Effect of transaction costs on smallholder maize market participation: Case of Kwanza District, Trans Nzoia County, Kenya

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Abstract

Access to marketing outlets of agricultural output is essential in commercializing smallholder agriculture in developing countries, Kenya included. This also applies to maize farming, which is a major staple food and livelihood activity for smallholder farmers of Kwanza district, Trans Nzoia County, Kenya. The farmers, however, have limited access to formal maize markets thus reducing income earned from maize farming. This study was therefore aimed at assessing the effect of transaction costs on smallholder maize market participation. Multi stage sampling technique was used to select 196 smallholder maize farmers. Primary data was collected using semi structured questionnaires and a Tobit model was used to assess the factors affecting smallholder farmers' participation in maize markets. Waiting time before receiving payment, information search costs, sorting costs, cost of rent and age of household head influenced smallholder maize market participation negatively. The study recommends policies that favour emergence of institutions (collective action and agricultural credit) and those geared towards accurate and timely market information availability and access. Farmers who sell through formal maize markets should be paid on time; finally, marketing policies should target the relatively younger individuals. This will greatly help to commercialize the smallholder maize sector in the region.

Keywords: Informal market; formal market; maize and transaction costs

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1. Introduction

Smallholder agriculture is a major driver of rural economic growth and livelihood improvement in Kenya; however, it still remains semi subsistent. Policies aimed at ensuring the overall commercialization of smallholder agriculture are therefore of key importance (Olwande and Mathenge, 2012). Maize is a major food as well as a cash crop for many Kenyan smallholders. It accounts for the largest share of the cultivated agricultural land in the country. The small and medium scale sector accounts for about three quarters of all maize marketed in the country annually (Alene et al., 2008).

Commercialization of the agricultural sector, maize included, necessitates improving the ability of smallholders' to participate in markets (both informal and formal ones) thereby improving their incomes and livelihoods in the long run (Jagwe et al., 2011). As such, integrating smallholder farmers into the market mechanism through increased market participation leads to higher living standards and reduces vulnerability of farmers to marketing risks (Yamano and Arai, 2010; Azam et al., 2012). Increased commercialization of agriculture must be based upon the establishment of efficient and well-functioning markets and trading systems that keep transaction costs low, minimize risks and provide information to all actors (IFAD, 2003; World Bank, 2008). Participants of commercial agriculture hold considerable potential for unlocking suitable opportunities necessary for providing better incomes and sustainable livelihoods for smallholder farmers (Omiti et al., 2009).

Smallholder market participation especially in Africa is constrained by various factors including small size of operations, weak technical capacity, high vulnerability to risks and lack of sufficient capital (Ton, 2010). It is also constrained by geographical barriers in poor and remote areas, lack of economies of scale, high transaction costs and marketing risks (Maitre et al., 2011). Interventions aimed at facilitating smallholder organizations, reducing the cost of inter market commerce and improving access to improved technologies are therefore central to stimulating smallholder market access (Key *et al.,* 2000; Barrett, 2008). More so, rural roads infrastructure, market information systems, value addition and collective marketing are essential in reducing transaction costs and enhancing market participation among the farmers (Ouma and Jagwe, 2010). Olwande and Mathenge, (2012) noted that access to and increased land productivity as well as promotion of social capital through collective action is important in ensuring smallholder market access and participation. Information communication technology tools (ICT's) are also essential in increasing smallholder market participation in Sub-Saharan Africa (Zanello, 2011).

Majority of smallholder maize farmers in Kwanza district, Trans Nzoia County, have limited access to formal maize markets (urban processors/ millers and the N.C.P.B). This derails the overall process of commercializing the sector in the region. It is however not clear what factors limit the smallholder farmers from accessing these markets with emphasis on transaction costs. Therefore, the study was geared towards filling this knowledge gap. The main objective of the study was to contribute to smallholder maize farmers' commercialization process by improving their ability to efficiently participate in formal maize markets for improved incomes. The specific objective was to determine the effect of transaction costs on the intensity of participation of smallholder farmers in maize markets.

