Determinants of market participation for smallholder cassava processors in north and north-eastern Uganda

Article *in* Journal Of Rural Development · November 2018

CITATIONS
2

READS
394

2 authors:

Basil Mugonola
Gulu University (GU)
31 PUBLICATIONS **186** CITATIONS
SEE PROFILE

Duncan Ongeng
Gulu University (GU)
49 PUBLICATIONS **661** CITATIONS
SEE PROFILE

African Journal of Rural Development,Vol. 2 (4): October-December 2017: pp. 549-563. ISSN 2415-2838

Determinants of market participation for smallholder cassava processors in north and north-eastern Uganda

B. MUGONOLA[1], W. AJOK[1*] and D. ONGENG[2]
[1]Department of Rural Development and Agribusiness, Faculty of Agriculture and Environment, Gulu University, P.O Box 166, Gulu, Uganda
[2]Department of Food Science and Post-Harvest Technology, Faculty of Agriculture and Environment, Gulu University, P.O Box 166, Gulu, Uganda
***Corresponding author:** anywinnie.winnie@gmail.com

ABSTRACT
Cassava (*Manihot esculenta crantz)* is a crop of global significance especially in the tropics where it is a source of food, animal feeds and industrial starch. However, the rapid Post-Harvest Physiological Deterioration (PPD), bulkiness of fresh cassava roots and high toxicity of some cassava varieties prohibits prolonged marketing and market participation of smallholder farmers. A cross-sectional study was conducted in north and north-eastern Uganda to ascertain the drivers of market participation for smallholder cassava farmers. Data were collected using pre-tested questionnaires administered to 185 randomly selected respondents and using STATA package, a two stage Heckman's model was fitted involving a Probit model and OLS regression in the first and second stages, respectively. Results of the first stage Probit model revealed that farm land size, market distance, size of household, transport cost and off-farm annual income significantly ($P<0.05$) influenced the market participation decisions of smallholder cassava processors. In the OLS regression of the outcomes model, gender, market distance, contract marketing, marketing experience, education level, and land allocated to cassava production and group marketing significantly increased the sales revenues of processed cassava products. Our findings indicate that socio-economic and institutional factors are important in stimulating smallholder cassava farmers' market participation. Therefore, policy support is needed in the areas of contract marketing, processing to prolong cassava shelf-life, strengthen market access conditions and lift smallholder farmers from income poverty.

Key words: Cassava, Heckman's model, market participation, Uganda

RÉSUMÉ
Le manioc (Manihot esculenta crantz) est une culture d'importance mondiale, en particulier dans les tropiques, où elle constitue une source de d'aliments et d'amidon industriel. Toutefois, la détérioration physiologique post-récolte accélérée, l'encombrement des racines de manioc frais et la toxicité élevée de certaines variétés de manioc entravent la commercialisation prolongée et la participation au marché des petits agriculteurs. Une étude a été menée au nord et au nord-est de l'Ouganda pour déterminer les facteurs de participation des petits producteurs de manioc au marché. Les données ont été collectées à l'aide des questionnaires pré-testés administrés à 185 répondants aléatoirement sélectionnés. Le

Cite as: Mugonola, B., Ajok, W. and Ongeng, D. 2017. Determinants of market participation for smallholder cassava processors in north and north-eastern Uganda. *African Journal of Rural Development* 2 (4): 549-563.

Received: 28 August 2017
Accepted: 15 November 2017
Published: 31 December 2017

modèle de Heckman en deux étapes soit un modèle Probit et une régression par la methode des CMO dans les premier et deuxième étapes, respectivement, a été utilisé à l'aide du package STATA. Les résultats de la première étape du modèle Probit ont révélé que la taille des terres agricoles, la distance au marché, la taille des ménages, les coûts de transport et le revenu annuel hors exploitation (P <0,05) influençaient considérablement les décisions des petits producteurs de manioc. Dans la régression CMO, le sexe, la distance du marché, le marketing contractuel, l'expérience sur le marketing, le niveau de formation, les terres allouées à la production de manioc et à la commercialisation de groupe ont augmenté les chiffres d'affaires des produits transformés à base de manioc. Nos résultats indiquent que les facteurs socioéconomiques et institutionnels sont importants pour stimuler la participation des petits producteurs de manioc au marché. Par conséquent, un soutien politique en ce qui concerne la commercialisation contractuelle et la transformation, est nécessaire pour prolonger la durée de conservation du manioc, renforcer les conditions d'accès au marché et améliorer les revenus des petits agriculteurs.

Mots clés: manioc, modèle de Heckman, participation au marché, Ouganda

INTRODUCTION

Production of cassava (*Manihotes culenta Crantz*) lies traditionally in the tropical countries of Latin America, Asia and Africa. Cassava is ranked 19th among the top crops produced globally, with total production at 269,125,963MT (FAO, 2012). Globally the production of cassava is for human consumption, animal feeds and extraction of starch for industrial use. It is the starch roots and leaves that are consumed. Cassava is Africa's second most important staple food crop in terms of per capita calories consumed and it is a major source of calories for roughly two out of every five Africans (Onyemauwa, 2010). The importance of cassava in Africa becomes obvious when its annual production is compared to the rest of the world: while the world's average production was about 270,293,801 MT in 2014 (FAOSTAT, 2015), Africa's share of production was about 54.7% of the world's average total production between 2010-2014, Latin America at 12.5%, Asia 32.8% and Oceania at 0.1%.

In Uganda, over 75% of the smallholder farmers grow cassava for both food security and income generation (Roothaert and Muhanji, 2009; Salami, 2010). Further, by region, cassava is a very important food security crop and more recently an income crop in eastern, northern, and north-western parts of Uganda, with per capita consumption of 132 kg/person/year which accounts for about 11% of the total caloric intake (Haggblade and Dewina, 2010). It is ranks second to bananas in terms of area occupied, total production and per capita consumption in Uganda (Mbwika *et al.,* 2001; Prakash, 2014).

