

*Full Length Research Paper*

# Household determinants of food security in rural Central Uganda

John Baptist Semazzi\* and Moses Kakungulu

Department of Economics, Uganda Martyrs University, P. O. Box 5498, Kampala, Uganda.

Received 22 May, 2020; Accepted 8 September, 2020

**This study contributes to the literature by presenting empirical evidence on the drivers of rural household food security, which is critical for food security policy implementation. We used household survey data collected from 265 households from rural central Uganda, and a binary logistic regression model to estimate the determinants of household food security. Households with more land size, no livestock, and smaller household size were found as being more food secure. The results suggest the need to: review policies on land tenure system and land use, promote food storage and market for produce and to design strategies to increase household incomes.**

**Key words:** Food security, determinants, Logit model, households, Gomba, Uganda.

## INTRODUCTION

Food security is at the center stage in the world's economic development debate. This concern is due to the fact that the world's population is increasing very fast and is expected to reach 9.8 billion by the year 2050 (DESA, 2017). This will increase pressures on the environment, global food supplies and energy resources. In her article, "Food Insecurity and Food Stamp Program", Jensen (2002) reports that, in the face of abundant supplies of food worldwide, nearly 800 million people suffered from malnutrition and undernourishment. Most of these undernourished live in low income countries.

According to 2014 national population and housing census (UNHS) results, annual population growth rate between 2002 and 2014 censuses was 3.03% (UBOS, 2018). This rapid population growth will lead to acute land constraints and accelerated land degradation if not

controlled. Land degradation due to deforestation, and the rapid conversion of natural vegetation into arable lands, exposing big areas to sheet erosion and reducing their productivity happens to be a threat. This problem is partly attributed to the poorly defined land ownership rights (National Environment Management Authority - NEMA, 2016). Declining soil fertility means farmers are experiencing less yields with lower value and less nutrient intensive crops. In addition, land use affects the land available for food production. For example, mining, urbanization and industrialization affect land available for food production leading to food insecurity. Use of land for cash crops also reduces land available for food production. Rural – Urban migration reduces labor available for cultivation hence decreasing food production.

The overall goal of the Uganda food and nutrition Policy

\*Corresponding author. Email: [jbsemazzi@gmail.com](mailto:jbsemazzi@gmail.com).

(2003) is to ensure food security and adequate nutrition for all the people of Uganda, for their health as well as their social and economic well-being, while the overall objective of the policy is to promote the nutritional status of the people of Uganda, ensuring availability, accessibility and affordability of food in the quantities and qualities sufficient to satisfy the dietary needs of individuals sustainably (MAAIF and MOH, 2003). This is in response to the very fact that rural households in sub Saharan Africa are increasingly faced with challenges of food insecurity (Nyariki and Wiggins, 1997), with the situation being worsened by increasing population and reduced land productivity.

Despite continuing economic growth, Uganda faces persistent challenges to achieve food security. The effectiveness of policy and development strategies to help rural households achieve food security must improve, since rural households follow diverse livelihood strategies, which differ across the regions and with their degree of food availability. The diversity of livelihood strategies must be considered when targeting interventions (Wichern et al., 2017).

Indeed, the government of Uganda through the plan for modernization of agriculture (this is a framework which sets out the strategic vision and principles upon which interventions to address poverty eradication through transformation of the agricultural sector can be developed), has made endeavors in promotion of food production by identifying key determinants that can reverse the situation of food insecurity. These determinants at household level include: land size, land usage, availability of factors of production such as labor, effective storage, and processing. This entails developing effective utilization of farm land to maximize production per unit; diversification of farming activities through mixed farming to minimize losses due to natural calamities; linkages to appropriate markets to ensure good price thus boosting farmers' incomes; promotion of cooperatives and farmer organization to facilitate effective production and appropriate utilization of family and community resources to subsidize cost of production (OPM, 2005). Modernization of agriculture is expected to contribute towards improvement of incomes by raising farm productivity, increasing the share of agricultural production that is marketed and creating more on farm and off farm employment opportunities (OPM, 2005). Incidentally, when one analyzes the above key determinants, their effectiveness remains not well established. This article therefore, is aimed at establishing the effectiveness of these key determinants in the battle against food insecurity. This is the reason we carried out a research study on various determinants of food security in rural central Uganda. We contribute to the literature by presenting empirical evidence on the drivers of rural household food security. Understanding what drives household food security dynamics in developing countries is critical for food security policy

implementation.

