

Factors Influencing Smallholder Dairy Farmers' Decision to Participate in Milk Markets in Uganda

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Abstract: *This study was done in six agro-ecological zones of Uganda. It identifies determinants of milk market participation among smallholder farmers in Uganda. Secondary data used was obtained from a household survey data set by Makerere University and the National Graduate Institute for Policy studies (GRIPS) of which 271 small holder dairy farmers were purposively selected. Data was analyzed using a two stage Heckman model. Results indicated, gender ($P = 0.000$), age ($P = 0.000$) and education ($P = 0.001$), led to increased participation. Similarly, distance to market ($P = 0.000$), ownership of transport ($P = 0.001$) and communication facilities ($P = 0.001$) had highly positive and significant impact on participation decision. We recommend increased support towards women, youth involvement in dairy marketing and training in tailor made programs. Enhanced enablement of ownership of transport and communication facilities of smallholder dairy farmers is also justified for increased participation.*

Keywords: *Market Participation, first-step Heckman model, Dairy, smallholder*

1. INTRODUCTION

Uganda's agricultural sector transformation from subsistence to commercial production calls for increase in smallholder access to input and output markets as a key precondition. This will enable smallholder farmers to benefit more from efficient markets and expose them to competition (World Bank, 2009). This in particular, calls for the expansion of market opportunities (including increased market information, sales, market entry, entrepreneurships and incomes) for smallholder livestock producers to take advantage of the rising demand as an escape route out of poverty. Total consumption of meat and milk in Sub-Saharan Africa (SSA) was expected to increase from 11.3 to 35.4 million tons between 1997 and 2020 (Ehui *et al.*, 2002). Delgado *et al.* (1999) also projected a 50% rise in consumption of livestock products per person from 1993 to 2020, with most of the increases attributed to population growth, increased incomes, urban migration and its accompanying lifestyles, in Sub-Saharan African countries. This expected increase in demand for livestock products has profound implications for market participation, food security and poverty alleviation among rural people in SSA.

Dairying is Uganda's second major agricultural activity after cereal production in contributing to national GDP, and bearing over 50% of the livestock sub-sector output (Grimand *et al.*, 2007, DDA, 2010; Balikowa, 2011). The dairy sub sector in Uganda employs various actors along the milk chain right from production to marketing (Balikowa, 2011). Milk production grew by 4.9% from 637.8 million to 1.08 billion liters per annum between 1999 and 2010. This growth stems mainly from the increasing demand for milk and other milk products and establishment of milk processing plants in the producing areas, which derives from the increased demand for milk; and introduction of a livestock improvement program in the country all of which lead to higher yields that in turn precipitate market participation (UBOS, 2008; FAO, 2011).

2. PROBLEM STATEMENT OF THE STUDY

Dairying is an important sub sector to Uganda's livestock economy accounting for about 67 per cent of value of output from the livestock sector. While 70% of the total annual production of 1.5 billion (2008 estimates) liters is marketed, while 30% (0.45 billion liters) is consumed by the producing households. It is also estimated that at least 80 percent of Uganda/s total milk production is marketed through the informal marketing channel, of which over 70 percent are smallholder farmers (Sikawa, g.

y., & Mugisha, j. 2012). This is an indication that milk is not only produced for feeding the family but as a source of income through marketing. Besides, these statistics also provide opportunity for increased smallholder dairy farmer employment through engagement in milk markets however, factors influencing market participation in milk markets are not yet known. This study therefore addresses the factors that drive smallholders to participate in milk markets in Uganda. Dairy and beef cattle were identified as strategic agricultural commodities for the country that are to receive increased investment levels for accelerated production (Benson, T., & Mugarura, S. 2013). In particular, the government of Uganda has been committing resources towards increasing productivity and creating sustainable market linkages for farmers through the Plan for Modernization of Agriculture (PMA).

