Nexus of Agricultural Policies and Nutrition Outcomes: Linkages Between Land Access Policies and Nutrition Outcomes in SSA

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Nexus of Agricultural Policies and Nutrition Outcomes: Linkages Between Land Access Policies and Nutrition Outcomes In SSA

By

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Abstract

The need to make agricultural policies more useful for nutrition has stirred interest in the study of the impact of agriculture policies on nutrition. It is from this viewpoint that this paper provides an economic theoretical linkage between land policies and nutritional outcomes, and assesses the nutritional implications of shrinking or increasing arable land sizes in sub-Saharan Africa (SSA). First, using theoretical derivations, the study demonstrates that the association between landholding status and household nutrition is influenced by complex associations between intervening variables which require the use of micro-level data. Second, making use of case studies based on micro-level analyses, and the application of national-level data, the findings confirm that land reforms that provide access to arable land are nutrition sensitive. In addition, the results show that market-driven land reforms are more nutrition-sensitive than politically or government-driven reforms. The state of the health system also significantly influences nutritional outcomes. The main policy implication is that SSA countries can significantly improve nutritional outcomes through improved land access via market-driven reforms. There is also a need to strengthen health delivery systems to reduce the prevalence of malnutrition. Last, countries in SSA must intensify research on the impact of agricultural policies using micro-level data in order to address the complexity of the relationship between nutrition and land policies.

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1. Introduction

There has been an increased focus on agricultural policies that enhance nutrition. The growing population in sub-Saharan Africa (SSA) puts pressure on customary tenure systems (Holden & Bezabih, 2008) and an increasing demand for land due to rising food prices (Deininger et al., 2014) has consequences for land inequality and food security. There is a fear that emerging land markets and rising investor demand for land in countries with historical land imbalances might lead to increased food insecurity among vulnerable smallholder farmers due to a loss of land rights (Holden & Ghebru, 2016; German et al., 2013). Therefore, land reform and redistribution policies in some African countries such as Zimbabwe have been used as a tool for redressing historical imbalances and to improve food security for vulnerable smallholder farmers. While farm sizes are shrinking in countries such as Malawi, Uganda, Ethiopia, Kenya, Rwanda and Nigeria, land policies in countries such as Zambia and Tanzania have generally increased farm sizes (Jayne et al., 2014). In Zimbabwe, land policies were aimed at accelerating land reforms to redistribute large commercial farms to smallholder communal farmers in order to improve agricultural land access for a larger population. In other countries such as Malawi, land registration in the 1980s was aimed at unlocking the availability of land resources among those using them.

After independence from former colonial masters, many African countries undertook land reforms to address the historical land ownership imbalances. These were predominantly in Southern Africa (Angola, Botswana, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe), Kenya and Côte d'Ivoire. In countries such as Angola, Mozambique and Zambia, the reforms were aimed at nationalizing settler land, while in other countries such as Zimbabwe, Kenya, Malawi, Swaziland and Botswana, the reforms were based on market-based mechanisms. For example, in Zimbabwe, Zambia, Angola and Botswana, the reforms originally compensated settler farmers using funds provided by the former colonial masters. However, notwithstanding these reforms, limited access to land and inequality in land ownership have remained noticeably high in these countries (Byamugisha, 2013).

While it is usually agreed that land distribution policies that boost land sizes for otherwise land-scarce communal smallholder farmers are crucial for improving the food security and nutrition of a nation, changes in land size may have serious consequences for food crop production and nutritional outcomes. For example, the large tracts of land gained by subsistence farmers from communal areas through the

Fast Track Land Reform (FTLR) programme in Zimbabwe shifted attention from food crop production to non-food cash crops, in particular tobacco (Scoones et al., 2011; Zikhali, 2008). On the one hand, cash crops such as tobacco and cotton can improve farmers' income which, in turn, has the potential to improve their nutritional status. On the other hand, increased cash crop production at the expense of food crops can reduce the market supply of food crops, thereby potentially leading to a rise in food prices. High food prices have detrimental effects on the nutritional status of a nation (Webb & Block, 2012; Haddad, 2000). Hence, changes in food crop production driven by land reform-induced agricultural resource reallocations can have serious implications for food security and the nutritional status of the citizens of a nation.