2. Materials and methods

The study was done in Kwanza district, Trans Nzoia County, Kenya. The area is located in the upper Midland Agro- Ecological Zone (UMZ) and is endowed with brown red and clay soils derived from volcanic ash. Multistage sampling design was used for sampling. In the first stage, Kwanza district was selected purposively because of the large number of smallholder maize farmers in the region, the district has two divisions, Kwanza and Endebess which were all selected. Kwanza division has 5 locations while Endebess has three locations. In the second stage, three locations in Kwanza and two in Endebess were random selected proportionate to the size of the district. In the third stage, three villages were randomly selected from each location. Finally, from each village, respondents were selected through a systematic random sampling procedure proportionate to the size of the location. This gave a sample size of 196 respondents with 72 and 124 farmers from Endebess and Kwanza divisions respectively.

3. Data analysis

Majority of the smallholder farmers in the region practiced maize farming both for food and as a source of income. A large proportion of the farmers therefore participated in maize marketing; however, the degree of participation varies among different households. This situation disqualified two step procedures like the Heckman or the double hurdle model in analysis of the data because of the fewer number of non-participants in maize markets. The Tobit model developed by Tobin (1958) thus came in handy because of its ability to censure the non-participants in maize markets in the specified period. Tobit interprets all the zero observations as corner solutions where the household is assumed to be a maize seller with zero sales. The model also assumed that the decision to sell and the actual sales level were simultaneously determined by the same variables such that the variables that increased the probability of selling also increased the total amount of maize output sold. The decision to participate in maize markets and the intensity of participation were thus jointly determined (Sindi, 2008). To address the problem of endogeneity of transaction costs in behavioral choice models, the Tobit model data was split into three: the informal maize market participants, formal maize market participants and the pooled data. The dependent variable for all the three regressions was the proportion of total output harvested and sold in that particular season. The proportion ranged between 0 and 1 with 0 being the lower limit and 1 the upper limit. The Tobit model was specified as shown in equations 1, 2 and 3:

$$y_i^* = x_i'\beta + \varepsilon_i, \varepsilon_1 \sim N\,(0, \sigma^2) \qquad (1)$$

$$y_i = 0 \; if \, y_i^* \leq 0 \qquad (2)$$

$$y_i = y_i^* if \, y_i^* > 0 \qquad (3)$$

where, y_i^* was the proportion of output harvested and sold by a farmer and it took a continuous value between 0 and 1. x_i' was a vector of factors explaining values of the dependent variable.

The log likelihood function for the Tobit model was then specified as:

$$LnL = \sum_0 Ln\phi(^{-x_i\beta}/_\sigma) + \sum_+ Ln\left\{\sigma^{-1}\phi[^{(y_i - x_i\beta)}/_\sigma]\right\} \qquad (4)$$

The empirical specification for examining the influence of the independent variables on market participation which is described in Table 1 is as shown in equation 5:

$$\begin{aligned}Y_i^* = \ &\beta_0 + \beta_1(\text{WAITIMEBFORESELLING}) + \beta_2(\text{TRANSPORTCOST}) \\ &+ \beta_3(\text{WAITIMEBFOREPAY}) + \beta_4(\text{SORTING}) \\ &+ \beta_5(\text{RENT}) + \beta_6(\text{INFOSEARCH}) \\ &+ \beta_7(\text{TENTOWNERSHIP}) + \beta_8(\text{OUTPUTPRICE}) \\ &+ \beta_9(\text{CREDITACCESS}) + \beta_{10}(\text{EDUCATION}) \\ &+ \beta_{11}(\text{HHOLDSIZE}) + \beta_{12}(\text{AGE}) + \beta_{13}(\text{GENDER}) + \varepsilon_i\end{aligned} \qquad (5)$$

Table 1. Description of variables used in the Tobit model

Variable	Definition and measurement	Expected sign
Dependent variable		
Proportion of maize output marketed out of the total harvested (0 to 1)		
Independent variables		
WAITIMEBFORESELLING	Waiting time before selling produce at the market (Hours)	–
TRANSPORTCOST	Transport cost from the farm to the market per 90 Kgs bag (KES)	–
WAITIMEBFOREPAY	Waiting time before receiving payment (days)	–
SORTING	Cost of sorting maize per 90 Kgs bag (KES)	–
RENT	Cost of rent paid to the market per 90 kg bag(KES)	–
INFOSEARCH	Cost of searching for market information on both prices and demand situations (KES)	–
TENTOWNERSHIP	If the farmer owns tents used for drying maize or not (No/ Yes)	+
OUTPUTPRICE	Price of maize output per 90 Kgs bag (KES)	+
CREDITACCESS	If the farmer accessed agricultural credit the previous season (No/ Yes)	+
EDUCATION	Years of schooling for the household head(Years)	+
HHOLDSIZE	Number of household members (Number)	–
AGE	Age of the household head (Years)	+/–
GENDER	Gender of the household head(Female/male)	+/–

4. Results and discussions

4.1. Socio economic and transaction cost characteristics for maize market participants

A *t*-test was done to find out the mean differences of various continuous variables between informal and formal maize market participants. The results were presented in Table 2.