This study is based on four pillars namely: food availability, food accessibility, food utilization and food stability (Food and Agriculture Organization - FAO, 1996; World Food Programme - WFP, 2013). In this study, food availability refers to foods grown and harvested by individual households for home consumption; food accessibility is based on incomes of individual households, from sale of own food and other sources; food utilization is determined by what individual households harvest from own production, and their net incomes (food entitlement); Food stability is to what extent a household can afford enough portions of qualitative and quantitative food in a year. When one talks of food security, it does not necessarily mean quantity or quality of food a household consumes, but also how much income a household earns in terms of money, and for how long this household can maintain qualitative and quantitative food consumption. In most cases, food grown by a household is supplemented by income to fulfil the principle of food security. Food insecurity is more of a rural phenomenon across all food security indicators except for caloric deficiency. Rural dwellers tend to consume more calories by bulking up on staples to fuel them to carry out a higher level of manual work (WFP, 2013).

In a review made by the Uganda Parliamentary Forum on food security, it was noted that Uganda was not doing well in terms of global nutrition ranking (EPRC, 2017). The review also warned that the absence of food storage at national level shows Uganda's lack of preparedness to manage emergencies (EPRC, 2017). The review put more emphasis on food utilization, food availability and food stability, than food accessibility. For a country to ensure enough food for all, there need be surplus food production for storage, but also for sale by households for an income.

In a research carried out in south-central Uganda on determinants of seasonal food security, results showed that land size and crop yields were more important for smallholder food security than soil quality (Apanovich and Mazur, 2018). This article focused primarily on food availability, with disregard to soil quality. Soil quality is very essential in production of a variety of crops (including fruits) that promote a balanced diet in households, increase household incomes, ensures food availability and food stability.

In order to address the food insecurity problem, Makerere University College of agricultural and environmental studies (CAES) in partnership with the Ministry of Agriculture Animal Industries and Fisheries (MAAIF), on 30<sup>th</sup> August, 2018 held Uganda's action planning meeting to assess the implementation of the Malabo declaration. This declaration was aimed at accelerating agricultural growth and transformation for shared prosperity, and improved livelihoods mostly centered in small scale farmers' agriculture. This meant

ending hunger by the year 2025. The outcome of the above meeting showed that Uganda had not been performing well in fulfilling the Malabo declaration, and yet agriculture is now a business many smallholder farmers aspire to engage in. It was also observed in that same meeting that, there is need to engage the youth in whatever is done in agriculture to embrace rapid growth (Wamai, 2018). Incidentally, it is not clear what measurement, the above partners used to determine the present food security status in the country.

In review of the above findings, it is evident that: the government through Plan for Modernization of Agriculture (PMA) was expected to contribute towards improvement of incomes by raising farm productivity, increasing the share of agricultural production that is marketed and creating more on farm and off farm employment opportunities, but the effectiveness of all these economic activities is not yet well established; Uganda Parliamentary Forum on Food Security put more emphasis on food utilization, food availability and food stability than food accessibility; a research by Apanovich and Mazur (2018) focused primarily on food availability (Apanovich and Mazur, 2018); while Uganda's action planning meeting revealed the current food security status in the country, but the measurement used to come to this is not clear. Therefore, the effectiveness of the above studies remain wanting or need further research. This article therefore examines the protracted determinants of food security in rural communities in Uganda using the binary logistic regression model, with emphasis on food availability, food accessibility, food utilization and food stability. Household food security is meant to embrace all its four pillars at ago to give a meaningful outcome. Therefore, the very fact that this article assesses the effectiveness of all the four aspects of household food security is enough justification for its publication.