Once the cassava root is separated from the main plant, it undergoes Postharvest Physiological Deterioration (PPD) (Onyenwoke and Simonyan, 2014). The damaged tubers normally respond with a healing mechanism which produces coumaric acids initiated about 15 minutes after damage and fails to switch off in harvested tubers (Beeching *et al.,* 2003). The whole process continues until the entire tuber is oxidized and blackened within two to three days after harvest, rendering it unpalatable and useless. Post-Harvest Physiological Deterioration (PPD) and bulkiness constitute some of the main obstacles to fresh cassava marketing in local and international markets and thus limiting the margins that cassava market participants obtain (Zidenga, 2012; Naziri *et al.,* 2014). Due to these, significant proportions of cassava produced rarely makes it from the rural

areas to the urban centers for marketing.

Despite the fact that the north and north eastern regions are the major producers of cassava in Uganda (UBOS, 2013), the volume of cassava marketed from these regions is dismal and limited in scope. Therefore, cassava processing and value addition are fronted as viable options to alleviating challenges faced by smallholder farmers in the cassava value chain. According to Chukwuji *et al.* (2007) and Achem *et al.* (2013) the need for processing and value addition arises in order to reduce bulkiness of fresh cassava roots (contains 60-70% water), remove toxicity of fresh roots of the bitter variety (cynogenic glycoside), increase shelf-life (rots within 3-4 days of harvest), facilitate transportation to the urban markets, increase on the nutritive content (its low in other nutrients especially in proteins), to convert cassava root into other usages (confectionary and industrial extraction of starch) and to stabilize products prices and supply (FAO and IFAD, 2005). Whereas processed cassava products are important cassava based foods in Uganda and by implication are expected to ease the cassava marketing constraints, there is limited information on how these drive the smallholders' participation in cassava marketing. Processed cassava products ('Gari' products, flour and chips) are now available on the market with increasing demand, but the participation of smallholder processors, especially in the north and north-eastern Uganda remains limited. There is lack of information on 'Gari', processing of High Quality Cassava Flour (HQF) and chipping that make economic sense. It is against this background that this study sought to identify the factors that determine the decisions of smallholder cassava processors to participate in the marketing of processed cassava products in the north and north-eastern Uganda.

MARKET PARTICIPATION

The definition of market participation entails both inputs and outputs market access by smallholder farmers and other value chain actors. Market participation can be defined on one hand as the actors' increasing engagement with markets (Mwongoso *et al.,* 2015). Sebatta *et al.* (2014) on the other hand defined market participation as the quantity or proportion of the harvested output that is marketed. In effect, market participation is about accumulating proportions of crops and animal products meant for sales. In order for it to be effective, other factors of production like hired labour, land and credit are required (Mwongoso *et al.,* 2015). Relatedly, smallholder farmers have been defined in terms of their underlying characteristics including farm size, number of assets (proxy for wealth), market positioning, level of vulnerability to risk and access to labour and technology (Sigei and Kibet, 2014). Smallholder farmers' market participation generates employment opportunities to the local communities through activities like sorting, grading and transportation among others and this eventually spurs the development of rural roads, small and medium enterprises and other economic infrastructures (Sigei *et al.,* 2014).

It has been observed that various factors affect smallholder farmers' market participation to varying degrees both spatially and temporally. However, there seems to be no consensus in the literature on any particular factor or a set of factors as these have varied from study to study. Generally, factors that affect accumulation of marketable surpluses will definitely affect market participation for smallholder farmers. These factors have been broadly categorized into: socio-economic factors, institutional factors, market factors and external factors (such as political instability of the nation, natural disasters and calamities). These factors may have negative and/or positive effects, which can either enhance or cause a decline in the welfare of the actors in the markets. The literature is replete with socio-economic factors that affect

market participation. For instance, Gobena *et al.* (2012), Geremew (2013), Abu *et al*. (2014) and Sebatta *et al.* (2014) reported socio-economic factors like age, gender, education, experience, household size and land size to have an impact on market participation for smallholder farmers in the marketing of various crops. Other studies have also individually revealed that education level and household size had impacts on market participation (Omiti and Mccullough, 2009; Osmani and Hossain, 2015) of smallholder farmers.

Institutional factors like group membership, access to extension services and infrastructure had an influence on market participation (Bahta and Bauer, 2007; Omiti and Mccullough, 2009; Jagwe *et al.,* 2010; Sebatta *et al.,* 2014). Access to communication equipment as noted by Abeykoon *et al.* (2013) including mobile phones, radios, and televisions were reported to positively and significantly impact on market participation. Further, in a study conducted on cassava market participation decisions of producing households in Africa by Enete and Igbokwe (2009), it was revealed that price, market access, availability of information on prices of cassava products, farm size and level of formal education were significant in influencing market participation among producers. Other studies have lumped all the institutional, market and external factors together. For instance, Sigei *et al.* (2013), revealed that six variables (gender, group marketing, price information, marketing experience, vehicle ownership and contract arrangements) were significant in influencing the extent of market participation. Elias *et al.* (2013) reported that age, ownership of livestock, education level of household head, and owned land size were significant in influencing extent of livestock market participation. On the other hand, Munyua *et al.* (2010) found out that motor-able road, age, household asset portfolios, degree of commercialization, membership in farmer groups and marketing experience had impacts on the extent of market participation of certified maize seed. Maziku, (2015) found out that farmers' age, education level, family size, transport means and distance to the market impacted on the extent of maize market participation. Further, Zamasiya *et al.* (2014) found out that market distance had an impact on the extent of soybean market participation. In a related study, Bahta and Bauer (2007) revealed that hectarage cost, extension services and non-farm income were responsible for the extent of livestock market participation. All these variables had significant impacts on the extent of market participation as indicated by various researchers. However, there seems to be no consensus on a particular set (s) of variables that influence market participation as there were a number of variations across studies, enterprises and countries.