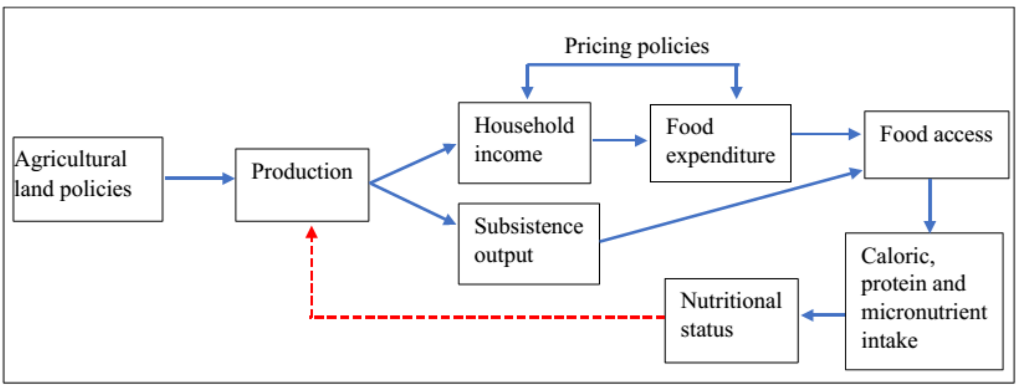
Although researchers recognize that investment in agriculture is an important opportunity for reducing malnutrition (Herforth et al., 2012), the problem remains in the identification of nutrition-sensitive agricultural policies (FAO, 2012). This paper, therefore, provides an economic theoretical link between land policies and nutritional outcomes and assesses the nutritional implications of shrinking or increasing arable land sizes in SSA. In other words, the paper examines whether larger arable land sizes are nutrition-sensitive or not. In addition to assessing the association between nutritional outcomes and land policy-induced farm sizes, this paper also scrutinizes the nutrition-sensitivity difference between land policies that aim to unlock the availability of land resources using market systems, and those that aim to increase the share of landowners through the nationalization of land. From this perspective, the paper looks at differentials in nutritional outcomes between two groups of selected SSA countries with regard to their land reforms, for example, the prevalence of malnutrition in countries whose land reforms were based on markets versus those whose land reform policies were aimed at the nationalization of farms.

Producing a healthy society through an improvement in nutritional outcomes is an objective of all governments and is Sustainable Development Goal (SDG) 3, which is aimed at ensuring the good health and well-being of all. In addition, the renewed focus on agriculture has been encouraging nutrition-sensitive agricultural policies (USAID, 2011). The knowledge of how agricultural policies, such as increasing the accessibility of agricultural land through land distribution, influence nutritional outcomes is therefore crucial for governments and policy makers when designing policies that are sensitive to food security and nutritional outcomes. It is against this background that this paper seeks to inform policy makers about how land policies may be shaped to promote nutrition in SSA.

2. Brief literature review and framework

Although malnutrition has been linked to food security since the 1970s (Shrestha et al., 2012), attention shifted towards improving incomes and livelihoods rather than food production following Amartya Sen's publication on the causes of famine in 1981, Poverty and Famines. Unfortunately, changes in income failed to translate into increased calorie consumption leading to the realization that both issues need to be addressed (Shrestha et al., 2012). Today there is a considerable volume of research on the linkages between agriculture and nutritional outcomes. The pathway through which agriculture translates into improved nutritional outcomes is well-documented by a number of studies (UNICEF-WHO-World Bank, 2015; Gillespie et al., 2012; Hawkes et al., 2012; Chung, 2012; Masset et al., 2011). For example, Masset et al. (2011) demonstrate how agricultural technologies are translated into improved nutritional outcomes via improved incomes and dietary composition (Figure 1). Concurring with these studies, Bonnard (1999) argues that most agricultural interventions influence households' nutritional status either through the improved production of subsistence food or increased agricultural incomes. The studies further recognize that some interventions may directly influence nutritional outcomes, for example, increasing the production of vegetables for household consumption, while other interventions may be indirect, such as land redistribution policy.

Figure 1: Linking agricultural policies to nutritional status



Source: Author's adaptation of Masset et al., 2011

While there is a consensus among many researchers that agricultural production and productivity influence household nutritional outcomes, it must be noted that productivity in agriculture can be driven by the health status of farmers. In an investigation into the impact of nutritional status on agricultural productivity, Haddad and Bouis (1991) established that better nutritional status of adults is positively associated with higher levels of productivity and wages. Other studies (Sahn & Alderman, 1988; Strauss, 1986) also indicate the possibility of a bi-directional association between agricultural productivity and nutritional status. These findings demonstrate the importance of controlling for endogeneity when modelling the impact of agricultural interventions on nutritional outcomes. The dotted line running from nutritional status to production in Figure 1 demonstrates a reverse causal relationship that may exist between nutrition and agricultural production.