## MATERIALS AND METHODS

This study was conducted in Gomba district in rural central Uganda (Figure 1). The district is characterized by food insecurity, especially during dry spells. Traditionally, households in the research area are farm-households, deriving the majority of their income from mixed cropping. The most commonly cultivated crops include maize, bananas, sweet potatoes, cassava and beans. The area is predominantly characterized by traditional food production and subsistence orientation. We conducted a household survey in the area in May 2014. The survey included 265 households, selected in a multistage sampling design. In the first stage, four rural parishes of Kisoga, Mamba, Bukundugulu, and Nsambwe in Kyegonza sub-county were selected. In the second stage, one village was selected from each of the selected parishes. In the third stage, 265 households were selected from the four selected villages using Krejcie and Morgan (1970) procedure. Systematic random sampling was used to select these households. That is, every third household was selected skipping two households in between. A structured quantitative questionnaire was used and survey data included information on household demographics, productive assets, living standards, and income sources from agricultural production and

marketing (both crops and livestock). Household survey data was complemented with qualitative information from semi-structured interviews with district agricultural officers, community development officers and sub-county chiefs on rural livelihood strategies.

The method used in measuring household food security is based on Sen (1982) entitlement approach. The dependent variable (The four pillars of household food security) was measured as follows: food availability was calculated by converting all food harvested by an individual household for home consumption in one year into Uganda shillings; food accessibility was estimated in Uganda shillings in accordance with all the net incomes of a given household in one year; food utilization was determined in Uganda shillings by a combination of food available and food accessible to a given household in one year; all the above 3 pillars were considered for a period of one year, hence determining food stability. Food available plus food accessible to a given household equals to expected food utilization of that household (food entitlement). A standard measure (of required quantity and quality of food per household in a year, that is, Uganda shillings 2500 times number of people in a household times 365 days) in Uganda shillings for a food secure household, taking into consideration the number of household members, was established. Households equaling to, or above that measure were considered food secure. Uganda shillings 2500, the equivalent of one US dollar then, was estimated to cover one individual member of a household in a day. A balanced diet (required quality of food) means that, a household should try to eat at least 5 portions of a variety of fruit and vegetables every day. The common of these in the rural areas of Uganda are: bananas, mangoes, oranges, avocados, sweet corn, pineapples, cabbage, pepper, onions, and tomatoes. In addition to this, base meals on higher fiber starchy foods like potatoes, peas, beans, nuts and potatoes with skin need to be consumed. Other protein foods like poultry and eggs are also necessary. These foods need to be consumed on a regular basis. There are many other kinds of foods to be consumed for a balanced diet, but the above are the most commonly available ones in Uganda's rural areas.

The quantitative data collected was analyzed to describe the household level characteristics using t-tests and chi-square along with the binary logistic regression to examine the determinants of household food security. Stata 12 was used.

Household food security is influenced by a number of factors. They range from socio-economic to institutional factors. Modelling a relationship between food secure and food insecure households requires use of discrete choice models (Kabunga et al., 2011; Wellington et al., 2013). Therefore, the logit model was used in this study since it is easier and simpler to interpret and thus has been widely applied in decision studies (Adesina and Seidi, 1995). The household food security logit model is then specified as follows (Cameron and Trivedi, 2005);

