and WHZ are negative in all three waves (2008–2013) and individual waves which are wave 1 (2008/09), wave 2 (2010/11), and wave 3 (2012/13); as well indicating marginally stunted, underweight, and wasted, respectively (Table 1). The results indicated that, on average, 45 percent of the children are stunted, 14 percent are underweight, and 5 percent are wasted in all three waves. The rate of underweight is similar to the rate reported in Tanzania by the NBS (2015).

Table 1: Descriptive Statistics of the Variables Used

	All waves (2008/09, 2011, and 2012/13)					2008/09	2010/11	2012/13
Variable	*N*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Mean*	*Mean*	*Mean*
Height for age z scores	4636	-1.667	1.987	-5.996	5.904	-1.92	-1.559	-1.595
Weight for age z scores	4636	-0.813	1.298	-5.211	5.802	-0.889	-0.82	-0.744
Weight for height z scores	4636	-0.014	1.266	-5.993	5.942	0.083	-0.11	0.022
Stunted	4636	0.449	0.497	0	1	0.527	0.429	0.41
Underweight	4636	0.149	0.357	0	1	0.159	0.168	0.121
Wasted	4636	0.045	0.202	0	1	0.038	0.06	0.043
Child sex (Male=1)	4636	0.488	0.5	0	1	0.474	0.484	0.503
Child age (Months)	4636	31.025	16.116	0	59	28.865	30.574	33.242
Household head sex (Male=1)	4636	0.855	0.352	0	1	0.86	0.844	0.863
Household head age (Years)	4636	42.525	13.419	18	102	41.004	42.435	43.822
Consumption exp. (log)	4636	14.779	0.745	12.215	17.546	14.593	14.66	15.062
Household size	4636	5.568	3.843	1	55	5.621	5.269	4.669
Food assistance (Yes=1)	4636	0.059	0.236	0	1	0.024	0.048	0.10
Access safe water (Yes=1)	4636	0.327	0.469	0	1	0.342	0.319	0.323
Residence (Rural=1)	4636	0.746	0.436	0	1	0.772	0.751	0.788
Primary education	4636	0.888	0.316	0	1	0.888	0.891	0.884
Secondary education	4636	0.103	0.304	0	1	0.102	0.102	0.104
Tertiary education	4636	0.009	0.097	0	1	0.01	0.007	0.012
Weather shocks	4636	0.094	0.293	0	1	0.082	0.075	0.127
Food price rise shocks	4636	0.198	0.399	0	1	0.247	0.179	0.182
Severe water shortage shocks	4636	0.065	0.246	0	1	0.101	0.06	0.043
Death shocks	4636	0.142	0.349	0	1	0.182	0.145	0.107
N (for each wave)						1233	1828	1575

Note: N represents the number of observations.

Source: Authors computations from three waves of TNPS (Wave 1, 2008/09, Wave 2, 2010/11and Wave 3, 2012/13).

On average, the age of a child is 31 months in all three waves; with males being 49 percent and females being 51 percent. This shows that the sex of children was distributed almost equally. The average household size is around 5.6 people per household. This finding is consistent with the NBS (ibid.). In addition, overall 86 percent of the families are male-headed, with an average of 42 years in all three waves. Also, on average, 89 percent of the households in the sample had attained basic education, while 10 percent had attained secondary education; and only 1 percent had attained tertiary education that includes college and university education. Also, on average, only 33 percent of the households had access to clean and safe water. Moreover, on average, 7 percent of individuals in households were hospitalized in all three waves, probably because people do not tend to seek health services in the formal health systems. Moreover, the findings show that, on average, many households in the sample are not well-off as they fell below 50 on the index. Total household expenditure on an annual basis had an average of TZS 3,400,000 (antilog of 14.8). Averagely, 74 percent of the household in the sample were living in rural areas. Moreover, on average, 9 percent of the household reported having been affected by weather shocks, 20 percent by food price rises, 6 percent by severe water shortages, and 14 percent by death shocks in all the three waves.

4.2 The Effects of Household Shocks on the Nutrition Status of Younger Children (Between 0–59 Months)

Tables 2, 3, and 4 present the estimates of the marginal effect of the random effects probit regression model of the effects of household shocks on child nutrition status measured by stunting, underweight, and wasting, respectively. Columns (1–4) of Table 2 present the results of the marginal effect for individual shocks; which are weather shocks, food price rise shocks, severe water shortage shocks, and death shocks on stunting.