Table 2. Socio economic and transaction cost characteristics for maize market participants

Variable	Informal markets = 128		Formal markets = 50		Pooled data = 178		
	Mean	Std dev	Mean	std. dev	mean	std. dev	*t*-value
Waiting time before selling	2.64	0.86	16.53	5.97	9.99	15.46	(-10.57)***
Transport cost to the market	14.14	14.39	129.83	11.26	33.62	45.59	(-41.48)***
Waiting time before payment	1.50	0.66	23.42	21.52	5.49	13.14	(-12.46)***
Cost of sorting maize per bag	38.85	16.71	122.58	47.16	45.26	48.69	(-17.04)***
Rent per bag	12.09	3.74	53.53	11.28	18.03	16.02	(-36.24)***
Cost of information search	116.67	29.31	401.67	70.08	164.97	114.11	(-36.36)***
Distance to the market	0.67	1.87	24.84	7.23	4.73	9.68	(-35.46)***
Output price	2576.19	561.26	3031.67	435.79	2651.97	566.14	(-4.19)***
Household size	8.21	6.05	5.33	1.09	7.97	6.12	(1.40)
Age	53.72	8.98	32.97	5.94	50.08	11.62	(12.12)***
Output produced	110.99	68.33	150.27	105.99	100.12	85.70	(-1.82)

***, **, *, Significance at 1, 5 and 10% respectively, Standard errors in parenthesis, Source: Field survey, May 2012

The cost of rent, sorting maize, transport cost per bag, distance to the market, waiting time before selling, waiting time before receiving payment and information search costs were all significantly different between the two market categories. The costs of accessing formal maize markets were generally higher than those of accessing informal maize markets. More so, age of household head and output price were significantly different between the two markets. Formal maize markets offered higher prices as compared to the informal ones. The relatively younger individuals preferred to sell their surplus output through formal maize markets. This may be attributed to older farmers being risk averse and reluctant to adopt new technologies (Ayuya, 2010).

4.2. Tobit estimates for the effect of transaction costs on smallholder maize market participation

The censored Tobit model was used to assess the effect of transaction costs on the proportion of total maize output sold through the informal markets, formal markets and on the pooled data. The log likelihood for the fitted model was -183.9355, -72.0748 and -219.3639 for the informal markets, formal markets and the pooled data respectively. The Pseudo R^2 for all the three categories was above the statistical threshold of 20% showing that the proportion of total output marketed was attributed to the variables considered in the model. Results of the analysis were presented in Table 3. They showed transaction costs to have varied effects on households depending on the market they sold to.

Waiting time at the market place before selling had a negative effect on the proportion of output marketed through formal maize markets and the pooled data at 5% significance level. Increase in waiting time before selling output by one hour reduced the proportion of output sold through the formal markets and the pooled data by 1.66% and 1.40% respectively. This means that the more hours of waiting at the market before selling, the less the proportion of output farmers would be willing to market through the formal markets and the pooled data. Since most farmers hire modes of transport to transport the output to the markets, increase in waiting time before selling may imply an increase in delay charges by transporters hence reducing the number of farmers willing to market through the formal markets

Transport cost had a negative influence on the proportion of maize output marketed through the formal markets and the pooled data at 1% and 10% significance level respectively. Increase in transport cost by one Kenya Shilling reduced the proportion of maize output marketed through formal maize markets and the pooled data by 1.67% and 0.84% respectively.

This variable was used to capture the extent of isolation of farming households from the market since transport cost increases with distance to the market, state of infrastructure and the mode of transport used. It is associated with the per unit cost of accessing the market (Key et al., 2000). The result tallied those of Okoye *et al.* (2010) who found out that farmers with high cost of crop transportation were likely to be more of autarkic other than sellers and buyers other than autarkic.