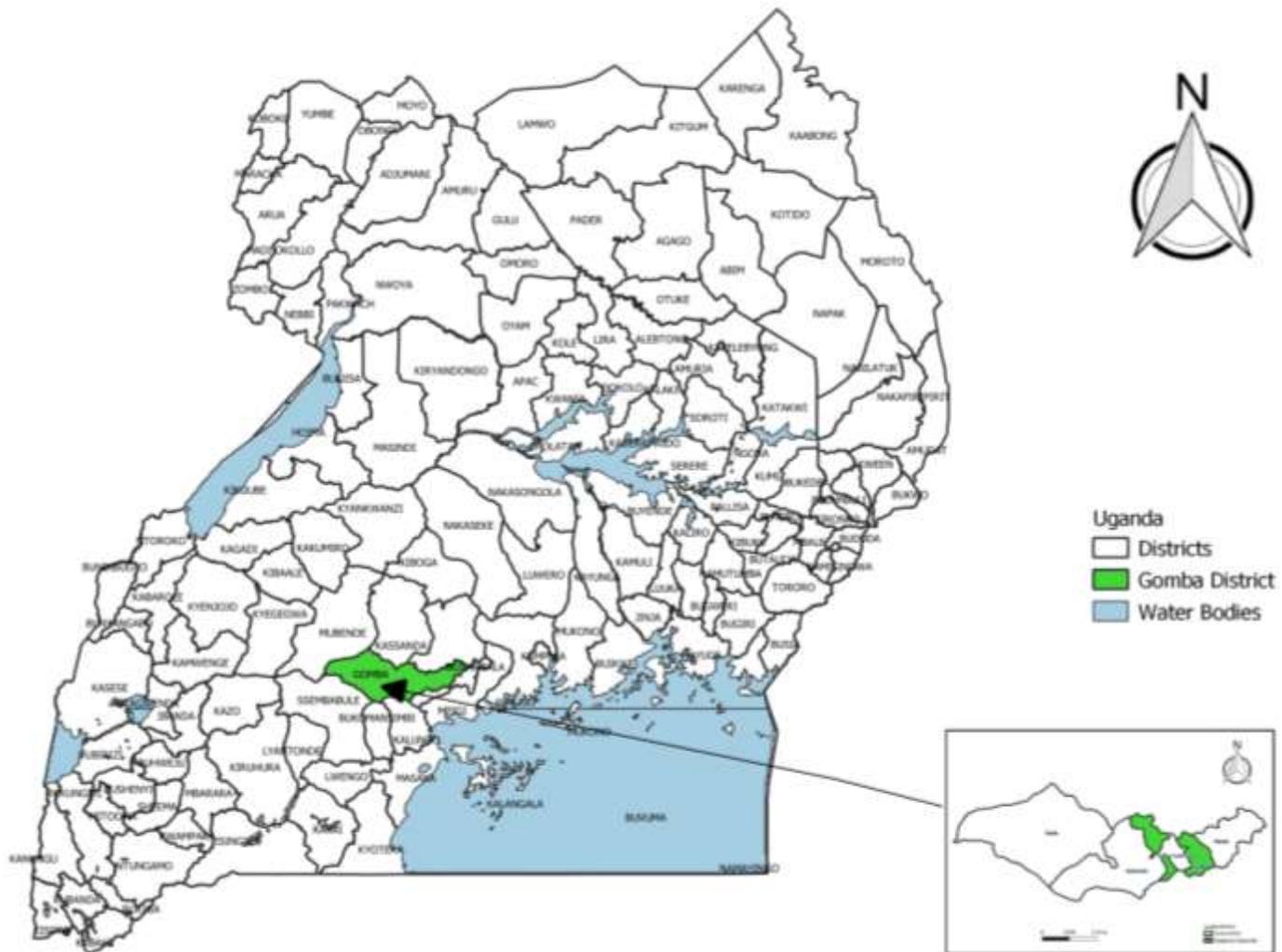
$$\Pr(y_{ji} = 1|X) = \Phi(X'\beta) = \frac{e^{X'\beta}}{1+e^{X'\beta}}$$

Where  $\Phi(\cdot)$  is a logistic cumulative distribution function (CDF). The logit model was estimated using maximum likelihood estimation (MLE), assuming independence across observations and that the ML estimator of  $\beta$  is consistent and asymptotically normally distributed. However, the estimation rests on the strong assumption that the latent error term is normally distributed and homoscedastic.

## RESULTS AND DISCUSSION

### Household characteristics

In Table 1, we present the summary statistics for household characteristics for food secure and food



**Figure 1.** Map of Uganda showing the Study Area in Gomba district, Kyegonza sub-county  
Source: QGIS mapping program.

insecure households. We found that 75% of the households in the sample are male-headed; the average age of the household head is 42 years and the average household size is 6 members. The average age shows that the farmers interviewed are still economically active, and that decisions regarding household food security are greatly influenced by males. Majority of the respondents (69%) have primary education, whereas 68% are married. This shows that the education levels are still low in the study area. Most of the households interviewed (57%) are Kibanja holders. This implies that majority of the respondents do not have full user rights (tenure security) of the land. Households who are food secure are more likely to be headed by young males and are smaller in size as compared to food insecure households. In addition, food secure households are less likely to be Kibanja holders but more likely to be having leasehold as compared to food insecure households.

