



What Drives Smallholder Farmers' Behaviour in the Potato Market in Uganda

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Abstract

Smallholder potato farmers in Uganda can be described as subsistence and in some cases self sufficient characterised with low or no surpluses for sale into the market. This study set out to bring to the fore front the factors that lead to observed smallholder farmers' behaviour as net sellers, net buyers or autarkic in the market. Data were collected from 200 smallholder potato farmers in Kabale and Mbale districts. Descriptive statistics and an ordered probit model were used to analyse the data. Results showed that dependency ratio, square of distance from home to the market and a farmer having a transport means positively influenced net selling rather than net buying or net buying rather than autarky among smallholders.

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1. Introduction

In most of the developing countries, potato (*Solanum tuberosum L*) is considered the fourth most important food crop after rice, wheat and maize [1,2]. [3] also noted that potato is an important cash crop in the highlands of East and Central Africa, grown on about 110,000 ha. [1] adds that potato is a highly productive crop that produces more food per unit area and per unit time than wheat, rice and maize.

Many of the producers of the potato in Uganda are smallholders who cultivate less than one hectare and the majority are subsistence farmers with low productivity and yields. [4,5,6] attributed the low yields to farmers' failure to use improved inputs leading to lack of competitive production and low market participation. This is the reason why they generate small marketable surpluses of the crop into the market [4, 7]. [8] argued that farm households especially subsistence ones must have access to productive technologies and adequate private and public goods in order to produce a marketable surplus, yet investment in private assets, improved technologies and public goods requires that households earn enough that they can save and invest.

1.1 *Potato production in Uganda*

Potato was introduced into East Africa in the 1880s by the British. In Uganda, potato production is concentrated in Kigezi highlands of Kabale and Kisoro in the south-west, Mountain Elgon districts of Mbale and Kapchorwa in eastern Uganda with highlands between 1,500m and 3,000m above sea level (Wang'ombe, 2008). The Kigezi highlands produce about 60% of total Ugandan potato output [1] and South Eastern Uganda contributes 10%. The remaining 30% comes from the districts of Mubende, Nebbi, Masaka, Mbarara and Rakai [4, 7]. In recent years, the introduction of lowland varieties extended the crop to other regions like the central and west Nile as a commercial activity and increased potato output over the years [4, 7].

1.2 *Driving factors behind smallholder farmers' market behaviour*

There are three types of farmers according to participation levels, that is, net sellers, net buyers and autarkic [10,11]. [12] defined a net seller as a farmer or household with positive net sales and a net buyer as one with negative net sales. [13] stated that the poorer farmers who are the rural majority are more likely to be net-buyers of crop produce; while [14] stated that some agricultural households are net purchasers of food, even in years of average rainfall, while others fail to participate in cash markets altogether. The author added that the consumer-producer price dilemma clearly was not limited to rural-urban cases but that it also existed with equal force within rural areas.

[15] stated that not only buying is an important aspect of smallholder behaviour, but that the same smallholders may be buying back the same product, they have sold at a later date, even resulting in inverse arbitrage. In this case, producers sell early in the harvest period at a low price and later buy back the same good in a later period at a higher price. [16] supported this argument when they found that of the nearly 30% of the sample of smallholders in western Kenya that were net maize sellers in the harvest period, 62% were net maize buyers a

few months later. [8] asserted that a relatively small share of households in eastern and Southern Africa sell food grains and for many of those who do sell, the quantity sold is often small and dwarfed by gross purchases at other times of the year.

[13] defined a net seller as a household with positive net sales and net buyer as one with negative net sales. Many studies have used descriptive statistics to clearly understand the characteristics of various groupings of farmers. [17] argued that fixed transaction costs, assets and access to information influence a farmer's position in the market as net seller, net buyer or autarkic.

Smallholder farmers' market behaviour has a lot to do with their level of market orientation. However, [18] asserted that market orientation of subsistence farmers is nevertheless a largely under-researched area. The authors added that market oriented subsistence farmers will react immediately to improved market conditions by reallocating part of their production from consumption to the market. [8] argued that the two major causes of the observed smallholder farmer market behaviour are non-uniformity of market access because households may face different transactions costs to market and that geographic markets may likewise be differentially integrated into the global economy which leads to some households to self-select out of markets, attenuate the behavioural and welfare effects of price shocks, and result in structural patterns of market participation.