Whereas other agricultural policies, such as pricing policies, influence nutrition via farmers' incomes, land policies influence nutrition via production. They shape farmers' production structure which, in turn, shapes their incomes and food consumption. In cases where larger farm sizes are less productive than smaller ones, land policies that increase farm size may be detrimental to nutritional outcomes. For example, Carletto et al. (2013) demonstrate that there exists an inverse relationship (IR) between farm size and land productivity and that this relationship is not only due to differences in land quality and measurement error. Rather, the question is whether the observed shrinking land sizes are improving productivity and nutrition in SSA countries. Therefore, it is crucial to investigate the association between farm size and nutritional outcomes. Some evidence shows that there has been an expansion of medium-sized farms characterized by skewed distribution in some SSA countries, specifically in Ghana, Kenya, Zambia and Malawi (Anseeuw et al., 2016; Jayne et al., 2016). However, generally, farm sizes have continued to shrink in many SSA countries due to population growth pressure.

In many developing countries, the provision of land titles is argued to be largely skewed in favour of the wealthy classes and the politically connected (Benjaminsen et al., 2009). Many land tenure reforms fail to produce any meaningful benefits. However, in countries such as Ethiopia and Rwanda, better tenure security from low-cost reforms significantly improved investments in soil conservation, tree planting, productivity and land markets (Ali et al., 2014; Deininger et al., 2011; Holden et al., 2011), and therefore also food security and child nutrition (Holden & Ghebru, 2013). A study by Pindiriri (forthcoming) in Zimbabwe established that improved land access has a significant positive impact on nutritional outcomes, but access to land alone is not sufficient to improve child nutrition. For example, malnutrition has continued to be pronounced in countries such as Zimbabwe despite the reforms which aimed at transferring land to a larger share of land-constrained rural peasants. The linkage between land policies and nutritional outcome is not simple. There is a need for more research to be conducted in this area.

Pritchard et al. (2017) argue that the association between landholding status and household nutrition is intermediated by complex associations between intervening variables. There are several interventions that influence this relationship, including changes in the structure of agricultural practices (e.g., from subsistence to commercial farming), household decision making in food distribution and prioritization, changes in non-farm livelihood portfolios and the use of land holding as collateral security in accessing bank loans, among other things. By studying two Indian villages, Pritchard et al. (2017) found evidence that land holding influences nutrition through the increased consumption of milk, but with insignificant variations in the consumption of other agricultural products. These researchers underscore the greater complexity and diversity in rural social landscapes that cannot be addressed by traditional research that relies on large-scale national datasets. Land reforms that increase farm sizes provide farmers with opportunities to change their agricultural practices, such as moving from crop production to fodder and livestock production.

3. Deriving connection between land policies and nutrition

As in Zeng et al. (2014), this paper applies an agricultural household model to demonstrate the theoretical relationship between land access and nutritional outcomes. In the applied model, a farming household is assumed to be rational and therefore considered to be a utility maximizer. The household utility function takes the following form:

$$U_i = U_i(F_i, PF_i, PNF_i, \sum_{j=1}^{N} N_{ij}) \quad (1)$$

where *F*, *PF* and *PNF* are the consumed food crops produced by the household, consumed food crops, and non-food crops purchased by the household, respectively. The nutrition status of children is a crucial consumptive service of the household. Therefore, N_{ij} enters the utility function as the nutritional status of child *j* in household *i*. A summation of N_{ij} provides the overall nutritional status of children in a household with *N* children. However, childrens' nutrition depends on the individual-level food intake of that particular child, child characteristics (*CC*) and household characteristics (*HH*). The child nutrition function can be expressed as:

$$N_{ij} = N_{ij}(F_i, PF_i, PNF_i, CC_{ij}, HH_i) \quad (2)$$

Children consume a proportion of the overall household consumption, where the resource allocation decision within the household, a proportion α_{ij}, also depends on child and household characteristics. With λ representing consumption type (*F*, *PF* or *NPF*) of either child *j* in household *i* or household *i*, the household's allocation decision can be presented as:

$$\lambda_{ij} = \alpha_{ij}(CC_{ij}, HH_i)\lambda_i \quad (3)$$

The production of both food crops and non-food crops depends on the available agricultural land. Incomes generated from the sale of crops enable farming households to purchase food. Hence the variables *F*, *PF* and *PNF* in Equation 2 depend on the land available for agricultural activities (*AL*). The household is assumed to produce food crops (*F*) using agricultural land and other inputs. The food production function of the farming household is therefore expressed as:

$$Y_i^F = Y_i^F(AL_i, Z_i) \quad (4)$$

where Y_i^F is the produced output of food by household *i*, AL_i is the agricultural land available for household *i*, and Z_i is a vector of other inputs used by household *i* in food production. If the household receives m_i as off-farm income (income from non-agricultural employment and transfers), then its budget constraint is:

$$p_{PF}PF + p_{PNF}PNF = p_F(Y_i^F - F_i) - p_Z Z_i + m_i \quad (5)$$

The farming household maximizes the utility function in Equation 1 subject to constraints from Equations 2 to 5. Agricultural markets are imperfect in most SSA countries, hence farmers' production and consumption decisions can be assumed to be inseparable. The j^{th} consumption decision that household *i* makes is given as:

$$CD_{ij} = CD_{ij}(AL_i, CC_{ij}, HH_i, p) \quad (6)$$

where CD is the consumption decision for *j* = *F*, *PF*, *PNF*, and *p* is a vector of food prices and non-food prices (produced and purchased). Replacing *F*, *PF* and *PNF* in Equation 2 with the information in Equation 6 gives:

$$N_{ij} = N_{ij}(AL_i, CC_{ij}, HH_i, p) \quad (7)$$

Agricultural land (*AL*) is theoretically linked to child nutrition of the farming household as demonstrated in Equation 7. Therefore, any land policy that alters land holdings has some implications for nutrition. Following Berger et al. (2005) and Case et al. (2002), the empirical model can be specified as a linear function of the form:

$$N_{ij} = \beta_0 + \beta_1 AL_i + \beta_2 CC_i + \beta_3 HH_i + \beta_4 PI_i^F + \beta_5 m_i + v_{ij} \quad (8)$$

where PI_i^F is the food price index facing household *i*, βs are parameters and the other variables are defined as before. Agricultural land (*AL*), household characteristics (*HH*), child characteristics (*CC*) and household income (*m*) are assumed to be exogenous. Food price index is included in the nutrition meta-production function in Equation 8 because it is part of the household constraint to utility maximization.

Modelling the nutritional impacts of agricultural policies is therefore a micro phenomenon. The process requires micro-level data, in particular, data collected at the household level (Pritchard et al., 2017). With similar surveys across countries, a fixed effects model may be applied. However, household surveys in SSA countries are carried out in varying periods with varying variables. A panel analysis for SSA households may not be possible because of data problems. Studies linking agricultural policies to nutrition have therefore been constrained to country case studies. It is against this background that this paper mainly relies on measures of association from descriptive statistics and country examples. The paper describes the association between the prevalence of malnutrition and arable land size, and access to land in SSA countries. The question is how nutrition-sensitive a land policy is that improves access to larger arable land sizes. If nutrition is sensitive to arable land sizes, then land policies that expand farm sizes are likely to benefit households in nutrition.

The paper makes use of online available country level data on nutrition and arable land sizes obtained from the World Bank data bank (World Bank, 2021). Observations are only available for some years. It is important to note that a rigorous analysis of the nutrition-agricultural policy relationship is only possible with household level data that encompass the variables derived earlier in the utility maximization problem. In this regard, the analysis in this paper, which relies on country-level data, only provides an indication of the association between malnutrition and land access policies. In establishing this association, a simple regression analysis is done in the following section. Arable land is exogenous in this regression of a nutrition model although nutrition influences its productivity. In other words, nutrition does not drive the availability of arable land, only its productivity. In addition to agriculture-related variables, this paper also controls for the strength of the health system in the land-nutrition relationship. The number of nurses and midwives per thousand in the population is a good indicator of the strength of the health system in a country.

The simple model for measuring the association between malnutrition and arable land is:

$$Mal_i = \beta_0 + \beta_1 AL_i + \beta_2 HS_i + \varepsilon_i \quad (9)$$

where *Mal* is a measure of malnutrition prevalence (height for age and weight for age), *AL* is arable land that measures access to agricultural land, *HS* is the health sector status proxied by the number of nurses and midwives per 1,000 in the population, and ε is the error term assumed to be independently and identically distributed with a mean of zero and a constant variance. The βs are the estimated parameters. Equation 9 was estimated using the least squares method with robust standard errors. Unlike the model in Equation 8, which requires household-level data, the model in Equation 9 provides simple measures of association rather than the actual impact of land access on nutrition, which requires household-level data and several complicated pathways.

4. Findings

The data show that most SSA countries experienced a significant decline in the prevalence of child malnutrition over the past decade (using both height for age and weight for age measures), except countries such as Niger whose prevalence for malnutrition (height for age) rose from about 39.9% in 2012 to 48.5% in 2018. Similarly, malnutrition prevalence measured by the weight of children under five increased in Niger from 32.1% in 2012 to about 37.5% in 2018. In this paper, two measures of child malnutrition are considered. First, height-for-age malnutrition is measured as the percentage of children under five whose height falls short of what is expected for their age under normal conditions. Second, weight-for-age malnutrition, which is measured as the percentage of children under five whose weight does not tally with what is expected for their age under normal conditions.

In some countries, the prevalence of malnutrition has declined significantly over the past decade. For example, in Zimbabwe the prevalence of malnutrition measured by height for age declined from a high of 35.1% in 2009 to a low of 23.5% in 2019. In Ghana it declined from 28.4% in 2008 to 17.5% in 2017. Table 1 provides trends in the prevalence of malnutrition in selected SSA countries in the last decade. Countries such as Burundi have continued to have very high malnutrition prevalence rates; it was 57.6% in 2009 and only marginally declined to 54.2% in 2019.