METHODS AND DATA

The study was conducted in north and north eastern Uganda in Gulu, Lira, Kaberamaido and Soroti districts. A cross sectional survey design was used to collect both qualitative and quantitative data from both cassava processors and non-processors. A multi- stage sampling procedure was used where in the first stage four districts (Gulu, Lira, Kaberamaido and Soroti) were purposely selected based on their locations and extent of cassava production and processing (two districts in the north (Gulu and Lira) and two in north-eastern Uganda (Soroti and Kaberamaido). Secondly, two sub-counties were purposively sampled from each of the selected districts based on the relative extent of cassava production and processing. Thirdly, two parishes from each sub county were purposely selected based on relative extent of cassava production and processing. Finally, the households interviewed were randomly selected in the fourth sampling stage using the list of all smallholder farmers in the parish as a sampling frame. The total number of households interviewed was 185. However,

not all respondents were processing the three cassava products at the time of the study and therefore the processors and non-processors were drawn from the same sample using post-survey classification techniques.

The Heckman's two-stage model (Heckman, 1979) was used to determine the socio-economic, institutional and market factors that affect the decisions of cassava processors to participate in the marketing of 'Gari', flour and chips as used in (Abeykoon *et al.,* 2013; Kansiime *et al.,* 2014; Sebatta *et al.,* 2014; Sigei and Bett, 2014). The model consists of two steps; firstly, the selection equation was estimated using a Probit model and secondly, an outcome equation was estimated using Ordinary Least Squares (OLS) regression. The choice of the Probit model was motivated by the fact that the dependent variable was dichotomous while the OLS regression was chosen because the dependent variable was continuous. A Probit model predicts the probability of whether an individual household participated in the marketing of processed cassava products or not (Equation 1).

$Pr\ (Y_i = 1/X_i, \alpha) = \phi\ (h(X_i, \alpha)) + \varepsilon_i$ 1

Where:

Y_i is an indicator variable equal to one for smallholders that processed and marketed cassava and zero otherwise.

ϕ is the standard normal cumulative distribution function,

X_i, are the factors affecting the decision to participate in processed cassava products markets,

α is the vector of coefficients to be estimated, and ε_i is the error term assumed to be distributed normally with a mean of zero and variance δ^2.

The latent variable Y^*_i takes the value of 1 if the perceived benefits that the i^{th} household gets from participating in marketing of processed cassava products is greater than zero, and zero otherwise. This is shown as follows,

$Y_i^* = Xi + u_i$ 2

Where Yi*is the latent level of utility the smallholder cassava processors got from participating in the market, $u_i \sim N(0,1)$ and,

$Y_i^* = 1$ if $Y_i^* > 0$ 3

$Y_i^* = 0$ if Y_i^* 0 4

In the second step, an additional regressor in the sales equation was included to correct for potential selection bias. This regressor was the Inverse Mills Ratio (IMR). The IMR is computed as:

$$\frac{\varphi\ (h(X_i, \alpha\tilde{}\ ))}{(\varphi\ (X_i\ ,\ \alpha\sim)} \text{.....5}$$

Where φ is the normal probability density function. The second-stage equation is given by:

$$E=(Y_i\ |X=1)=f(X_i\ \beta)+\lambda\ \frac{\varphi\ (h(X_i, \alpha\tilde{}))}{(\varphi\ (X_i\ ,\ \alpha\sim)} \text{.....6}$$

Where E is the expectation operator, Y_i is the (continuous) proportion of cassava products sold, X_i are the independent variables that affect the sales revenue/ volume of processed cassava products, and β is the vector of the corresponding coefficients to be estimated. Therefore, Y_i can be expressed as follows

$Y_i^* = \beta' X_i + u_i$ 7

$Y_i^*$is only observed for those cassava processors who participate in the marketing,

Where $u_i \sim N(0, \sigma u)$. ($X_i = 1$), in which case $Y_i = Y_i^*$

The model can thus be estimated as follows; in the first step of deciding whether to participate in processed cassava marketing or not. This can be specified as (Equation 8):

$$P_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \text{.....} \beta_n X_n + e \text{.....8}$$

Where participation is denoted by 1 and non-participation is denoted by 0, β_0 is a constant, $\beta_1 .. \beta_n$ are the coefficients of the independent variables. X_i are the explanatory variables.

The second stage (Outcome equation) which hinges on a positive outcome from the first stage was estimated by the use of OLS as follows:

$Y_i=\beta_0+\beta_1 X_1+\beta_2 X_2.....\beta_n X_n+e$……9

Where Y_i denotes the proportion of processed cassava sold, β_0 is a constant, β_1…..β_n are parameters and Xi are the explanatory variables.

Empirical model

Heckman (1979) suggested a two-step procedure which involves the estimation of a standard Probit and a linear regression model. The two equations for the two steps are specified as follows. The variables used in the Heckman two stage model are shown in Table 1.

Step1. (Selection equation)

$Pi=\beta_0+\beta_1 X_1+\beta_2 X_2+.....+\beta_3 X_3+e$

$P(i(0,1))=\beta_0+\beta_1 Age+\beta_2 Gender+\beta_3 Hsize+\beta_4 Educ+\beta_5 FrmExp+\beta_6 MrktExp+\beta_7 ProcsExp+\beta_8 LandCas+\beta_9 OffrmActs+\beta_{10} OffrmInc+\beta_{11} TrspCost+\beta_{12} MktDisc+\beta_{13} CasBuyers+\beta_{14} MktProxmty+\beta_{15} MktInfo+\beta_{16} Contract+\beta_{17} Grouomembership+\beta_{118} Finance+ei$……10

Step2. (Outcome equation)