#### Assets and welfare indicators of the households

In Figure 2, we present the summary statistics for the assets and welfare indicators of the households in terms of livestock, land, household income and food storage status, and compare these for food secure and food insecure households.

We found that food secure households are likely to have more land with less livestock units. The average land size for the food secure and food insecure households was about 4.9 and 2.8 acres respectively. This implies that households with bigger land are in position to utilize it for more food production. On average, 81% of the food insecure households own livestock as compared to only 44% of the food secure households. This could be the fact that the food insecure households spent much of their time in grazing cattle instead of concentrating on crop cultivation. Food secure

**Table 1.** Mean comparison of household characteristics and welfare indicators for food secure and food-insecure households.

Characteristic	Total sample	Food Insecure	Food secure
<b>Household characteristics</b>			
Gender HH head (1=Male)	0.75 (0.43)	0.73 (0.45)	0.79 (0.41)
Age HH head (years)	41.5 (12.2)	42.2 (12.1)	40.7 (12.3)
Household size	5.9 (3.1)	6.3 (3.1)	5.3*** (3.0)
<b>Share of HH heads with: (%)</b>			
No education	9.4	9.7	9.1
Primary	69.4	69.0	70.0
Secondary	16.6	16.1	17.3
Tertiary	4.5	5.2	3.6
<b>Share of HH heads who are: (%)</b>			
Single	20.0	18.7	20.9
Married	68.3	66.5	70.9
<b>Land tenure (%)</b>			
Leasehold	37.7	31.6	46.4**
Kibanja holder	56.6	63.2	47.3***
Mailo Land	1.1	0.6	1.8
Hired/Borrowed	4.5	4.5	4.5
<b>Number of observations</b>	<b>265</b>	<b>155</b>	<b>110</b>

Mean comparison t-tests were used to compare household characteristics for food secure with food-insecure households. Significant differences are indicated with \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$  or \*  $p < 0.1$ . Standard deviations of the mean are reported between parentheses.

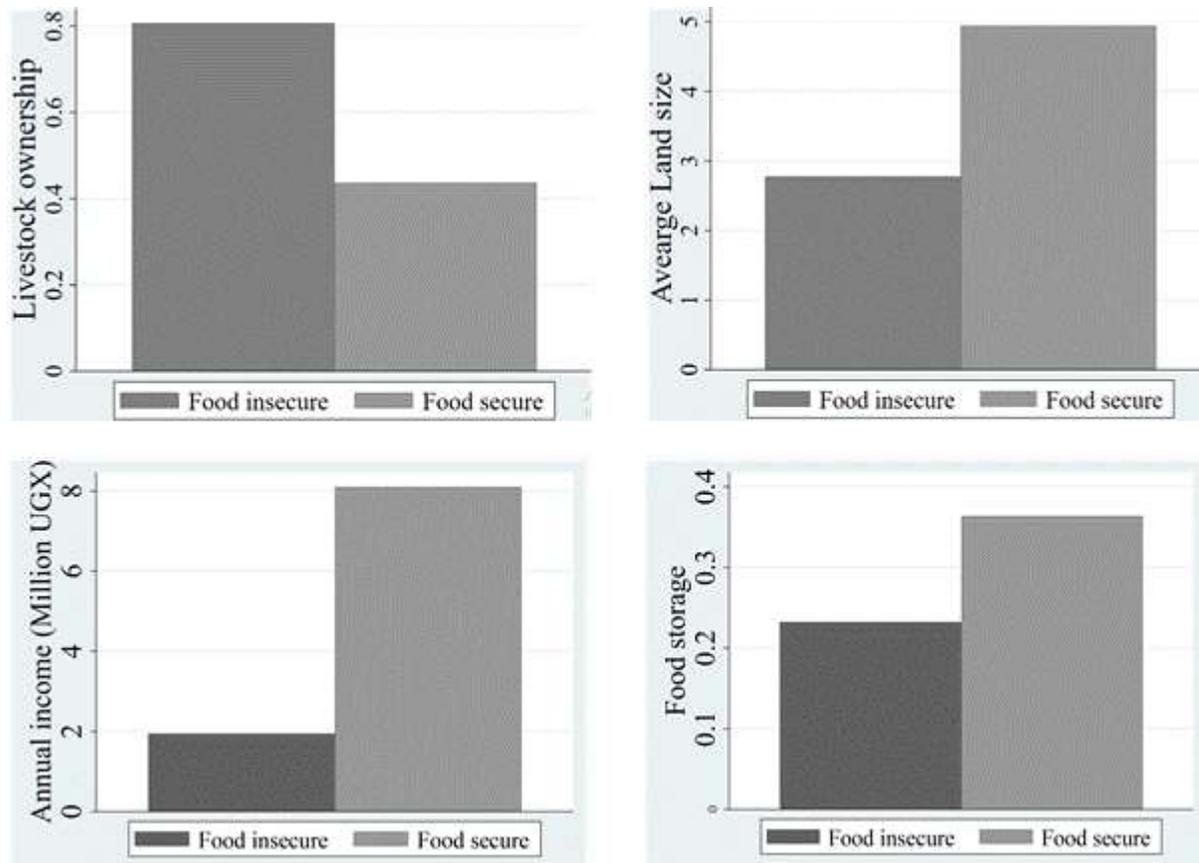
households have more annual average incomes and are more likely to store food as compared to food insecure households. The average household income for food secure and food insecure households is 8,101,432 UGX and 1,945,694 Uganda shillings respectively. The percentage of households that have the ability to store food is very low in the study area. On average, 36% of the food secure households are able to store food as compared to only 23% of the food insecure households. This implies that majority of the households are vulnerable to food shortage in the study area.