Waiting time before payment was received had a negative influence on proportions of surplus output marketed through both the formal markets and on the pooled data at 5% significance level. Increase in waiting time before payment was received by one day reduced the proportion of output marketed through both the formal markets and the pooled data by 2.26% and 0.22% respectively. Further discussions with farmers indicated that most of the first harvest is sold immediately to provide cash for harvesting the rest of the farm, funding Christmas festivities and pay school fees in early January. Therefore, farmers would not prefer selling their maize output through markets that delay payments.

Cost of sorting maize output in order to meet the required market standards influenced proportions of maize output sold through formal maize markets negatively. A one Kenya Shilling increase in the cost of sorting a 90 kg bag of maize reduced the proportion of output sold by households through formal markets by 2.18%. This may be because quality standards in the formal markets are high and requires an extra cost in terms of sorting to meet the standards. This may serve to discourage the farmers to sell through formal maize markets.

Table 3. Tobit estimates for the effect of transaction costs on the extent of smallholder maize market participation

Variables	Informal maize markets		Formal market participation		Pooled data	
	dy/dx	Coef.	dy/dx	Coef.	dy/dx	Coef.
Waiting time before selling	-0.0048	-0.0048(0.0120)	-0.0166	-0.0166(0.0080)**	-0.0140	-0.0140(0.0053)**
Transport cost	-0.0404	-0.0404(0.0274)	-0.0167	-0.0167(0.0061)***	-0.0084	-0.0084(0.0045)*
Waiting time before pay	-0.0500	-0.0500(0.0354)	-0.0226	-0.0226(0.0109)**	-0.0022	-0.0022(0.0011)**
Sorting cost	-0.0138	-0.0138(0.0038)	-0.0218	-0.0218(0.0053)***	-0.0050	-0.0050(0.0020)
Rent	-0.0011	-0.0011(0.0007)	-0.0141	-0.0141(0.0065)**	-0.0119	-0.0119(0.0046)**
Information search cost	-0.0015	-0.0015(0.0018)	-0.0171	-0.0171(0.0079)**	-0.0105	-0.0105(0.0061)*
Tent ownership	0.0023	0.0023(0.0124)	0.0294	0.0294(0.0144)**	0.0108	0.0108(0.0038)**
Output price	0.0100	0.0100(0.0250)	0.0129	0.0129(0.0037)***	0.0111	0.0111(0.0059)*
Access to Credit	0.0445	0.0445(0.0145)***	0.0487	0.0487(0.0237)**	0.0426	0.0426(0.0137)**
Education Level	-0.0003	-0.0003(0.0019)	0.0006	0.0006(0.0020)	-0.0014	-0.0014(0.0019)
Household Size	-0.0133	-0.0133(0.0015)***	-0.0003	-0.0003(0.0052)	-0.0127	-0.0127(0.0067)*
Age	0.0016	0.0016(0.0009)*	-0.0319	-0.0319(0.0086)***	-0.0016	-0.0016(0.0008)**
Gender	-0.0066	-0.0066(0.0133)	-0.0235	-0.0235(0.0151)	-0.0057	-0.0057(0.0123)
	Number of obs=128; LR chi2(15) = 311.18; prob>chi2= 0.0000; pseudo R^2 = 0.485; log likelihood= -183.9355; Left C. = 0 ; Right C. = 0		Number of obs = 50; LR chi2(15) = 247.50; Prob>chi2 = 0.0000; Log likelihood = -72.0748; Pseudo R^2 = 0.2394; Left C. = 0 ; Right C = 0		Number of obs = 196; LR chi2(15) =610.72; Prob>chi2 = 0.0000; log likelihood = -219.3639; Pseudo R^2= 0.3550; Left C = 18 ; Right C. = 0	

***, **, *, Significance at 1, 5 and 10% respectively, Standard errors in parenthesis, Source: Field survey, May 2012

Cost of rent was significant at 5% level in the formal markets and the pooled data. Rent here captured the money paid by sellers either legally or illegally to induce their output to be accepted in the market. A one Kenya Shilling increase in the cost of rent paid per bag reduced the proportions of output marketed through the formal maize markets and the pooled data by 1.41% and 1.19% respectively. This cost was found to discourage smallholders from selling their output through formal maize markets especially urban processors/ millers and the N.C.P.B. Further discussions with the farmers also revealed that this cost is normally highest during the harvest time and at around the land preparation and acquisition of inputs stage when supply is very high as compared to the demand.