$Yi=\beta_0+\beta_1 X_1+\beta_2 X_2+.....+\beta_3 X_3+e$

$Yi=\beta_0+\beta_1 Age+\beta_2 Gen+\beta_3 Hsiz+\beta_4 Educ+\beta_5 FrmExp+\beta_6 ProcExp+\beta_7 MktExp+\beta_8 LandCas+\beta_9 OffAct++\beta_{11} OffarmIncome+\beta_{12} Transport+\beta_{13} TransportCost+\beta_{14} MarketDistc+\beta_{15} CassBuyers+\beta_{16} MrktInfo+\beta_{17} ContractArrang+\beta_{18} GroupMembership+\beta19 Finance+\beta_{20} IMR+ei$…….....11

Table 1. Variables used in the Heckman's two stage models

Variables	Description	Expected sign
Age	Age of household head (Years)	
Gen	Sex of household head (Female=1, Otherwise =0)	+/-
Educ	Years spent in school (Years)	+/-
Hsize	Number of persons in a household (Numbers)	+
OffrmInc	Annual off farm income of household head (Shillings)	
Transport	Ownership of transport means (Yes=1, Otherwise=0)	+/-
MktDisc	Distance to the nearest market (Kilometre)	
CasOcm	Annual production of processed cassava (Kilograms)	+
FrmExp	Farming experience of household head (Years)	+/-
MktExp	Cassava marketing experience (Years)	+/-
ProExp	Cassava processing experience (Years)	+/-
MrkInfo	Production and marketing information (NGOs=1, Universities=2, Phones=3, Neighbours=4, Radios=5, Extension Agents=5)	+/-
Landcas	Land allocated for cassava production (Acres)	+/-
OffAct	Off farm activities (Civil servant=1, brewing=2, Petty business=3, Others=4)	+
TransportCost	Transport cost to the market (shillings)	-
CasPrice	A unit price per kilogram of processed cassava products (Shillings)	+
Finance	Credit access by household (Yes=1, Otherwise=0)	+
Contract arrang	Contract arrangements for marketing processed cassava products (Yes=1, Otherwise=0)	+/-
Group-marketing	Group marketing (Yes=1, Otherwise=0)	+/-
Marketing experience	Marketing experience (Years)	+/-
Group-membership	Membership to a group (Yes=1, Otherwise=0)	+
Extension service	Access to extension services (Extension agents=1, NGOs=2, Universities =3, BDS=4)	+/-

The expected signs in Table 1 indicate a positive, negative or mixed effects on market participation decisions and the subsequent volume of cassava products marketed. Data were processed and analysed using SPSS version 20, Excel 2007 and STATA version 13.

RESULTS AND DISCUSSIONS

The factors that positively and significantly influenced the decision of smallholder cassava processors to participate in marketing of cassava flour included age of respondent in years, land size allocated for cassava production (acreage), Transport hire, Market distance (Km), dummy for market access and contract arrangements. On the other hand, farming experience, total land size, owned transport means, transport cost, cassava buyer (Traders) and University as an information sources had negative coefficients. These factors seem to increase the volume of cassava production which may be beyond the ability of the household to process and therefore they choose to sell it fresh. Positive and significant coefficients meant those variables increased the probability of marketing processed cassava flour while negative coefficients meant the reverse. Contrary to the *a priori* expectations, variables such as gender, household size, off farm activities, information source-Neighbours had no significant impact on the decision of the smallholder processors to market processed cassava flour (Table 2).

Age of cassava processor positively and significantly (P = 0.01) influenced the decision to participate in the marketing of processed cassava flour. From the Marginal effects, an increase in processors' age by one year increased the probability to market cassava flour by a value of 0.010. This means that households with relatively older household heads were more likely to participate in marketing of processed cassava flour (Table 2). This findings is supported by Bahta (2012) and Sebatta *et al.* (2014) who reported that older farmers had better access to market information and networks which are requisites for market participation. On the contrary Abu *et al.* (2014) asserted that older people were more concerned about food security than the young people who are mindful of the quality of life. In addition, Sigei *et al.* (2013) also asserted that younger household heads are more enthusiastic and tend to be more market oriented than their older counterparts. In order to determine how far age can go in increasing the probability of processed cassava market participation, the threshold test was done on the age of those processing cassava flour by including the variable age along with the age_ squared (age^2) to ascertain whether there is a normal "U" or an inverted "U". The result turned out not to be significant and therefore made it impossible to determine the age threshold.

Farming experience negatively and significantly (P=0.01) influenced the decision of cassava processors to market processed cassava flour. One year's increase in the farming experience of cassava processors reduced the probability of marketing processed cassava product by 0.010 (Table 2). Farm land size also negatively and significantly (P =0.1) influenced the decision of cassava processors to participate in the marketing of processed cassava flour. Increase in farm size by one acre of land for cassava production decreased the probability of marketing flour by 0.038. However, contrary to this finding, Gobena *et al*. (2012) asserted that larger farms encouraged market participation as they directly resulted in marketable surpluses (Omiti and Mccullough, 2009). Interestingly, land acreage allocated for cassava production was positive and significant (P=0.05) in influencing the decision of cassava processors to participate in the market. Allocating an additional acre of land to cassava production increased the probability of marketing processed cassava flour by 0.1 (Table 2). This finding indicates that it is not the absolute farm acreage but the proportion allocated to specific crops that determines the scale, efficiency and intensification for that crop.

Being able to hire appropriate transportation for processed cassava products was found to positively and significantly (P = 0.01) influence the decision of cassava processors to participate in the marketing of processed cassava products.

Payment for the transportation of processed cassava products increased the probability of marketing of processed cassava flour by 0.171. The implication was that being able to pay for the transportation of flour enabled processors to access better markets where good prices were offered. This result is corroborated by the fact that markets for cassava flour products are in distant urban places which necessitate appropriate transport means to reach them.