### Econometric results

In Table 2, we present the results of the logistic regression showing the household determinants of food security status. The results show that land size leads to an improved household food security situation. Keeping other factors constant, the increase in land size is associated with the increased likelihood of the household being food secure. We found that land size in the categories 3 to less than 6 ha; 6 to 9 ha and more than 9 ha increases the likelihood of the household being food secure by 0.347, 0.495 and 0.684 respectively. This

finding is consistent with that of Bogale and Shimelis (2009), and Van der Veen and Gebrehiwot (2011) but contradicts the results of Sikwela (2008). This implies that food production could be increased through expansion of land areas under cultivation.

We also find that livestock rearing reduces household food security. Results show that keeping livestock reduces the likelihood of the household being food secure by 0.319. It is likely that animals reared by individual households are too few to make an impact. Instead of solving the problem of food insecurity, these animals may end up consuming rather than improving the household food security status. These findings are consistent with Mayanja et al. (2015) where one of the highly significant factor associated with increasing household food insecurity in the rainy season, was low livestock holdings for agro-pastoralists. They contradict results of Mbolanyi et al. (2017), where livestock ownership positively influenced household food security (Mbolanyi et al., 2017). The results also contradict those by Bashir et al. (2012) where both large and small livestock assets significantly improve food security (Bashir et al., 2012). It also contradicts findings of Beyene and Muche (2010), Muhoyi et al. (2014) and Owolade et al. (2013). The above findings give an



**Figure 2.** Mean comparison of Assets and Welfare indicators for food secure and insecure households.  
Source: Authors' calculations from survey data.

impression that food security can be improved with increased livestock holdings.

Household size is also associated with reduced household food security. We found that household size in the categories 5 to 8 members; 9 to 12 members and more than 12 members decreases the likelihood of the household being food secure by 0.321, 0.409 and 0.493 respectively when other factors are held constant. The explanation could be that increase in household size results in increased demand for food, which may not be accompanied by food production. This is consistent with the studies conducted by Olayemi (2012) and Paddy (2003), which show a negative correlation between household size and household food security.