Table 2: The Effects of Household Shocks on Child Nutrition Status (Measured by Stunting)

Variables	[1] Stunting	[2] Stunting	[3] Stunting	[4] Stunting
Weather shocks	0.130**			
	(0.079)			
Food price rise shocks		0.334***		
		(0.058)		
Water shortage shocks			0.160	
			(0.092)	
Death shocks				0.142**
				(0.065)
Child sex (Male=1)	0.168***	0.160***	0.166***	0.164***
	(0.047)	(0.047)	(0.047)	(0.048)
Child Age (Months)	0.430***	0.438***	0.432***	0.432***
	(0.046)	(0.046)	(0.046)	(0.040)
Household sex	0.049	0.046	0.048	0.051
	(0.076)	(0.075)	(0.075)	(0.076)
Household head age	-0.002	-0.002	-0.003	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Consumption real exp(log)	-0.140***	-0.152***	-0.143***	-0.144***
	(0.033)	(0.034)	(0.033)	(0.034)
Household size	0.009	0.011*	0.010*	0.010*
	(0.006)	(0.006)	(0.006)	(0.006)
Food assistance(Yes=1)	-0.283***	-0.211***	-0.301***	-0.293***
	(0.102)	(0.101)	(0.100)	(0.100)
Access safe water	-0.178***	-0.179***	-0.176***	-0.174***
	(0.055)	(0.056)	(0.055)	(0.056)
Residence (Rural=1)	-0.072	-0.085	-0.075	-0.080
	(0.057)	(0.058)	(0.057)	(0.057)
Secondary education level	-0.331***	-0.324***	-0.325***	-0.320***
	(0.089)	(0.089)	(0.089)	(0.089)
Tertiary education level	-0.839***	-0.868***	-0.838***	-0.828***
	(0.301)	(0.301)	(0.300)	(0.302)
Observations	4,636	4,636	4,636	4,636

Note: Robust Standard errors in parentheses *** $p<0.01$, ** $p<0.05$, * $p<0.1$

The results in Table 2 indicate that, keeping other factors constant, the experience of weather shocks on child stunting was positively and statistically significant at a 5 percent level of significance in column [1]. This shows that weather shocks are associated with a higher probability of a child being stunted. Particularly, when a household experiences weather shocks, the probability of a child being stunted increases by 13 percent.

Moreover, the results in Table 2 further reveal that the experience of food price rise shocks on child stunting was positively and statistically significant at a 1 percent level of significance in column [2]. This shows that a food price rise shock is associated with a higher probability of a child being stunted. Particularly, when households experience food price rise shocks, the probability of child stunting increases by 34 percent. Furthermore, the results show that the experience of death shocks on child stunting was positively and statistically significant at a 5 percent level of significance in column [2]. This shows that death shocks are associated with a higher probability of a child being stunted. Particularly, when a households experiences death shocks, the probability of a child being stunted increases by 14 percent.

Table 3 shows the marginal effect results of the effects of household shocks on child nutrition status measured by underweight. Columns (1–4) show the regression of each shock on underweight, i.e., regressions of weather shocks, food price rise shocks, severe water shortage, and death shocks.

Table 3: The Effects of Household Shocks on Child Nutrition Status Measured by Underweight

Variables	[1] Underweight	[2] Underweight	[3] Underweight	[4] Underweight
Weather shocks	0.216**			
	(0.108)			
Food price rise shocks		0.100		
		(0.075)		
Severe water shortage			-0.134	
			(0.122)	
Death shocks				0.113
				(0.085)
Child sex (Male=1)	0.401***	0.396***	0.399***	0.398***
	(0.061)	(0.062)	(0.061)	(0.062)
Child Age (months)	0.669***	0.668***	0.670***	0.672***
	(0.064)	(0.065)	(0.064)	(0.064)
Household head sex	0.027	0.027	0.029	0.032
	(0.093)	(0.093)	(0.093)	(0.094)
Household head age (years)	0.001	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)
Consumption real exp (log)	-0.136***	-0.143***	-0.140***	-0.141***
	(0.043)	(0.043)	(0.043)	(0.043)
Household size	0.011	0.012*	0.013*	0.012*
	(0.007)	(0.007)	(0.007)	(0.007)
Food assistance(Yes=1)	-0.388**	-0.408**	-0.308**	-0.476**
	(0.144)	(0.143)	(0.143)	(0.143)
Access safe water	-0.143**	-0.138*	-0.138*	-0.135*
	(0.071)	(0.071)	(0.071)	(0.071)