This study aimed to: (1) characterise smallholder potato farmers' market participation behaviour and, (2) determine factors that drive smallholder farmers' behaviour in the potato market as net sellers, net buyers and autarkic. The study was guided by two hypotheses: (1) number of annual health centre visits a farmer makes negatively influence net selling behaviour and, (2) having other food sources apart from potato positively influences a farmer's net selling behaviour.

2. Research Methodology

2.1 Study area and Sampling procedure

The study was conducted in Kabale and Mbale districts in South Western and Eastern Uganda respectively. The districts were selected purposively for being the major potato producing areas in Uganda. The main economic activities in the study area are growing crops especially potato, sorghum and coffee and rearing animals. A stratified random sampling technique based on farmers' participation in potato markets was adopted in choosing the respondents. This was followed by a snow ball sampling method to ensure inclusion of the three farmer categories in the sample, that is, the net sellers, net buyers and the autarkic. Two sub-counties from Kabale and one from Mbale district were purposively selected to represent the leading potato producing areas. Two parishes from each sub-county were also purposively selected followed by random sampling of respondents where 60 farmers were selected from Mbale and 140 from Kabale in proportion of the area's contribution to national potato output giving a total sample of 200 farmers. Data were collected between December 2011 and May 2012 to capture data for the two major potato growing seasons in the study area using a pre-tested structured questionnaire.

2.2 Analytical methods

Potato producers can participate in the market by selling their surplus produce that is above their consumption needs, buying from the market to satisfy the consumption gap left by inadequate farm output or choosing to be self sufficient by consuming all they produce without selling to or buying from the market. The analytical methods used in this study included an ordered probit model was employed in characterising potato farmers into net sellers, net buyers and autarkic. The model was stated as;

$$Y_i = X_i \beta_i + \varepsilon \dots\dots\dots(1)$$

The latent variable Y_i exhibits itself in ordinal categories, which can be coded 0, 1, 2, ..., k.

X_i are the factors that influence a farmer's behaviour as a net seller, net buyer or autarkic and ε is the error term.

The response of category k is thus observed when the underlying continuous response falls in the k-th interval as;

$$Y=0 \text{ if } Y^* \leq \mathfrak{R}_0 \dots\dots\dots(2)$$

$$Y=1 \text{ if } \mathfrak{R}_0 \leq Y^* \leq \mathfrak{R}_1 \dots\dots\dots(3)$$

$$Y=2 \text{ if } \mathfrak{R}_1 \leq Y^* \leq \mathfrak{R}_2 \dots\dots\dots(4)$$

Where;

$Y=0, Y=1, Y=2$ depict the three farmer categories that is, autarkic, net-buyer and net-seller, respectively.

$\mathfrak{R}_0, \mathfrak{R}_1, \mathfrak{R}_2$ are self-sufficiency, net-buying and net-selling potato thresholds, respectively.

The empirical model is specified as;

$$\text{Pr}(Y=0, Y=1 \text{ or } Y=2) = f(X_1, X_2, \dots, X_{12}) \dots\dots\dots(5)$$

Where, $X_1 \dots X_{12}$ are the variables specified in Table 1 that are hypothesised to influence the probability that a randomly selected household belongs to category Y.

Potato sales were calculated as;

$$S_n = p_i + b_i - c_i - g_i - d_i - l_i \dots\dots\dots(6)$$

Where;

S_n = Potato sales (kg),

p_i = Quantity of potato Produced by farmer (kg)

b_i =Quantity of potato bought outside the farm (kg)

c_i =Quantity consumed by farmers' household (kg)

g_i = quantity given out as gifts (kg)

d_i = quantity kept for seed (kg)

l_i =quantity lost after harvest (kg).