Despite rapid expansion of production and inherent potential in this sub sector, it is not certain whether smallholder milk producers will be in position to exploit the emerging marketing opportunities. Inability of smallholder producers to participate in markets is one of the major limitations in harnessing opportunities in the country's livestock production and marketing. Availability of marketing outlets guarantees economic returns to smallholder dairy farming. Besides, literature shows deficits in milk supply against surplus milk production in some regions of the country Balikowa, (2010). This implies there is potential market which calls for increased market participation. This justifies the need for a study to identify factors influencing milk market participation so that policy recommendation measures can be devised for promotion of smallholder market participation.

3. MATERIALS AND METHODS

3.1. Study Area

Uganda's major milk production zones (milk sheds) are shown in Figure 1 below. They are categorised into seven agro-ecological zones and these include bimodal high (BH), bimodal medium (BM) and bimodal low (BL) rainfall zones, south western highlands (SWH) and Eastern highlands (EH), unimodal medium (UM) and unimodal low (UL) rainfall zones DDA, 2010 and Sserunkuuma, 2014) and are grouped according to social economic and ecological conditions within them. According to Wood *et al.* (1999), zoning is based on three main factors namely agricultural potential, rainfall pattern and market access. Besides, this grouping also considers the farming systems and practices which are fairly homogeneous (Balikowa, D. (2011) and J.Ekou, (2014). Considering the bimodal highland BH rainfall zone as the base zone, the zones help to demonstrate differences in dairy production potential and market infrastructure dynamics.



Figure1. Uganda's Milk Production zones (milk sheds)

Source: DDA 2010

3.2. Study Design

This study uses secondary data of 2005 obtained from Research on Poverty, Environment, and Agricultural Technology project (RePEAT) of the National Graduate Institute for Policy Studies (GRIPS) and the Faculty of Agriculture, Makerere University in Uganda, which aimed at identifying agricultural technologies and farming systems with potential to contribute to increased agricultural productivity and reduced poverty in Uganda. The data was supplemented by review of literature from research reports, journal articles and related research and theses.

Ninety four communities (LC1s, the lowest administrative unit) were selected, covering about two thirds of Uganda. This represented 7 of the 9 major farming systems of the country. The LC1s were selected using a stratified random sample. Stratification was based on 16 development domains defined by the different agro-ecological and market access zones and differences in population density as proposed by Pender, et al., (2001). From each of the 94 LC1s, 10 households were randomly selected for household surveys. This made a total of 940 households. Out of these 940 households kept different breeds of cattle including local breeds, cross breeds and a combination of local and cross breed cows. From the 940 cattle keeping households, this study purposively selected dairy farming households which had at least one milk producing cow at the time of the survey to make a total sample of 271 households, of which, 202 households had local cows, 45 cross and 24 kept both local and cross breed cows.

From each farm of the 271 households, the study obtained information on three categories of variables; (i) household head characteristics (gender, age, education, household size as proxy for family labor, phone and communication facilities); (ii) household head endowment of productive assets (land owned, breed type, credit access, herd size, number of milking cows, quantity of milk produced, ownership of transport) and (iii) community level characteristics (distance to major town, distance to nearest market, presence of livestock program in LC1 area, population density, proportion of market participation and five agro-ecological zones). Additional information was gathered from literature and reports.

3.3. Data Analysis

Data analysis was performed using STATA (Version 12) software. The determinants of milk market participation were determined using Heckman first step econometric model where P -values at 1%, 5% and 10% were considered significant.

4. RESULTS

Household head characteristics which included gender ($P = 0.000$), age ($P = 0.000$) and education of household head ($P = 0.001$) had significant influence on milk market participation. Endowment of productive assets found positive and highly significant included ownership of communication facility, ($P = 0.001$), ownership of transport ($P = 0.001$) facility and quantity of milk produced per lactating cow per year ($P = 0.047$), which came out strongly significant. Community level variable found positive and highly significant was distance to nearest market (miles) with ($P = 0.000$). Three others registered positive and strongly significant signs and included bimodal medium rainfall zone ($P = 0.038$) eastern highlands ($P = 0.045$) and presence of livestock program in area ($P = 0.018$). The signs of all the significant parameter estimates were positive and are consistent with prior expectations except for gender and eastern highlands, which were positive but were hypothesized to have negative effect on market participation (Table 1).