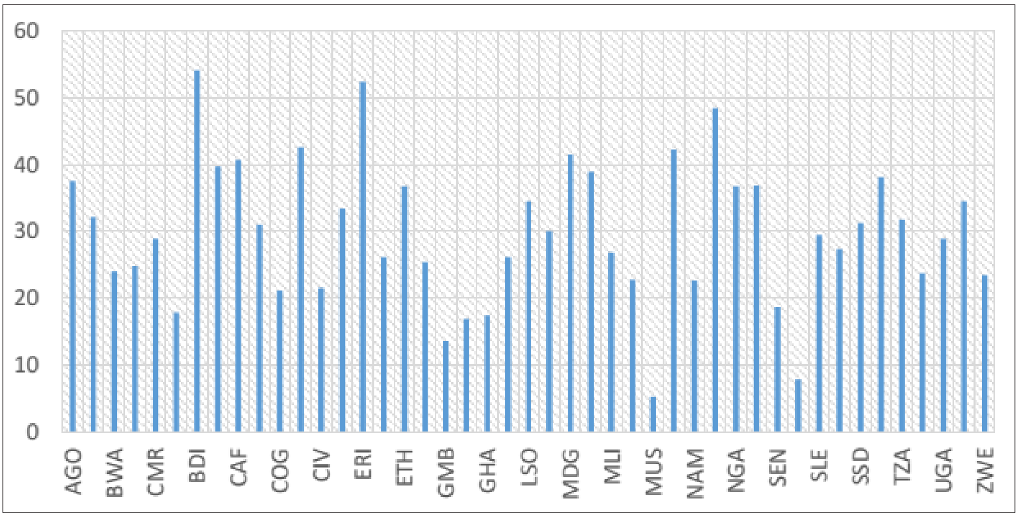
Table 1: Prevalence of malnutrition, height for age (% of children under 5)

	2009/10	2011/12	2016	2018/19	Malnutrition status
Burkina Faso	34.7	32.8	26.8	24.9	Decreased
Burundi	57.6	-	55.9	54.2	Decreased
Central African Republic	40.7	39.7	-	40.8	Increased
Ethiopia	-	44.4	38.4	36.8	Decreased
Eritrea	52.5	-	-	-	-
Ghana	28.4	22.8	18.8	17.5	Decreased
Kenya	35.5	-	26.2	-	Decreased
Malawi	48.8	42.4	38.3	39.0	Decreased
Niger	-	39.9	41.3	48.5	Increased
Rwanda	52	44.3	36.9	-	Decreased
Senegal	-	15.5	17.1	18.8	Increased
Togo	29.8	26.2	27.6	23.8	Decreased
Zimbabwe	32.2	27.6	27.1	23.5	Decreased

Source: World Bank Development Indicators

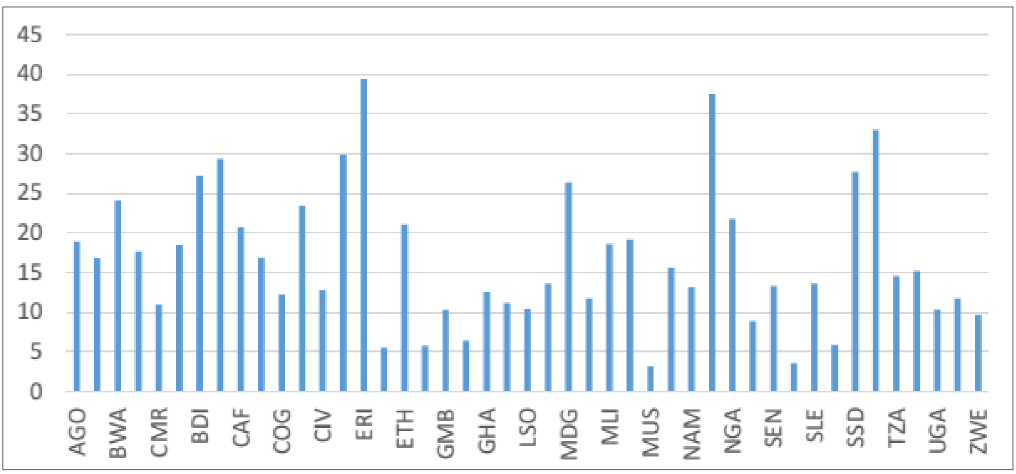
Although malnutrition prevalence rates in many SSA countries are on a declining trend, they are still unacceptably high compared to other regions. For example, in the Arab region, countries such as Tunisia have single-digit prevalence rates. In 2018, the malnutrition prevalence rate (height for age) was 8.4% in Tunisia and weight for age was only 1.6%. Countries in SSA with the worst prevalence rates include Burundi, Eritrea, Niger, Democratic Republic of Congo, Madagascar, Mozambique and Sudan. Malnutrition prevalence rates for SSA countries are presented in Figures 2a and 2b.