## CONCLUSIONS AND POLICY RECOMMENDATIONS

In this study, we provide evidence on the household determinants of food security in rural Uganda. Previous studies have analyzed the determinants at macro-economic levels without focusing on what influences food security at household level. Evidence on food security at

household level is highly relevant given the high levels of food shortages in developing countries, and the beneficial nutritional effects associated with food availability. We address this research gap using survey data from farm households in rural central Uganda in Gomba district where food insecurity is prevalent. Our results suggest that household factors in terms of the nature of social and asset composition in rural areas can be an important instrument for reducing food insecurity and accelerating rural development in developing countries. Our analysis contributes to the discussion on whether household factors can be important drivers of food security in rural areas of developing countries. Our analysis is done at the household level, and our results imply that availability of land at household increases food security while livestock ownership reduces food security. In addition, household size decreases food security. In developing countries, land is the main factor of production. Therefore, possession of land can importantly contribute to food production especially in rural areas. Based on this, land owners with big chunks of land which is redundant can be advised to lease it or hire it out to those with the capacity to grow food; farmers can be taught modern farming

**Table 2.** Logistic regression results for the determinants of food security.

Variable name	Coefficient	Marginal effects	Odds ratios	Robust Std. Err.
<b>Land holdings</b>				
Below 3 ha	1			
3 to less than 6 ha	2.147	0.347	8.558***	0.449
6 to 9 ha	3.085	0.495	21.857***	0.626
More than 9 ha	4.870	0.684	130.374***	1.021
<b>Land tenure</b>				
Leasehold	1			
Kibanja holder	0.205	0.029	1.227	0.381
Mailo land	1.067	0.160	2.907	1.396
Hired/Borrowed land	1.301	0.196	3.673*	0.695
HH owns Livestock (1=Yes)	-2.159	-0.319	0.115***	0.369
<b>Household size</b>				
1 to 4 members	1			
5 to 8 members	-2.225	-0.321	0.108***	0.417
9 to 12 members	-2.984	-0.409	0.051***	0.629
Above 12 members	-3.893	-0.493	0.020**	1.548
HH stores food (1=Yes)	0.506	0.075	0.603	0.353
Constant	3.247	0.075	25.708***	0.874***
Number of observations	265			
Wald chi <sup>2</sup> (11)	79.51			
Prob > chi <sup>2</sup>	0.000			
Pseudo R <sup>2</sup>	0.331			

Significant effects are indicated with \* p<0.1, \*\* p<0.05 or \*\*\*p<0.01.

practices like climate smart agriculture to improve their production and incomes, especially during these times of severe climate change; lazy household members need to be cautioned and made to work; households need to be sensitized on the importance of livestock products for improved health, soil enrichment and higher incomes; and how to come up with traditional but good storage facilities for keeping their food. Stored food can help during famine or emergency times like this period of corona virus pandemic. It is therefore recommended that government: reviews the land tenure and land use acts while also protecting the landlords, for improved food production at household and national level, and for higher income taxes to government to enable it improve the necessary social services; puts in place national food storage facilities to improve its preparedness to manage emergencies; promotes climate smart agriculture, through changing the behavior, strategies and agricultural practices of small scale agricultural farmers; institutes a policy which ensures increased livestock rearing at household level; through cooperative unions purchases agricultural produce from rural households at a good price to motivate them to grow more for improved food security status.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

## ACKNOWLEDGEMENTS

Sincere gratitude goes to Mary Nanfuka, and Joseph Muhereza of Uganda Martyrs University, and Tom Lutalo of Uganda Virus Research Institute for technical support. Appreciation also goes to the contribution made by Josephine Bwogi through reviewing and editing this article.

## REFERENCES

- Adesina A, Seidi S (1995). Farmers perceptions and adoption of new agricultural technology: analysis of modern mangrove rice varieties in Guinea Bissau. *Quarterly Journal of International Agriculture* 34(4):358-371.
- Apanovich N, Mazur RE (2018). Determinants of seasonal food security among smallholder farmers in south-central Uganda. *Agriculture and Food Security* 7:87.
- Bashir MK, Schilizzi S, Pandit R (2012). Livestock and rural household food security: The case of small farmers of the Punjab, Pakistan,