The potato sales made by a farmer annually were assumed to be the difference between what the farmer produced and bought ($P_i + b_i$) and what was utilized by the farmer in form of household consumption, gifts given to friends and potato seed kept for replanting the following season and losses after harvest but before selling ($-c_i - g_i - d_i - l_i$) in equation 6 above. Net sales were then calculated as a difference between what the farmer sold and bought ($S_n - b_i$). A positive value of net sales qualified a farmer as a net seller, a negative value qualified a farmer as a net buyer while zero sales and zero purchases qualified the farmer as autarkic (self-sufficient).

Descriptive statistics were also used to calculate and compare the average sales, average purchases and yields of potato, farmers' age, dependency ratios as well as land size holdings of the different farmer categories in addition to other variables. This was done to explain the observed behaviours of the three farmer groups further. Measures of central tendency, dispersion and association provided statistical summaries of the data collected on the three farmer categories that is, the net sellers, net buyers and autarkic. Net selling is defined as a situation where a farmer sells more potato than they buy from the market. Net buying is where a farmer buys more from the market than she/he sells there.

2.3 *A priori expectations*

The choice of variables to include in the estimation were based on the literature and market participation theory. For example, [19] focusing on farmers' choice to participate in crop markets as sellers stated that the choices are guided by net returns that the farmer gains by participating. In this study, it was expected that farmer's level of education, age as a proxy for experience and having a contractual relationship with potato buyers positively influence net selling behavior.

Table 1: Explanatory variables and hypothesised relationship with net selling, net buying and autarky

Variable	Variable description	Expected sign		
		Net selling	Net buying	Autarky
Pr(Y=0, Y=1 or Y=2)	Probability of being net seller, net buyer or autarkic			
	Household characteristics			
X ₁	Farmer's education level (Years in school)	+	+	-
X ₂	Farmer's age (Years)	+	±	±
X ₃	Dependency ratio (Dependants per working household member)	-	+	+
X ₄	Availability of other food sources other than potato	+	-	-
	Farmer endowments (Assets)			
X ₅	Farmer's total land owned (ha)	+	+	-
X ₆	Farmer has a transport means like a motorcycle	+	+	-
	Information access			
X ₇	Square of distance from home to nearest potato market (Km ²)	-	-	+
X ₈	Farmer sells potato on contract	+	-	-
X ₉	Transport cost for 100Kg bag of potato to nearest market (UShs)	-	-	+
X ₁₀	Farmer has access to credit services	+	+	-
X ₁₁	Number of hospital visits made to the farm per year	-	+	+
X ₁₂	Road condition to nearest potato market (1=good, 0=poor).	±	+	+

The other factor that was expected to influence farmer behaviour as net sellers, net buyers or self-sufficient (autarkic) was availability of other foodstuffs in the farmer's household. This was expected to negatively affect both net buying and autarky but positively impact on net selling (table 1). This is because a farmer with a variety of foods can easily produce a surplus above his/her consumption needs which can be sold. In addition, having

other foods in the home is expected to lead to a reduction in potato quantities bought from the market, hence reducing net-buying and self-sufficiency (autarky).

Proximity to markets has been cited by many researchers in agriculture as a major factor in determining participation behaviour of smallholder farmers in output markets. Square of distance from the farmer's home to the nearest village market in kilometers squared (to capture increasing distance effect) and the cost of transporting 100Kg bag of potato to that market were expected to negatively affect both net buying and net selling but positively affect autarky behaviour. This is because farmers who are far away from markets face higher transport costs which means they are likely to sell and buy less with the remaining option being self sufficient (growing potato for home consumption only).

2.4 Empirical estimation procedure and hypothesis testing

Estimation of the model outlined above in equations (1) to (5) followed a series of regression diagnostics. Variables used in both stages of the model were first checked for normality using Exploratory Data Analysis using the coefficient of kurtosis and skewness. Regression diagnostics included tests for multicollinearity, self-selection bias and heteroscedasticity. Multicollinearity was tested using the variance inflation factor (VIF) while heteroscedasticity was checked using Breusch-Pagan/Cook-Weisberg tests [20].