Further, distance to the nearest market positively and significantly (P=0.05) influenced the decision of cassava processors to participate in the marketing of processed cassava flour (Table 2). This result contradicts our *a priori* expectation and theory as processors nearer to the market are expected to participate more than their counterparts who are far away from the markets (Bahta and Bauer, 2007). Market provided by urban traders for processed cassava flour was found negatively and significantly (P= 0.05) influenced the decision of cassava processors to participate in the marketing of processed flour. Availability of urban traders reduced on the probability of marketing processed flour by 0.145. This implied that prices offered by urban traders were much lower than those offered by other buyers which limited marketing of processed cassava flour. Lower prices kill marketing incentives leading to low participation. Contract arrangements positively and significantly (P=0.05) influenced the decision of cassava processors to participate in the marketing of processed cassava flour. Having contract arrangement increased the probability of marketing flour by 0.291. This implied that contract arrangements guaranteed ready market and better prices which facilitated market participation. This result in line with the findings by Sigei *et al.* (2013) where the authors found out that availability of contract arrangements enhanced market participation (Table 2).

Table 2. Results for Probit and Marginal effects for cassava flour marketing in north and north-eastern Uganda

Variables	Probit regression Coefficients	Marginal effects Coefficients
Age of household head (Years)	0.026(0.013)*	0.010(00.005)
Gender of household head (Female=1, 0= otherwise)	0.090(0.242)	0.035(0.095)
Size of household (Numbers)	0.023(0.032)	0.009(0.012)
Farming experience (Years)	-0.026(0.013)*	-0.010(0.005)*
Total farm land size (Acres)	-0.098(0.051)*	-0.038(0.019)*
Farm land size for cassava production(Acres)	0.257(0.109)**	0. 100(0.042)**
Off Farm Activities(1= Civil servant; 0=otherwise)	0.148(0.097)	0.058(0.038)
Transport mode used(on head=1, otherwise=0)	-0.179(0.089)**	-0.070(0.035)**
Transport hire (Yes=1, 0=Otherwise)	0.450(0.243)*	0.171(0.089)*
Transport cost (Shillings)	-0.000(0.000)*	-0.000(0.000)*
Market distance (kilometers)	0.091(0.036)**	0.035(0.014)**
Cassava buyer (Traders=1, Otherwise=0)	-0.491(0.239)**	-0.193(0.093)**
Proximity to the market(Yes=1,0=Otherwise)	0.374(0.217)*	0.145(0.084)*
Information (Neighbors=1, 0=Otherwise)	0.287(0.233)	0.112(0.090)
Information (Universities=1, 0=Otherwise)	-1.232(0.428)***	-0.379(0.086)***
Contract arrangement (Yes=1, 0=Otherwise)	0.748(0.313)**	0.291(0.115)**
Constant	-1.4385(0.6278)	
Log Likelihood:-	104.77	
P-Value:	0.0003	
No of Observation	185	
PseudoR^2:	0.1800	

Figures in parentheses are standard errors, ***, ** and * imply significance at 1%, 5% and 10%, respectively

Our results (Table 3) reveal that variables such as off farm annual income, cassava buyer (Brewers), information (obtained from phones), information (obtained from extension workers), Extension services (provided by NGOs) positively influenced the decisions to market processed cassava gari and chips. On the other hand household size, transport cost and contract arrangement negatively influenced the decision of cassava processors to participate in the marketing of gari and chips. Contrary to our earlier expectations, the direction of variables like age of participant in years, gender and off farm activities had no significant impact on the decision of the smallholder processors to participate in the marketing of processed gari and chip.

Results further revealed that size of household negatively and significantly (P=0.05) influenced the decision of cassava processors to participate in the marketing of processed gari and chips. An increase in a household size by one person reduced the probability of market participation by 0.024 (Table 3). This implied that with large family sizes most of what is produced is consumed leaving little or no marketable surplus which prohibited marketing of gari and chips. This finding is in line with results of Gebremedhin and Jaleta (2010) and Abu *et al.* (2014) who reported that larger family sizes necessitated higher consumption requirements/ higher consumption costs, thus most of what the family produced was consumed. Contrary to this, Omiti and Mccullough (2009) argued that larger family sizes enhanced surplus production as such families had more labor resources for increased production.

Off farm annual income positively and significantly (P=0.05) influenced the decision of cassava processors to sell gari and chips. An increase in the household's off farm income by one shilling (Uganda currency) increased the probability of marketing processed gari and chips by 0.083 (Table 3). This implied that access to off-farm income enhanced economic power, large scale production acquisition and pre-financing of inputs leading to increased market participation. This result supports the results in (Abu *et al.,* 2014) who argued that off farm income enhances large scale production and input acquisition.

Access to production and marketing information via phones was found positive and significant (P= 0.05) in influencing the decision of cassava processor to participate in the marketing of processed cassava gari and chips. Having a phone increased the household participation in the marketing of processed cassava gari and chips by 0.157. The implication was that information obtained via phones was reliable, accurate and above all, the information could easily be accessed by processors which made it easier to persuade processors to sell their gari and chips than those without phones. Access to production and marketing information through extension agents was found to also positively and significantly (P =0.01) influence cassava processors' decision to participate in the marketing of processed cassava gari and chips. Availability of extension agents who provided cassava gari and chips processors with production and marketing information increased the probability of marketing gari and chips by 0.262 (Table 3). This implied that extension agents provided processors with information on new technology, and helped in the identification of market opportunities which facilitated production and marketing of processed cassava gari and chips. In related studies by Bahta and Bauer (2007), Persson (2009) and Sebatta *et al.* (2014), these authors asserted that extension agents provided marketing information and new improved varieties to farmers which enhanced their market participation. Other factors are indicated in Table 3 with their respective coefficients and marginal effects.