- Working Paper 1207, School of Agricultural and Resource Economics, University of Western Australia,, Crawley, Australia
- Beyene F, Muche M (2010). Determinants of food security among rural households of Central Ethiopia: an empirical analysis. *Quarterly Journal of International Agriculture* 49(4):299-318.
- Bogale A, Shimelis A (2009). Household level determinants of food insecurity in rural areas of Dire Dawa, Eastern Ethiopia. *African Journal of Food, Agriculture, Nutrition and Development* 9:9.
- Cameron AC, Trivedi PK, (2005). *Microeconometrics. Methods and Applications*. Cambridge University Press
- Department of Economic and Social Affairs (DESA) (2017). *The World Population Prospects: The 2017 Revision*.
- EPRC (2017). *Ensure food security or forget middle income dream*.
- Food and Agriculture Organization (FAO) (1996). *Declaration on World Food Security, World Food Summit, Rome, Italy*.
- Jensen HH (2002). Food insecurity and the food stamp program. *American Journal of Agricultural Economics* 84:1215-1228.
- Kabunga NS, Dubois T, Qaim M (2011). Information asymmetries and technology adoption: The case of tissue culture bananas in Kenya, Courant Research Centre: Poverty, Equity and Growth-Discussion Papers.
- Krejcie RV, Morgan DW (1970). Determining sample size for research activities. *Educational and psychological measurement* 30:607-610.
- MAAIF, MOH (2003). *The Uganda Food and Nutrition Policy*. The Republic of Uganda.
- Mayanja MN, Rubaire-Akiiki C, Greiner T, Morton JF (2015). Characterising food insecurity in pastoral and agro-pastoral communities in Uganda using a consumption coping strategy index. *Pastoralism* 5:11.
- Mbolanyi B, Egeru A, Mfitumukiza D (2017). Determinants of household food security in a rangeland area of Uganda. *African Journal of Rural Development* 2(2):213-223.
- Muhoyi E, Mukura T, Ndedzu D, Makova T, Munamati O (2014). Determinants of household food security in Murehwa District. *Journal of Economics and Sustainable Development* 5(3):84-92.
- National Environment Management Authority (NEMA) (2016). *State of the environment report for Uganda 2014*, National Environment Management Authority (NEMA) Kampala P 82.
- Nyariki DM, Wiggins S (1997). Household food insecurity in Sub-Saharan Africa: Lessons from Kenya. *British Food Journal* 99(7):249-262.
- Olayemi AO (2012). Effects of family size on household food security in Osun State, Nigeria. *Asian journal of agriculture and rural development* 2(2):136-141.
- OPM (2005). *Evaluation Report : The plan for the modernisation of Agriculture* 12.
- Owolade E, Oyesola O, Yekinni O, Popoola M (2013). Determinants of Food Security among Rural Livestock Farmers in Southwestern Nigeria. *Journal of Agricultural Extension* 17(2):147-181.
- Paddy F (2003). *Gender differentials in land ownership and their impact on household food security: a case study of Masaka district*. A Masters Thesis, Uganda Press, Baltimore and London. [www.troz.uni-hohenheim.de/research/Thesis/MScAES/Paddy.pdf](http://www.troz.uni-hohenheim.de/research/Thesis/MScAES/Paddy.pdf)
- Sen A (1982). *Poverty and famines: an essay on entitlement and deprivation* Oxford university press, New York.
- Sikwela M (2008). *Determinants of household food security in the semi-arid areas of Zimbabwe: A case study of irrigated and non-irrigated farmers in Lupane and Hwange districts*. University of South Africa.
- Uganda Bureau Of Statistics (UBOS) (2018). *2018 Statistics Abstract* P. 11.
- Van der Veen A, Gebrehiwot T (2011). Effect of policy interventions on food security in Tigray, Northern Ethiopia. *Ecology and Society* 16(1):18.
- Wamai M (2018). *Mak and MAAIF Hold CAADP Malabo Declaration action planning meeting*, NEWS Makerere University.
- Wellington EM, Boxall AB, Cross P, Feil EJ, Gaze WH, Hawkey PM, Johnson-Rollings AS, Jones DL, Lee NM, Otten W (2013). The role of the natural environment in the emergence of antibiotic resistance in Gram-negative bacteria. *The Lancet infectious diseases* 13(2):155-165.
- World Food Programme (WFP) (2013). *Uganda Comprehensive Food Security and Vulnerability Analysis (CFSVA)* World Food Programme.
- Wichern J, van Wijk MT, Descheemaeker K, Romain F, Asten PJA, Giller KE (2017). Food availability and livelihood strategies among rural households across Uganda. *Food security* 9:1385-1403.