3. Results and Discussion

3.1 Characteristics of potato farmers in Kabale and Mbale

The characteristics of interviewed potato farmers that were considered included; household size, years spent in formal school, age, dependency ratio, gender, main and second occupation, main purpose of growing potato, market availability in the area, road condition to the nearest village market, credit access and possession of a transport means like a motor cycle or bicycle. Farmers' characteristics influence the farm management decisions and are important in understanding their decision making process.

Results in table 2 indicate that majority of the potato net buying farmers (55.6%) had access to a village market and this was significantly different ($P \leq 0.10$) from the net selling farmers at 33.1%. This result points to the fact that the net buyers had easy access to cheaper potato which is sold in the village markets; hence they found it rational to buy rather than producing themselves. This is in agreement with [21, 22] who asserted that due to high transport costs and low agricultural productivity, rural food markets are thin and isolated which leads farmers to face volatile food prices that are highly correlated with their own agricultural output.

Related to the above, the results further showed that more net buying smallholder farmers (72.2%) than net sellers (59.5%) had access to market information. This shows that by having access to village markets, net buyers are able to get access to market information as well which is very vital in making decisions on whether to buy or sell. [23] noted that in many parts of Africa where there is little or no access to markets, the livelihoods of rural farmers are disturbed with many of them migrating near to urban centres where they can get employed outside the farm and resort to becoming buyers rather than sellers.

Table 2: Characteristics of potato farmer categories (%)

Characteristic	Net seller	Net buyer	Autarkic
Farmer's gender (female)	19.60	22.20	27.80
Farmer has access to a village market	33.10	55.60*	44.40
Farmer has a contractual relationship with buyers	19.00	22.20	(Not applicable)
Potato farmer has access to market information	59.50	72.20	61.10
Farmer has access to credit	58.30	55.60	50.00
Potato farmer has other sources of food besides potato	81.60	88.90	77.80

Standard errors in parentheses; Significant level: * = 10%; ** = 5%; *** = 1%. Pegged against net seller farmer category.

Table 3: Other characteristics of potato farmer categories

Characteristic	Mean		
	Net seller	Net buyer	Autarkic
Dependency ratio	1.19 (1.14)	0.65** (0.59)	0.80 (0.79)
Distance to the nearest market (Km)	7.84 (8.15)	3.78** (5.01)	5.86 (4.51)
Farmer's education level (years in school)	7.09 (3.32)	7.06 (4.43)	6.39 (3.50)
Average Farmer's age (years)	40.93 (12.00)	38.33(12.25)	44.83 (15.10)
Total farm land owned (ha)	1.59 (1.83)	0.96 (0.92)	1.06 (1.42)
Transport cost of 100Kg of potato to market (UGX)	3,298.77(2,124.66)	3,444.44(2,864.02)	(Not applicable)
Annual family visits to a health centre	3.19 (2.53)	3.72 (2.27)	5.00*** (4.35)

Standard deviations in parentheses; Significant level: * = 10%; ** = 5%; *** = 1%. Pegged against net seller farmer category.

Results in table 3 indicate that there was a significant difference ($p \leq 0.05$) between the dependency ratio for potato net sellers and net buyers. Dependency ratio as a measure of the burden placed on the working household members by the young and old members of the family implied that net sellers more than the net

buyers or autarkic farmers have to sell more into the market to sustain the family in terms of providing for household needs that range from fees, clothing to feeding. [24] found a strong positive relationship between the family size in terms of number of children and the size of the farm operated by a household. The bigger size of the farm operated ensured that enough is produced to support the family in terms of food and other needs.

Results in **table3** further indicated that autarkic (self sufficient) smallholder potato farmers significantly ($P \leq 0.01$) had more visits to the health centre compared to the potato net buyers and net sellers. This research result points to the bigger problem facing many smallholders and this is the poor livelihoods and thus they spend much of the time fighting sickness rather than producing a marketable surplus. [25] stated that poor health results in a loss of days worked or in reduced worker capacity, which reduces output when family and hired labour are not perfect substitutes or when there are liquidity constraints.