Table3: Results for Probit and Marginal effects for marketing of cassava gari and chips

Variables	Probit regression	Marginal effect
Age of household head (Years)	-0.009(0.008)	-0.002(0.002)
Gender of household head (Female=1, Otherwise=0)	-0.301(0.257)	-0.091(0.082)
Size of household (Numbers)	-0.083(0.33)**	-0.024(0.009)**
Acreage cost (Shillings)	-0.403(0.456)	-0.116(0.131)
Off farm activities (civil servant =1, Otherwise=0)	-0.152(0.104)	-0.043(0.029)
Annual off farm income (Shillings)	0.285(0.138)**	0.083(0.039)**
Transport cost (Shillings)	-0.516(0.163)***	-0.15(0.047)***
Consumer brewery (Yes=1,Otherwise=0)	1.371(0.766)***	0.208(0.045)***
Information phone (Yes=1, Otherwise=0)	0.708(0.386)**	0.157(0.062)**
Information extension agents (Yes=1,Otherwise=0)	1.273(0.391)***	0.263(0.052)***
Extension services (If NGOs=1, Otherwise=0)	0.346(0.278)	0.103(0.083)
Contract arrangement (Yes=1, Otherwise=0)	-0.78(0.279)****	-0.26(0.095)***
-Cons	6.787(5.557)	-
Log Likelihood:	-85.712697	
P Value:	0.0000	
No. of observation:	185	
Pseudo R^2:	0.1985	

Note: Figures in parentheses are standard errors, ***, ** and * imply significance at 1%, 5% and 10% respectively

Factors that influenced the volume of processed cassava products sold. Results from the second stage (outcome equation) are presented in Tables 4 and 5 for cassava flour and 'gari and chips, respectively. Table 4 results indicated that gender of cassava processor positively and significantly (P= 0.1) affected the sales volume of cassava flour in the market. Being female increased the cassava flour sales revenue by UGX 51842.22 (approximately 15US$). This was because cassava processing in north and north eastern Uganda is considered a women's activity especially where traditional processing technology is used. This finding is contrary to that by Sigei *et al.* (2013) and Sebatta *et al.* (2014) who indicated that males dominated in market participation because of the contacts and decisions that they have which increased on their sales revenue. Contrary to that, Abu *et al.* (2014) found out that male headed household had less marketing strengths than their female headed counterparts which limited the extent of market participation.

Land size allocated for cassava production had a positive and significant (P =0.001) impact on the volume of flour sold in the market. A unit increase in land acreage allocated to cassava production increased the sales revenue of flour sold by UGX19,133, *ceteris paribus*. This finding is in agreement with the findings by Abu *et al.* (2014) which indicated land for production increased market participation and subsequently the sales volume. Distance to the market had positive and significant (P=0.05) impact on the volume of processed cassava flour sold in the market. This finding contradicts our *a priori* that the closer an agent is to the market, the higher the likelihood of his/her market access and participation. However Maziku (2015) reported that market distance negatively affected the extent of market participation, which is in line with our expectations and so the finding in this study will need to be further investigated to understand why this relatively strong and counter-intuitive results.

Extension services provided by NGOs were found to positively and significantly (P=0.05) influence the volume of cassava flour sold in the market. Indeed the easy access to extension

services provided by NGO increased the sales revenue by Uganda Shillings 55604.52. This was because NGOs provided these processors with better extension services in terms of demonstrations of new technology, production and marketing information than other extension workers. This finding agrees with the findings in Bahta (2012) where the author found out that extension services had positive impact on the extent of market participation. Contract arrangement for marketing was found to positively and significantly (P =0.05) influenced the volume of the cassava flour sold in the market. Having contract arrangement increased the sales revenue for flour by UGX78895.57(approximately 20US$). With contract arrangements processors were sure of the price and market that motivated them to work harder in order to meet the required output. This findings confirms the findings in (Geoffrey *et al.,* 2013) where the authors found out contract arrangement had positive impact on the extent of market participation.

Further, results of the second stage indicated that marketing experience, education level and group marketing of processed cassava gari and chips had positive coefficients. This implied that they increased on the sales revenue of processed cassava gari and chips (Table 5). In Table 5 the study found out that marketing experience positively and significantly (P=0.01) influenced the volume of processed cassava gari and chips sold in the market. An increase in a processor's marketing experience by one year increased the volume of processed cassava gari and chips sold in the markets by110664.7 UGX *ceteris paribus*. This is probably due to the increased skills and knowledge that the processors acquired as a result of their constant interaction with the buyers. This result is in line with the findings

Table 4. Ordinary Least Squares regression results for sales volume of cassava flour sold

Variables	OLS Regression Coefficients	Robustness Test Coefficients
Inverse mills ratio	-1528.72(3026.945)	-1528.72(1448.978)
Age of household head (Years)	-1219.63(886.8233)	-1219.63(620.0254)**
Gender of household head (Female=1, 0=Otherwise	51842.22(28874.87)*	51842.22(46100.3)
Education level (Years)	-3040.41(3347.919)	-3040.41(2460.449)
Farm land size for cassava production (Acres)	19133.17(5954.95)***	19133.17(7588.635)**
Off farm activities	-27042.91(10726.34)	-27042.91(21989.05)
Annual Income of household head (Shillings)	-10894.87(14577.81)	-10894.87(8344.07)
Transport cost (Shillings)	-5.220596(3.182543)	-5.220596(4.219911)
Distance to the market (Kilometers)	7617.68 (3602.124)**	7617.68(4826.158)
Flour buyers (Traders=1, 0=Otherwise)	-53599.02(26378.26)**	-53599.02 (31667.25)*
Proximity market(Yes=1, Otherwise=0)	-35495.49(24336.61)	-35495.49(17484.44)**
Extension by NGOs (Yes=1, Otherwise=0)	55604.52(24837.85)**	55604.52(27381.47)**
Contract Arrangement (Yes=1, Otherwise=0)	78895.57(30099.9)**	78895.57(46792.87) *
Group (Membership=1, Otherwise=0)	60089(31996.14)*	60089 (65803.12)
Constant	283503.6(208224.8)	
283503.6(135442.8)**		
No. of observations		
Prob> F		
Adjusted R^2	185	185
	0.0001	0.2125
	0.2143	0.2143

Note: Figures in parentheses are standard errors, ***, ** and * imply significance at 1%, 5% and 10%, respectively.

of Sigei *et al.* (2013) and Maziku, (2015) who reported that marketing experience had positive significant impact on the extent of market participation. Relatedly, education level of the household head positively and significantly (P=0.1) influenced the volume of processed cassava gari and chips sold in the market (Table 5). The implication was that the knowledge obtained broadened the information needed for production as well as marketing of gari and chips. This finding concurs with the results in Omiti and Mccullough (2009); Maziku (2015), who revealed that education level was significant in increasing the extent of market participation.