Table 1. Regression estimates of the determinants of market participation decision

Probit Results				
Variable symbol	Variable Name	Expected sign	Coefficient	P-value
X_1	Gender of household head (1 = female and 0 = male)	+	0.231 (0.044)	0.000***
X_2	Age of household head	+/_	0.005 (0.001)	0.000***
X_3	Education_of_household_head	+/_	0.013 (0.004)	0.001***
X_4	Access to credit	+	0.009 (0.030)	0.750

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X_5	Distance to nearest market (miles)	+	0.075 (0.021)	0.000***
X_6	Ownership of Phone facility	+	0.004 (0.036)	0.991
X_7	Ownership of communication facility	+	0.131 (0.040)	0.001***
X_8	Ownership of transport facility	+	0.110 (0.033)	0.001***
X_9	Household head belonging to Bimodal low (BL) rainfall zone	+/_	0.045 (0.046)	0.324
X_{10}	Household head belonging to Bimodal medium (BM) rainfall zone	+	0.080 (0.038)	0.038**
X_{11}	Household head belonging to Uni- medium (UM) rainfall zone	-	0.015 (0.077)	0.845
X_{12}	Household head belonging to South west highlands (SWH) zone	+/_	0.018 (0.046)	0.686
X_{13}	Household head belonging to Eastern highlands (EH) zone	-	0.054 (0.070)	0.045**
X_{14}	Presence of livestock program (AI and Veterinary services) in area	+	0.086 (0.036)	0.018**
X_{15}	Size of Land owned in acres	+/_	0.019 (0.014)	0.165
X_{16}	Milk production per lactating cow per year	+/_	0.001 (0.052)	0.047**
X_{16}^7	Inverse Mills ratio			
n			271	

5. DISCUSSION

A positive influence of female headed households (gender variable) on market participation, contrarily to prior negative expectations is an indication that female-headed households in Uganda have developed interest in markets. Several other factors explain these results but most important is that for female-headed households, women (female heads) are the primary decision makers. Findings by Sserunkuuma *et al.* (2010) indicated that although female-headed households are less likely to produce milk than a typical household, when they do, they are more likely to participate in milk markets as sellers.

The highly significant and positive effect of age on participation in markets stems from the fact that aged farmers are able to acquire skill and experiences in trade, which must have enabled them take advantages of participation faster than young people. The age variable as proxy for experience therefore positively influenced farmer decision to participate in milk markets. While studies by Winter-Nelson *et al.* (2005) and Arega *et al.*, (2008) hypothesized a positive relationship between age and participation arguing that the younger the respondent the less likelihood to participate, Heltberg *et al.* (2002) and Woldemicheal (2008) also came up with related findings to the effect that young people participate less in markets.

The highly significant and positive sign of education variable on participation decision arises from the fact that education plays a significant role in enhancing participation as it facilitates acceptance and uptake of productivity enhancing technologies such as improved breeds and communication technology all of which support market participation. These findings are in conformity with findings of Marenya and Barret, (2006) who, found the education variable to be highly significant and positive in influencing market participation. Education increases skill and successful implementation of improved production, processing and marketing practices, which enables farmers to adopt new agricultural innovations that enhance their capacity to produce for the market. These findings call for increased government investment in extending market participation skills training to smallholder farming communities in the country.

Endowment of productive household assets (ownership of transport facility, communication facility and quantity of milk produced per lactating cow per year) was found to have positive and highly significant influence on probability of participation. These results conquer with literature by Abdula

et. al. (2007) and Asfaw *et al.* (2010) which emphasize that private ownership of household assets is strongly and positively associated with market participation. Households need a minimum asset threshold in order to escape from poverty and participate in the market. Lack of assets may result in the exclusion of producers from new and remunerative market opportunities. Assets enhance the capacity of smallholder farmers to access, and take advantage of market opportunities, and they complement public goods in stimulating broad based product supply expansion.