Residence (Rural=1)	0.132**	0.139*	0.137*	0.140*
	(0.002)	(0.002)	(0.002)	(0.002)
Secondary education level	-0.178	-0.171	-0.172	-0.168
	(0.115)	(0.115)	(0.115)	(0.116)
Tertiary education level	-0.517	-0.517	-0.513	-0.506
	(0.397)	(0.397)	(0.397)	(0.399)
Observations	4,636	4,636	4,636	4,636

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

Keeping other factors constant, the experience of weather shocks on child underweight was positively and statistically significant at a 5 percent level of significance in column [1]. This shows that weather shocks are associated with a higher probability of a child being underweight: when a household experiences weather shocks the probability of a child being underweight increases by 21 percent. Kumar et al. (2016) found similar results in India. Weather shocks such as floods and negative rainfall might affect children's nutrition through the income channel due to their impacts on agricultural activities. Floods might destroy the output produced, and hence lead to food shortage; which in turn may reduce a household's consumption, which might eventually lead to a child being underweight.

Table 4 presents results of the effects of household shocks on child nutrition status. Each column (1–4) indicates the regression results of weather shocks, food price rise shocks, severe water shortage, and death shocks on child-wasting.

Table 4: The Effects of Household Shocks on Child Nutrition Status Measured by Wasting

Variables	**[1] Wasting**	**[2] Wasting**	**[3] Wasting**	**[4] Wasting**
Weather shocks	0.080			
	(0.135)			
Food price rise shocks		0.005		
		(0.093)		
Severe water shortage shocks			-0.107	
			(0.157)	
Death shocks				-0.065
				(0.109)
Child sex (Male=1)	0.336***	0.335***	0.335***	0.335***
	(0.077)	(0.078)	(0.078)	(0.078)
Child age (Months)	0.483***	0.482***	0.483***	0.483***
	(0.086)	(0.086)	(0.086)	(0.087)
Household head sex (Male=1)	-0.003	-0.001	-0.067	-0.000
	(0.108)	(0.108)	(0.108)	(0.108)
Household head age (years)	0.002	0.001	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.002)
Consumption real expenditure (log)	-0.059	-0.060	-0.060	-0.061
	(0.055)	(0.055)	(0.055)	(0.055)
Household size	-0.003	-0.006	-0.002	-0.002
	(0.010)	(0.010)	(0.010)	(0.010)
Food assistance	-0.043	-0.057	-0.058	-0.061
	(0.169)	(0.168)	(0.168)	(0.168)
Access to safe water	0.085	0.087	0.085	0.089
	(0.083)	(0.083)	(0.083)	(0.083)

Residence (Rural=1)	-0.105	-0.107	-0.109	-0.110
	(0.002)	(0.002)	(0.002)	(0.021)
Secondary education level	0.126	0.129	0.130	0.131
	(0.122)	(0.122)	(0.122)	(0.122)
Observations	4,636	4,636	4,636	4,636

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

The marginal effects in Table 4 indicated that all have no significant effects on child wasting. This might probably be due to the fact that the prevalence of wasting in Tanzania is relatively low (5 percent), hence its effects on nutrition might be insignificant. In addition, the weight-for-height z-scores (WHZ) are sensitive to short-run negative events (Rossel, 2008). Further, a child might gain and lose weight quickly, hence, shocks that occurred in the past two years might not necessarily have had a significant effect on child-wasting (Rossel, 2008).