3.2 Driving factors behind observed smallholder potato farmers' market behaviour

Dependence ratio had a positive and significant ($P \leq 0.10$) effect on potato farmers' behaviour to participate in the market as a net seller other than net buyer or autarkic. This result possibly indicates that because a farmer and the working household members have to satisfy the consumption needs of his/her family, they struggle to produce a surplus for sale. This result agrees with the findings of [26] that larger families are less able to buy and can less afford to liquidate their primary source of food. [27] however, in their study of market participation in crop and livestock markets also found that larger family sizes positively and significantly affected net buying in both crop and livestock markets.

Results in table 4 also reveal that a farmer having their own transport means like a bicycle or motor cycle had a positive and significant effect on their market participation behaviour as net sellers other than net buyers or net buyers other than autarkic ceteris paribus. This result means that a farmer with a means of transport can easily access the marketing point to sell their potato or buy potato incurring low transaction costs in terms of transport and accessing information. [8, 19, 28,29] agree that asset related barriers like lack of access to land and transport means like a bicycle have an impact on blocking smallholder farmers from entering crop markets.

The results further show that the coefficient for square of distance to the nearest potato market was positive and significant ($p \leq 0.05$) meaning that the longer the distance to the market, the more potato farmers tend to be autarkic other than net buyers and net sellers other than autarkic ceteris paribus. [30] found a high degree of correlation between the distance travelled to the point of sale and the distance to the nearest place where vehicular transport can be accessed yet many of the autarkic farmers cannot access such places and infrastructure.

The time taken to reach the garden had a positive and significant influence on potato farmer's behaviour as net sellers rather than net buyers and net buyers rather than autarkic (Table 4). The research area has a mountainous landscape and farmers possess parcels of land that are scattered and in some cases far from their homes. The result is counter intuitive but the possible explanation for this is that many of the farmers who have more land are the better of ones who can afford hired labour to work on those distant plots to produce a marketable surplus (net sellers) or hire them out to get money to buy potato (net buyers) while the autarkic farmers possess smaller plots

near their homesteads. [31,32] found that in Guinea highlands, horticultural farmers look at energy expended to reach the garden and what they will get out before choosing the garden site.

Table 4: Factors that influence farmer market participation behaviour.

Variable	Coefficient (S.E)
Farmer's education level (Years in school)	0.0069 (0.0321)
Dependency ratio (Dependants per working household member)	0.2759* (0.1529)
Availability of other food sources other than potato	-0.0583 (0.3146)
Farmer's total land owned (ha)	0.1067 (0.1061)
Farmer's age (years)	0.0015 (0.0098)
Road condition to nearest market (Good)	0.1759 (0.3403)
Farmer has a transport means like a motorcycle	0.4885** (0.2447)
Square of distance to nearest market (km ²)	0.0025** (0.0012)
Farmer sells potato on contract	-0.0107 (0.3068)
Annual family visits to a health centre	-0.0486 (0.0367)
Farmer has access to credit services	0.1810 (0.2374)
Transport cost for 100Kg of potato (UGX)	0.00002 (0.00005)
Time to reach the garden (Minutes)	0.0128* (0.0077)
C1: (Purchases)	0.0330
C2: (Sales)	0.5468
Prob>chi ²	0.0107
Pseudo R ²	0.1250

Standard errors in parentheses; Significant level: * = 10%; ** = 5%; *** = 1%. Pegged against net seller farmer category.

However, contrary to the prior expectation, having other sources of food other than potato negatively and though not significantly influenced farmers' being net sellers rather than net buyers and net buyers rather than autarkic ceteris paribus. This is because many of the smallholders are subsistence potato producers and possess small pieces of land and having another source of food discourages them from growing more potato to have a marketable surplus. [33] noted that it is possible to have an agricultural project at farm level where the main benefit is the food for own consumption a farmer gets but not the cash income from sale of the surplus crop produce.

4. Conclusions and Recommendations

The results suggest that farmers' household characteristics define their market behaviour as much as infrastructural characteristics. Having many dependants, farmers worked harder to sustain the family and eventually produced a marketable surplus to earn an income. However, it must be pointed out that in many rural areas, even the young ones who are less than eighteen years provide farm labour which may explain such kind of outcome.