Figure 2a: Prevalence of malnutrition, height for age



Source: Author's illustration using data from World Bank data bank (2021)

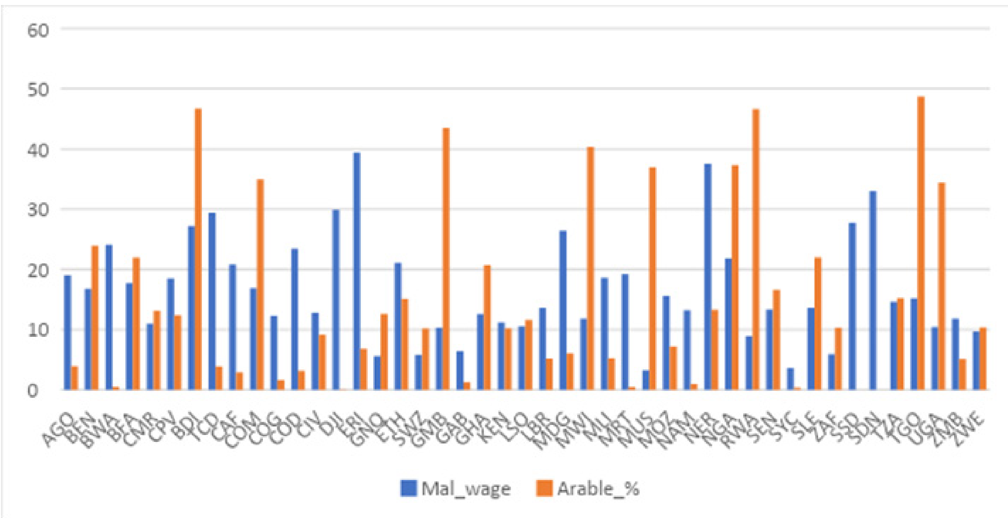
Figure 2b: Prevalence of malnutrition, weight for age



Source: Author's illustration using data from World Bank data bank (2021)

Mauritius and Seychelles have the lowest malnutrition prevalence among SSA countries. Gambia also has a lower prevalence rate in terms of height for age compared to other SSA countries. Countries such as Rwanda, Gambia, Togo and Malawi, with arable areas in excess of 30% of total agricultural land, have lower malnutrition prevalence rates (weight for age) compared to countries such as Angola, Chad, Central African Republic and Niger, among others. Despite having a larger share of arable land, Burundi is one of the SSA countries with the largest malnutrition prevalence rates. The bar graph and scatter plot in Figures 3a and 3b, respectively, show that there is a negative association between malnutrition prevalence rate and the size of arable land in SSA countries. Countries with a larger share of arable land have lower malnutrition prevalence rates. This points to the importance of agriculture in the fight against malnutrition. Implementing policies that expand arable land sizes may be beneficial to nutrition, and improving access to land is even more beneficial to households.

Figure 3a: Malnutrition prevalence rates (weight for age) and arable land



Notes: Mal_wage is malnutrition prevalence, weight for age and Arable_% is percentage of arable land.

The relationship between arable land and malnutrition presented in Figure 3b is supported by results from an ordinary least squares (OLS) estimation. Table 2 presents the OLS results in logs. The findings support the idea that malnutrition significantly responds to the size of arable land. The prevalence of malnutrition declines as arable land increases. This only points to an indicative relationship between arable land size and malnutrition. While the land-nutrition relationship is best explained using household-level data the findings in Table 2, which are based on national-level data, confirm the findings from household-level analyses (Pritchard et al., 2017; Kasiwa & Mazabedi, 2020; Pindiriri, forthcoming). Both national and household-level data show that access to arable land and its size influence nutritional outcomes. However, it is important to note that the actual relationship between policy-induced land access and nutrition can only be robustly estimated using household-level data. Therefore, much of the analysis in this paper relies on descriptive statistics and country case studies. The findings in Table 2 show that the state of the health system is an important determinant of nutrition. Countries with stronger health systems experience lower levels of malnutrition than those with weaker health systems.