Interestingly, the study found out that group marketing had positive and significant (P=0.01) impact on the volume of processed cassava, gari and chips marketed (Table 5). Having joint marketing increased the sales revenue for processed cassava, gari and chips by UGX88,7647 *ceteris paribus*. This implied that with group marketing, processors were able to have collective responsibilities and strong bargaining powers, shared costs, and enjoyed other benefits associated with social organization and networking. This finding concurs with the results of Sigei *et al.* (2013) who reported that group marketing had positive impact on the extent of market participation. Other variables with their coefficients with standard and robust errors for the OLS regression of cassava gari and chips are indicated as presented in Table 5.

CONCLUSIONS

This study on the determinants of market participation by smallholder cassava processors in north and north eastern Uganda used the Heckman's two stage model involving decision and outcome models. Generally, a host of socio-economic, institutional and market related factors were found to influence the decision to participate in the market and the quantities of different processed cassava products taken to the market. Specifically, the following factors positively influenced the probability of market participation for processed cassava products: age of household head, gender, acreage allocated to cassava production, ability to hire reliable transport, transport cost, presence of cassava buyers, annual off farm income, and information sources obtained from both neighbours and universities and contract arrangements. However, other factors that contradicted our *a priori* expectations include family size, farming experience, total farm land size, transport mode used and market distance.

Table 5.Ordinary Least Square regression results for sales volume of cassava gari and chips marketed

Variables	OLS Regression	Robustness
	Coefficients	Coefficients
Inverse Mills ratio	26666.79(199677.8)	26666.75(79390.61)
Gender of household head (Female=1,Otherwise=0)	-83682.4(565995.9)	836826.4(693257.1)
Household size (Numbers)	77384.13(65362.9)	7738.13(71640.47)
Marketing experience (Years)	110664.7(62592.1)***	110664.7(83322.65)
Education level (Years)	99365.68(24032.93)*	99365.68(83675.21)
Market cassava products (Group=1, Otherwise=0)	887647.4(488078)*	88764.4(803810)()
No. of observations	185	185
F (6, 178)	4.78	0.38
Prob> F	0.0002	0.8934
Adjusted R^2	0.1097	

Note: Figures in parentheses are standard errors, *** and * imply significance at 1%, 5% and 10% respectively

These factors need to be investigated further in the areas of north and north-eastern Uganda.

The influence of many of these factors varied depending on the direction and magnitude of the coefficients of the individual variables. In general, our findings indicate that socio-economic, market related as well as institutional factors are important in stimulating market participation decisions for smallholder cassava processors in north and north-eastern Uganda. Therefore, there is need for policy support in the areas of contract marketing, market access conditions for cassava processors and processing to prolong the shelf-life of fresh Cassava roots, strengthen market participation and lift smallholder farmers from income poverty.

ACKNOWLEDGEMENT

The authors acknowledge the funding from the Regional Universities Forum for Capacity Building in Agriculture (RUFORUM) Grant Number RU/2014/GRG-098 and the respective respondents in the study areas that made this study possible.

STATEMENT OF NO-CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this paper.

REFERENCES

Abeykoon, M. N. D. F., Weerahewa, J. and Silva, G. L. L. P. 2013. Determinants of market participation by indigenous poultry farmers: A case study in Anuradhapura District in Sri Lanka. *Tropical Agricultural Research* 24 (4): 347–361.

Abu, B. M., Osei-Asare, Y. B. and Wayo, S. 2014. Market participation of smallholder maize farmers in the upper west region of Ghana. *African Journal of Agricultural Research* 9 (31): 2427–2435. http://doi.org/10.5897/AJAR2014.8545

Achem, B.A., Mohammed, Length, F., Development, R. and Mgt, F. 2013. A comparative assessment of the profitability of cassava processing enterprises in Kwara State, Nigeria. *Global Journal of Current Research* 1 (2): 57–61.

Bahta, S. T. and Bauer, S. 2007. Anlysis of the determinants of market participation within the South African small scale livestock sector. Tropentag Paper, utilisation of diversity in land use sytems: Sustainable and organic approaches to meet human needs, October 9-.

Bahta, S. 2012. Policy options for improving market participation and sales of smallholder crop producers: A case study of the Free State Province of South Africa. *African Journal of Agricultural Reseearch* 7 (24): 3525–3533. http://doi.org/10.5897/AJAR11.631

Beeching, J. R., Reilly, K., Gomez-Vasquez, R., Hongying, L., Yuanhuai, H., Rodriguez, M. X. and Tohme, J. 2003. Post-harvest physiological deterioration of cassava. 12th Symposium of the International Society for Tropical Root Crops: Potential of root crops for food and industrial resources.

Chukwuji, C. O., Inoni, O. E. and Ike, P. C. 2007. Determinants of technical efficiency, In: Gari Processing in Delta State Nigeria. *Journal of Central European Agriculture* 8 (3): 327–336.

Elias, A., Nohmi, M., Yasunobu, K. and Ishida, A. 2013. Effect of agricultural extension program on smallholders' farm productivity: Evidence from three Peasant Associations in the Highlands of Ethiopia. *Journal of Agricultural Science* 5(8): 163–181. http://doi.org/10.5539/jas.v5n8p163

Enete, A. A. and Igbokwe, E. M. 2009. Cassava market participation decisions of producing households in Africa. *Tropicultura* 27 (3): 129–136.