Infrastructural characteristics like distance and having access to village and the time taken to reach the gardens given a mountain terrain are key in defining smallholder market participation behaviour. This calls for policies that ensure that the rural road network is functional to facilitate access to markets as well as production points, in this case the gardens which are far away from farmers' homesteads.

The high dependency ratio for the autarkic (self sufficient) smallholder farmers coupled with low education levels at only six years of schooling, small land holdings and many visits to the health centres are results that point to the fact that this group of farmers needs special interventions by both the government and the non government organisations. This group of smallholders needs special programs in terms of extension and health services in addition to other social services geared towards socio-economic transformation to bring them into market oriented production.

These results appear to identify a strong need for programs and practices that are aimed at enhancing smallholder farmers' access to markets and market information. Investments in infrastructure and other interventions that will ensure that more smallholder farmers produce and sell more into the market are highly recommended. This will ensure that more farmers will enter the potato market to sell rather than to buy, which will ensure increased household incomes and eventually improved rural livelihoods.

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References

- [1] FAO (2008). Workshop to commemorate the international year of potato. Bangkok Thailand, 6 May 2008 *proceedings*. www.potato2008.org/en/potato/index/html. Accessed Aug 2012.
- [2] Schwartzmann, M. (2010). Potato- a world production, a European business. *Twelfth Euro Blight Workshop Arras* (France). 3-6th May 2010.

- [3] Maredia, M.K., Byerlee, D. and Pee, P. (2000). Impacts of food crop improvement research: Evidence from Sub-Saharan Africa. *Food Policy*, 25:531-559.
- [4] Ferris, R.S.B., Okoboi, G., Crissman, C., Ewell, P. and Lemaga, B. (2001). Uganda's Irish Potato Sector, a paper prepared by IITA-FOODNET, CIP, PRAPACE, CGIAR and ASARECA at *the Government of Uganda's conference on competitiveness of selected strategic exports*.
- [5] Nkonya, E. and Kato, E. (2001). Agricultural Input Marketing in Uganda International Food Policy Research Institute (IFPRI). *A paper Presented at the IFPRI Policy Workshop, June 25-26, 2001, Kampala Uganda*.
- [6] Aliguma, L., Magala, D. and Lwasa, S. (2007). Connecting small-scale producers to markets: The case of the Nyabyumba United Farmers Group in Kabale district, Uganda. *Uganda Agricultural Economics Association (UAEA)*.
- [7] Okoboi, G. (2001). The marketing potential of Potatoes in Uganda and market opportunities for Rwanda. International Institute of Tropical Agriculture.
- [8] Barret, C.B. (2007). Smallholder market participation: Concepts and evidence from eastern and southern Africa. *Food Policy*. 33: 299–317.
- [9] Wang'ombe, J.G. (2008). The potato value chain in Kenya and Uganda. Maastricht School of management, DBA assignment.
- [10] Okoye, B.C; Onyenweaku, C.E and Ukoha, O.O. (2010). An Ordered probit model analysis of transaction costs and market participation by small-holder cassava farmers in south eastern Nigeria. *The Nigerian Agricultural Journal*.
- [11] Ohajianya, D.O and Ugochukwu, A.I. (2011). An Ordered Probit Model Analysis of Transaction costs and Market Participation by Sweet Potato Farmers in South Eastern Nigeria. *85th Annual Conference of the Agricultural Economics Society, Warwick University. 18- 20 April 2011*.
- [12] Rios, A.R., Shively, G.E. and Masters, W.A. (2008). Linkages between market participation and productivity: Results from a multi-country farm household sample. Prepared for presentation at the AAEA annual meeting, Orlando, Florida, July 27-29 2008.
- [13] Ana, R. R., Shively, G.E., and Masters, W.A. (2009). Farm Productivity and Household Market Participation: Evidence from LSMS Data. *Contributed Paper prepared for presentation at the International Association of Agricultural Economists Conference, Beijing, China*.
- [14] Goetz, S.J. (1992). A Selectivity Model of Household Food Marketing Behaviour in Sub-Saharan Africa. *American Journal of Agricultural Economics*, 74(2): 444-452.