This paper also analysed the role of other control variables on child nutrition status. Columns (1–4) of Table 2 revealed that food assistance was negatively and statistically significant at a 1 percent level of significance. It is noted that food assistance reduces the probability of child stunting by 28 percent, 21 percent, 30 percent, and 29 percent in columns [1], [2], [3], and [4], respectively. Similarly, in columns (1–4) food assistance reduces the probability of a child being underweight by 38, 40, 31 and 41 percent, respectively. Being a male child was associated with a higher probability of child stunting, underweight and wasting. The findings also revealed that child age is associated with a higher likelihood of a child being stunted, underweight, and wasted. Furthermore, the findings revealed that a 1 percent change in real consumption expenditure reduces the likelihood of child stunting and underweight by 14 percent in both Tables 2 and 3. Also, having a household head with secondary and tertiary education reduces the likelihood of a child being stunted and underweight, compared to one's household head having only primary education. Residing in rural areas was also associated with a higher probability of a child being underweight.

5. Discussion

Malnutrition among children between 0 and 59 months of age in Tanzania is still a public health challenge. Higher prevalence rates of child stunting and underweight (34 percent and 14 percent, respectively), indicated that malnutrition is still a challenge among younger children in Tanzania. Empirically, malnutrition has also been identified as among the outcomes of adverse household shocks. Furthermore, childhood malnutrition has also been documented as a result of various household shocks. Household shocks cause permanent effects on children's health through their impacts on children's nutrition. They also affect children's cognitive development, as well as their future labour market productivity. Accordingly, food assistance program is also evidenced as among the safety nets that can offset the effects of shocks, and thus child malnutrition, especially for poor households with constrained income.

Using Tanzania's national panel survey data, this study analysed the effects of household shocks on children's nutrition status. To this end, the study found that weather shocks increase the probability of a child being stunted and underweight. Previous studies (Ogasawara & Yumitori, 2019; Datar et al., 2013) have found similar results. Weather shocks such as droughts and floods might affect the nutrition status of younger children through the agricultural pathway. For a country like Tanzania, where about 75 percent of its population relies on agricultural activities to earn their living, weather shocks might cause crop loss and food shortage, a situation which might result in the loss of food nutrients intakes. This situation can result into childhood malnutrition (Stupar, 2010).

The findings also show a positive association between food price rise shocks and child stunting. Arndt et al. (2012), Sulaiman et al. (2009), and Yamauchi et al. (2019) found similar results. Food prices might affect the nutrition status of children through the income channel. In a short period of time suppliers cannot ultimately increase food production. This situation can create food shortages. Hence the rise in food prices can reduce the real income of households, which can lead to low purchasing power of households. This situation might reduce expenditure on food consumption, as well as expenditure on child health investments, which might in turn result into poor health and poor child nutrition outcomes, including stunting.

The findings of this study also revealed that the death of a family member increases the probability of a child being stunted. In this case, a household might have lost an important provider/source of income in a family. Thus, a death shock causes a permanent loss in income; which may lead to the reduction of family the investments in children's health. In addition, a household may fail to provide food for the family and to cater for other costs such as medicine due to income loss, which may also result into poor children's health, including childhood malnutrition This is corroborated in a study by Woldehanna (2010) in Ethiopia, which revealed that the death of caretakers increases malnutrition in younger children.

Food assistance was associated with a lower probability of child stunting and being underweight. Thus, children residing in households that received food assistance were less likely to be stunted and underweight compared to their counterparts. These findings imply that food assistance helps poor households in times of hunger and starvation. In this case, food assistance might help in reducing hunger and malnutrition, especially for poor households, in periods of shocks.

6. Conclusion

This study examined the effects of household shocks on the nutrition status of younger children aged 0–59 months in Tanzania. The study employed a three waves of panel data of Tanzania (2008/09, 2010/11, and 2012/13) to examine the effects of household shocks on children's nutrition status. The findings indicated that weather shocks, food price rise shocks, and death shocks negatively affect children's nutrition status. Also, food assistance was found to offset the negative effects of household shocks and children's malnutrition. The result implies that food is important to life, while weather shocks cause food loss/ shortage, which can also lead to an increase in food prices. Therefore, the government should improve food assistance programs to reach many households, especially poor and marginalized households, in periods of shocks to protect children against malnutrition. In addition, agricultural policies—such as irrigation schemes—which aim at increasing productivity should be enhanced to enable food availability in the country. This will eventually help reduce malnutrition among younger children in the country.

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