Figure 3b: Malnutrition prevalence rates and arable land scatter

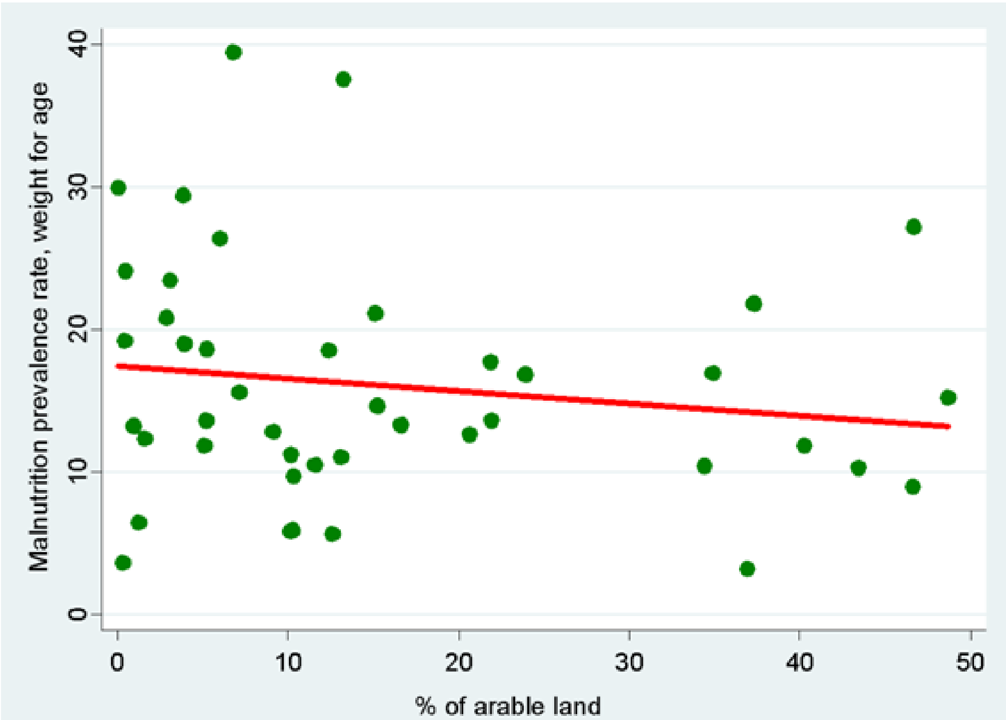


Table 2: OLS results

VARIABLES	Log of malnutrition (weight for age)
Log of arable land	-0.120**
	(0.0449)
Log of nurses per 1000	-0.333***
	(0.0797)
Log of agricultural land	0.194
	(0.129)
Constant	2.126***
	(0.462)
Observations	43
R-squared	0.350

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

In the Democratic Republic of Congo (DRC), an SSA country with one of the highest prevalences of malnutrition (height for age) in excess of 40%, Kasiwa and Mazabedi (2020) conducted a study on how access to land influences nutritional outcomes. Their findings show that access to land constitutes a significant determinant of childrens' dietary diversity and is associated with a significant increase in childrens' height-for-age z-score. The DRC only cultivates about 10% of its arable 80 million hectares (Kasiwa & Mazebedi, 2020). The country has disrupted land tenure and strong ethnic polarization, which do not favour the expansion of using unexploited space, demographic pressures and persistent insecurity in some areas, which has led farmers to miss planting seasons and the depletion of livestock (WFP, 2016). In this regard, land tenure security of farm households could have a positive impact on agricultural productivity, income, food security and household-level nutrition outcomes.

In Zimbabwe, a study by Pindiriri (forthcoming) looked at the impact of land reform policy-induced access to agricultural land on child nutritional outcomes. In the early 2000s, the Government of Zimbabwean instigated a land reform programme that morphed into what became known as the fast-track land reform (FTLR) programme with the aim to accelerate a land reform policy to redistribute large commercial farms to smallholder communal farmers in order to improve agricultural land access to a larger population. The findings by Pindiriri (forthcoming) show that increasing land holding for households has a positive impact on child nutritional outcomes, in particular, reducing underweight children. In other words, a resource access policy such as land reform improves child nutrition in agricultural or rural areas. However, the findings demonstrate that despite having smaller-sized agricultural land, the nutritional outcomes for children from urban households are significantly better than those from rural households who own larger tracts of agricultural land. This is an indication that access to land alone is not sufficient to improve child nutrition. The results further demonstrate that small livestock such as chickens, goats and pigs are important sources of food in child health production as child nutrition is strongly and positively related to these types of livestock. The implications of the 2020 Zimbabwe study findings by Pindiriri (2020) are that access to agricultural land in rural areas is crucial for improving child nutrition and reducing underweight, and that Zimbabwe must review its agricultural policy thrust which is biased towards intensifying cattle production at the expense of small livestock production.