Also ownership of transportation equipment mitigates transaction costs by reducing travel time to markets as well as the costs of transporting particularly bulky perishable products such as milk to the market by the farmer. Zaibet and Dunn (1988) and Makhura (2001) used probit models and argued that availability of own or hired transport (van or truck) is positively related to market participation regardless of location of a household. Similarly, Sserunkuuma *et. al.*, (2010) found participation in maize, cassava, banana and credit markets to be significantly higher among smallholder households that owned transport equipment, reflecting the importance of such assets in mitigating transaction costs of exchange by reducing travel time and cost to markets by farm households.

Ownership of communication related assets (TV, Radios etc) assets enables farmers to easily access market information which keeps farmers and traders attuned to the demands and changing preferences of consumers; guiding their farming, marketing, and investment decisions. However, the market information system in Uganda is poor and is characterized by absent, slow or infrequent information dissemination that adversely affects these crucial decisions. Farmers often lack market information regarding the worth of their produce and how much more they can earn in the terminal market.

Distance to nearest market variable shows a positive and highly significant influence on market participation as hypothesized, implying that most studied households were near market canters; they lived less than a mile on average (Table 1) suggesting that being nearer markets precipitates farmer entry into markets. As Nakazi and Sserunkuuma (2013) observed in a rice-milling decision study of smallholder farmers, the positive impact also implies that households that are nearer to selling (collection) points in market centres face lower transaction costs and loss due to spoilage and are therefore more encouraged selling their milk at these centres than distanced households. Nkori (2004) and Mburu *et al.* (2007) observed that the longer the distance to selling points, *ceteris paribus* the higher the transaction costs which in turn negatively influence producers' participation in a particular marketing channel.

6. COMMUNITY ASSETS

Presence of livestock improvement program (AI and Veterinary services) in area has a positive and strongly significant influence on participation as hypothesized. These results imply that interviewed farmers regularly visited livestock service providers (AI and veterinary services) within sub-counties. These findings conquer with Halloway and Ehui (2002) who identified that extension visit is directly related to marketing and that of Bahta and Bauer (2007) in South Africa which stated that extension visits significantly increased the probability that a small-scale farmer will sell his/her livestock products.

Being located in the bimodal medium (BM) rainfall zone positively and strongly affected farmer decision to participate in milk markets as was hypothesized. Production in this zone is supported by friendlier agro ecological environment, which enables pasture growth, management and availability of water resources for the animals to graze and produce milk for sale, and hence the higher farmers' willingness to participate in markets as prior expected. This zone characteristically uses production inputs more efficiently, implying that farmers in this zone have a positive return on resources invested, hence the positive and strong effect on probability to participate in milk markets as sellers.

Being located in the eastern highland agro ecological zone strongly and significantly impacted on smallholder dairy farmer decision to sell milk. The increased desire to sell milk could have stemmed not necessarily from many quantities but from the apparent marked difference in regional pricing that favor this region. Highest milk prices were observed in deficit milk shed regions (Eastern and Northern), while the most productive milk shed region (South and western) of Uganda received significantly lower prices in both urban and rural areas (MAAIF, 2010). Rainfall is also highest in mountainous eastern region (1,229- 1500 mm), which supports dairy production, and hence the ability to participate in milk markets.

The strong and significant influence of milk production per lactating cow per year on farmer market participation decision implies that the more milk produced, the more surpluses, which compels any farmer to dispose of surpluses through the market. Production per lactating cow per year was highest among households keeping crossbreed cows showing the effect of breeds on milk market participation. This implies that milk from households keeping crossbreed cows is for cash income, meaning that cross breed animals are primarily kept as cash earner. This conclusion is similar to Sserunkuuma's (2008) in assessment of impact of NERICA rice variety, in which more than half of the rice produced by Ugandan farmers was sold for cash income, "meaning that rice is primarily grown as a cash crop". Table 4.3 results confirm this finding since the proportion of households who participated in selling milk was 73% and significantly different among those keeping crossbreeds than the proportion (42%) of households keeping local cows that sold milk and cross breed cows produced significantly more milk (liters) per lactating cow per year compelling farmers keeping cross breed animals to dispose of surpluses for cash income. implying that interventions aimed at improving milk production and marketing could help female-headed households to reduce poverty.

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