Cost of information search was measured in terms of Kenya Shillings used for calling the markets to inquire about market prices and the actual travelling costs to the markets by farmers to inquire about prices and general market conditions for maize output. The cost was statistically significant at 5% and 10% level in the formal markets and the pooled data respectively. A one Kenya Shilling increase in cost of information search reduced the proportion of maize output marketed through the formal maize markets by 1.71% and by

1.05% on the pooled data. Farmers tend to avoid this cost by selling to the informal markets hence reducing proportion marketed through formal maize markets. In fact, it was found out that informal traders move from one household to the other during the harvest time searching for maize to purchase offering ready market to the farmers.

Tent ownership by a household had a positive and significant effect on the proportion of output marketed through both the formal maize markets and the pooled data at 5% significance level. Ownership of tents used for drying maize by farmers increased the proportions of maize sold through the formal maize markets and the pooled data by 2.94% and 1.08% respectively. This means that tents used for drying maize are a very important asset to smallholders especially because of the role they play in ensuring high quality of maize grain that can fetch higher prices in the market.

In addition to transaction costs, the study also found it necessary to assess the effect of other factors such as output price, access to credit, education level, household size, age and gender in influencing smallholder maize market participation. Output price had a positive influence on the intensity of market participation at 1% and 10% significance level in the formal markets and the pooled data respectively. Increase in output price by one Kenya Shilling increased the proportion of output sold through both the formal markets and the pooled data by 1.29% and 1.11% respectively. Higher output price is an incentive to the farmers since it increases their profit margins and therefore a rational farmer would be willing to sell in the markets offering higher prices. This result was consistent with those of Omiti et al. (2009) and Alene et al. (2008) who found out that better output prices were a key incentive for increased sales by farmers.

Access to credit had a positive and significant influence on the proportion of output sold through each of the market categories and the pooled data. Probability of a household accessing credit, be it either from a local group, microfinance institution or local bank increased the proportions of output marketed by 4.45%, 4.87% and 4.26% to the informal markets, formal markets and the pooled data respectively. This was probably due to the fact that credit acquisition enabled households acquire production inputs and other services essential in transforming production from subsistence to commercial production of maize hence producing more for the market. This result concur with those of Alene et al. (2008) who found out that credit worthy farmers had a 19% greater likelihood of market participation as compared to non credit worthy farmers.

Household size had a negative effect on the proportion of output sold through the informal markets and on the pooled data. Increase in household size by one member reduced the proportion of maize output marketed through both the informal markets and the pooled data by about 1.3%. It negatively influenced marketed proportions probably because maize is used as food by a large proportion of the population therefore the larger the household size, the smaller the quantity of output marketed. This can also be attributed to larger households being labor inefficient thus producing less output but consuming a higher proportion leaving smaller and decreasing proportions for sale (Alene et al., 2008; Omiti et al., 2009).

Age of household head had varied effects across the data set. A one year increase in age of household head increased the proportion of output marketed through informal maize markets by 0.16% and reduced the proportion marketed through formal maize markets and the pooled data by 3.19% and 0.16% respectively.

This shows that, as the farmer's age increased, the probability of producing more for the formal market tended to decline. This may be attributed to the fact that older farmers tend to be risk averse and reluctant to adopt technology hence their inability to produce more for the formal maize markets. A study by Bahta et al. (2012) on policy options for improving market participation and sales in South Africa also revealed an inverse relationship between smallholder market participation and the age of the household head.

5. Conclusion and policy implications

Transaction costs were found to be the major constraint against smallholder farmers actively participating in maize markets, especially the formal ones. The proportion of output marketed by the farmers out of the total harvested was negatively influenced by: waiting time in the market before selling, transport cost to the market per bag, waiting time before receiving payment for produce sold, cost of sorting produce, cost of rent and information search costs. Transport cost to the market affected those who sold through formal maize markets more than the informal maize market participants. This was probably because of the positive correlation between distance traveled to the market and cost of transport. The intensity of market participation was however positively influenced by a household's access to credit, output price and ownership of tents. The study recommends policies that favour emergence of institutions (collective action and agricultural credit) and those geared towards accurate and timely market information availability and access. Farmers who sell through formal maize markets (N.C.P.B) should be paid on time and marketing policies should target the relatively younger individuals, this will greatly help to commercialize the smallholder maize sector in the region.

Acknowledgement

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