- [15] Gabre-Madhin, E.Z. (2009). A market for all farmers: Market institutions and smallholder participation. Centre of evaluation for global action, working paper series. Agriculture for development paper No. AfD-0903, July 2009.
- [16] Stephens, E.C. and Barret,C. (2009). Incomplete Credit Markets and Commodity Marketing Behaviour. Economics Field Group, Pitzer College, June 2009.
- [17] Zezza, A., Winters, P., Davis, B., Carletto, G., Covarrubias, K., Tasciotto, L. and Quinona, E. (2011). Rural household access to Assets and Markets: A cross-country comparison. *European journal of development research*.
- [18] Kostov,P. And Lingard,J. (2004). Subsistence Agriculture in Transition Economies: Its Roles and Determinants. *Journal of Agricultural Economics*. 55 (3): 565-579.
- [19] Boughton, D., Mather, D., Barrett, C.B., Benfica, R., Danilo, A., Tschirley,D. and Cunguara, B. (2007). Market participation by rural Households in a low-income country: An asset-Based Approach Applied to Mozambique. Department of Agricultural Economics, 213 E, Agriculture Hall, Michigan State University.
- [20] Green, W. H. (2003). *Econometric Analysis 5th Edition* .Prentice Hall, Upper Saddle River. New Jersey 07458 New York University.
- [21] Fafchamps, M. (1992). Cash crop production, food price volatility and rural market integration in the Third world. *Journal of Agricultural Economics*, 74(1):90-99.
- [22] Poulton,C., Kydd, J. and Dorward, A. (2006). Overcoming Market Constraints on Pro-Poor Agricultural Growth in Sub-Saharan Africa. *Development Policy Review*. 24 (3): 243-277.
- [23] Wiggins, S. (2000). Interpreting Changes from the 1970s to the 1990s in African Agriculture Through Village Studies. The University of Reading, UK. *World Development*. 28,(4): 631-662.
- [24] Clay, D.C and Johnson, N.E. (1992). Size of Farm or Size of Family: Which Comes First? *Population Studies*, 46 (1992), 491-505.
- [25] Croppenstedt, A. and Muller, C. (2000). The Impact of Farmers' Health and Nutritional Status on Their Productivity and Efficiency: Evidence from Ethiopia. *Economic Development and Cultural Change*, 48(3):475-502.
- [26] Bellemare, M.F. and Barrett, C.B.(2006). An Ordered Tobit Model of Market Participation: Evidence from Kenya and Ethiopia, *American Journal of Agricultural Economics* 88(2): 324-334.

- [27] Jaleta, M. and Gebremedhin, B. (2011). Interdependence of smallholders' net market positions in crop and livestock markets: evidence from Ethiopia. Improving productivity and market success of Ethiopian farmers. Project working paper 27. Nairobi, Kenya, ILRI.
- [28] Hazell, P., Michael, J. and Gulati, A. (2003). The Role of Intermediate Factor Markets in Asia's Green Revolution: Lessons for Africa?: *American Journal of Agricultural Economics*, 85(5).
- [29] Heltberg, R. and Tarp, F. (2001). Agricultural Supply Response and Poverty in Mozambique. Institute of Economics, University of Copenhagen: Studiestraede, Copenhagen, Denmark.
- [30] Chapoto, A. and Jayne, T.S. (2011). Zambian farmers' access to maize markets. Working paper No. 57. Food security research project, Lusaka, Zambia, September 2011.
- [31] Sillitoe, P. (2002). After the 'affluent society': cost of living in the Papua New Guinea highlands according to time and energy expenditure–income. Cambridge University Press. *j. biosoc. sci.* 34: 433–461.
- [32] Sillitoe, P. (1999). Where to Next?: Garden Site Selection in the Papua New Guinea Highlands. *Oceania*, 69(3):184-208.
- [33] Gittinger, J. P. (1982). Economic Analysis of Agricultural Projects. Baltimore and London: Johns Hopkins University Press, 2nd edition, pp. 505.