Gebremedhin, B. and Jaleta, M. 2010. Commercialization of smallholders: Does market orientation translate into market participation? Working Paper No. 22.

Geoffrey, S. K., Hillary, B. K., Lawrence, K. K. and Mary, M. C. 2013. Determinants of market participation among small-scale pineapple farmers in Kericho County, Kenya. *Economics and Sustainable Development* 4 (19): 59–67.

Gobena, G. K. 2012. Analysis of smallholder farmers' participation in production and marketing of export potential crops : The case of sesame in Diga district, east Wollega zone of Oromia Regional State. Doctoral dissertation, Addis Ababa University.

Geremew, K. 2013. Determinants of smallholder farmers ' participation in sesame production : Evidence from Diga, Ethiopia. pp. 9–10. In: Proceedings of Nile Basin Dvelopment Challenge Science meeting, Addis Ababa.

Haggblade, S. and Dewina, R. 2010. Staple food prices in Uganda. pp. 25–26. In: Prepared for the COMESA policy seminar on "Variation in staple food prices: causes, consequence, and policy options," Maputo, Mozambique.

Heckman, J. 1979. Sample selection bias as a specification error. *Econometrica* 47 (1):153–161. http://doi.org/10.2307/1912352

IFAD and FAO. 2005. A review of cassava in Africa with country case studies on Nigeria, Ghana, the United Republic of Tanzania, Uganda and Benin. In: Proc. Valid. forum Glob. cassava Dev. Strateg.. Rome: International Fund for Agricultural Development/Food and Agriculture Organization of the United Nations.

Jagwe, J., Machethe, C. and Ouma, E. 2010. Transaction costs and smallholder farmers' participation in banana markets in the Great Lakes Region of Burundi, Rwanda and the Democratic Republic of Congo. *African Journal of Agricultural and Resource Economics* 6 (1): 302–317.

Maziku, P. 2015. Market access for maize smallholder farmers in Tanzania. pp.1-16. In: Proceedings of the Second European Academic Research Conference on Global Business, Economics, Finance and Banking. EAR15 Swiss Conference.

Mbwika. M, J., Whyte, J. B. A., Bua, D. A. and Sserunkuuma, D. 2001. Uganda Cassava Sub-sector Analysis. International Institute of Tropical Agriculture (IITA), Kampala, Uganda. 1-75pp.

Munyua, B., Hellin, J., Nyikal, R. and Mburu, J. 2010. Determinants for use of certified maize seed and the relative importance of transaction costs. pp. 19-23. In: Joint 3rd African Association of Agricultural Economics and 48th Agricultural Economic Association of South Africa Conference, Cape Town, South Africa.

Mwongoso, A. J., Kiwia, R. H., Komba, C. K. and Kafere, D. 2015. Determinants of soya bean market participation by smallholder NASFAM members and non-members. In: Research Reports Series, ISSN 0856-(April), 0856–9681.

Naziri, D., Quaye, W., Siwoku, B., Wanlapatit, S., Viet Phu, T. and Bennett, B. 2014. The diversity of postharvest losses in cassava value chains in selected developing countries. *Journal of Agriculture and Rural Development in the Tropics and Subtropics* 115 (2): 111–123. http://doi.org/urn:nbn:de:hebis:34-2014121946902

Omiti, J. M. and Mccullough, E. 2009. Factors influencing the intensity of market participation by smallholder farmers : A case study of rural and peri-urban areas of Kenya. *African Journal of Agriculral and Resource Economics* 3 (1): 57–82.

Onyemauwa, C. S. 2010. Analysis of household consumption of cassava products in Ohaozara, Ebonyi State, Southeast Nigeria. *International Journal of Agricultural Research* 2 (6): 1–6.

Onyenwoke, C. A. and Simonyan, K. J. 2014. Cassava post-harvest processing and storage in Nigeria: A review. *African Journal of Agricultural Research* 9 (53): 3853–3863.

http://doi.org/10.5897/AJAR2013.8261

Osmani, A. G. and Hossain, E. 2015. Market participation decision of smallholder farmers and its determinants in Bangladesh. *Economics of Agriculture* 62 (1): 163-179.

Persson, E. 2009. Market participation and poverty -smallholders on the Ugandan maize market. MSc Thesis, University of Lund, Sweden.

Prakash, A. 2014. Regional Conference on cassava in the Caribbean and Latin America. In: Regional Conference on cassava in the Carribbean and Latin America.

RootHaert, R. and Muhanji, G. 2009. Profit making for Smallholder Farmers. Proceedings of the 5th MATF Experience Sharing Workshop. 44pp

Salami, A., Kamara, A. B., Abdul, B. and John, C. 2010. Smallholder agriculture in East Africa : Trends, Constraints and Opportunities. Working Paper (April, 2010).

Sebatta, C., Mugisha, J., Katungi, E., Kashaaru, A. and Kyomugisha, H. 2014. Smallholder farmers' decision and level of participation in the potato market in Uganda. *Modern Economy* 5 (8): 895–906.

Sigei, G. K., Bett, H. and Kibet, L. 2014. Determinants of market participation among small scale pineapple farmers in Kericho County, Kenya. Msc Thesis, Egerton University. 81pp.

Uganda Bureau of Statistics (UBOS). 2013. Statistical Abstract. Kampala, Uganda. 39-40pp.

Zamasiya, B., Mango, N., Nyikahadzoi, K. and Siziba, S. 2014. Determinants of soybean market participation by smallholder farmers in Zimbabwe. *Journal of Development and Agricultural Economics* 6 (2): 49–58. http://doi.org/10.5897/JDAE2013.0446

Zidenga, T. 2012. Delaying postharvest physiological deterioration in cassava. ISB News Report (August), pp.1–4.