Malnutrition significantly differs between countries whose reforms are aimed at the nationalization of settler farms (Angola, Mozambique and Zambia) and countries whose reforms are based on market mechanisms (Kenya, Malawi, Swaziland and Botswana). Before 2000, Zimbabwe's reforms were also based on market mechanisms. The descriptive statistics in Table 3 are averages for the past two decades. The findings show that malnutrition prevalence is lower in countries that implemented market-based land reforms than in countries that nationalized settler farms. The difference in malnutrition prevalence is about 11.8% using height for age, and is statistically significant at 1%. Similarly, the weight-for-age malnutrition prevalence is lower for market-based reforms, although the difference is statistically insignificant.

While noting that the findings are derived from very few Southern African countries, they are still pointing to market-based reforms as more nutrition-sensitive than the nationalization of agricultural land. Land markets can transfer land from less productive to more productive farmers, thereby improving productivity and national food security. While markets are criticized for promoting a skewed distribution of land favouring the wealthy, it is important to note that in Africa and many other developing countries, inequality in land ownership is largely an outcome of political processes rather than market driven (Holden & Ghebru, 2016). The provision of land titles in many developing countries is argued to be largely skewed in favour of the politically connected wealthy classes (Benjaminsen et al., 2009).

Table 3: Market-based versus nationalized reform and nutritional outcomes in selected SSA countries

Variable	Nationalized reform	Market-based reform	Overall mean	Difference in mean
Malnutrition prevalence (height-for-age mean)	38.2	26.4	29.9	11.8***
Malnutrition prevalence (weight-for-age mean)	15.5	12.7	13.5	0.782

***, **and * means the difference is statistically significant at 1%, 5% and 10%, respectively.

The main implication of this market-driven land reform finding is that SSA countries can significantly improve nutrition using market-driven land reform processes rather than political processes. Security of tenure and properly defined property rights are central to creating nutrition-sensitive agriculture in Africa. Politically driven land reforms can be detrimental to food security and nutrition due to their inability to identify productive farmers, and may lead to a concentration of land in the hands of the politically connected few.

One of the land issues that requires extensive investigation in the area of nutrition is land governance and tenure systems in SSA countries. Over 70% of the SSA population resides in rural areas where only 10% of the land is registered and the rest is undocumented and thus vulnerable to land grabbing and expropriation without compensation (Byamugisha, 2013). In countries such as Zimbabwe, all land is state land. The government has the right to relocate whoever occupies a piece of land if, for example, minerals are discovered in the area or if the land is required for urban or road development. The customary and communal tenure systems prevalent in the rural areas do not allow landowners to sell their land on the market. In other words, most SSA countries have rural land tenure systems that are characterized by a lack of properly defined property rights. This discourages agricultural investments in rural areas and leaves rural communities vulnerable to malnutrition. Future research must look at how these tenure systems affect nutrition at the village household level.

5. Conclusion and policy implications

Two main issues are considered in this paper. First, a theoretical link between agricultural land policies and nutritional outcomes is derived from household models. Second, an association between malnutrition and land access, reform type (market or government) and the state of the health system is established. The derived nutrition meta-production function confirms the argument by Pritchard et al. (2017) that there exists a set of complex associations between land policies, intervening variables and nutrition. The major implication from this theoretical finding is that modelling a land policy impact on nutrition is a micro-level analysis that encompasses household decision making in food production and consumption, household characteristics and child characteristics. The micro-analysis fits the diversity of the rural social landscape and hence accounts for the individual heterogeneity appropriate for nutrition analysis.

Regarding associations, arable land access is negatively associated with malnutrition while market-driven land reforms are associated with lower levels of malnutrition. Arable land access is a major contributor to nutritional outcomes in SSA countries where more than 70% of the population resides in rural areas. In this regard, a resource access policy, such as land reform, improves child nutrition in SSA countries. Market-driven land reforms are more nutrition-sensitive than politically driven reforms. These findings point to the fact that although land access improves nutrition, the impact may vary from country to country due to differences in the types of reform. One of the major implications of these findings is that land policies that improve access to arable land and that are market-driven are nutrition-sensitive. Hence, SSA countries can benefit significantly in their attempt to reduce malnutrition through market-driven land policies. Politically-driven land reforms are detrimental to nutrition. While both household and national-level data confirm the importance of land policies on nutrition, it is important to note that other factors such as the state of the health system of a nation are critical drivers of nutrition in SSA countries. This finding points to the need to strengthen the health delivery systems in the region.

In summary, first, there is a need to intensify research on the impact of agricultural policies using micro-level data. Villages are diverse and the linkage between nutrition, land variables and intervening variables is complex. Hence, a complex approach that encompasses an intensified study of villages or experimental designs is required. Second, there is a need to improve access to arable land by households in SSA countries. The region has a large rural population that relies on agriculture. Hence, making arable land accessible can go a long way in solving malnutrition problems on the continent. Third, land reforms in SSA countries must be market-driven instead of politically driven. Investing in market-driven land reforms could be one of the best ways to improve agricultural productivity and, in turn, nutrition in SSA countries.

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