Transaction costs and smallholder farmers' participation in banana markets in the Great Lakes Region of Burundi, Rwanda and the Democratic Republic of Congo

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In this study, the Heckman procedure was used to analyze the way transaction costs affect smallholder farming households' participation in banana markets in the Great Lakes region of central Africa. The results reaffirm that fixed transaction costs largely determine a farmer's decision to participate in the market, and that the extent of participation is affected mainly by proportional transaction costs. Access to market information, whether directly or through formal or informal institutional arrangements, is critical for market participation. The size of the household and ownership of means of transport are critical in determining the intensity of market participation. The geographical location of the household affects market participation, since some locations have better infrastructure and hence are more commercialized. Policies aimed at encouraging market information access, investments in rural infrastructure and collective action by farmers may help to lower transaction costs and thus enhance market participation.

Keywords: transaction costs; market participation; smallholder farmers; bananas; Great Lakes Region

Dans cette étude, la méthode d'Heckman a servi d'instrument pour analyser la manière dont les coûts d'opération affectent la participation des petits fermiers au marché de la banane dans la région des Grands Lacs de l'Afrique centrale. Les résultats montrent une fois de plus que les coups d'opération fixes influent grandement sur la décision d'un petit fermier à se joindre au marché, et que l'ampleur de la participation dépend principalement des coûts d'opération proportionnels. L'accès à l'information concernant un marché représente un facteur fondamental de la participation au marché, que celui-ci soit direct ou qu'il soit obtenu grâce à des arrangements institutionnels officiels ou officieux. La taille du ménage et le fait de posséder un moyen de transport sont les déterminants cruciaux de l'intensité de la participation au marché. La situation géographique de l'exploitation agricole affecte la participation au marché puisque certaines zones possèdent une meilleure infrastructure, et sont par conséquent plus commercialisées. Les politiques visant à encourager l'accès à

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l'information sur les marchés, les investissements en matière d'infrastructure rurale et l'action collective des fermiers pourraient faire baisser les coûts d'opération et par conséquent pourraient augmenter la participation aux marchés.

Mots-clés : *coûts d'opération ; participation au marché ; petits fermiers ; bananes ; région des Grands Lacs*

1. Introduction

For most economies in Africa, agriculture remains a critical sector for attaining economic growth. However, to make a significant contribution to economic growth, the sector needs to be commercialized to enable smallholder farmers to participate in markets. Such participation is expected to have a positive impact on their incomes and thus enhance their livelihoods. Markets and improved market access for poor rural households are therefore a prerequisite for enhancing agriculture-based economic growth and increasing rural incomes. Intensification of production systems and increased commercialization must be built upon the establishment of efficient and well-functioning markets and trade systems that keep transaction costs low, minimize risk and extend information to all actors, particularly those living in areas of marginal productivity and weak infrastructure (IFAD, 2003;World Bank, 2008).

The challenges for the smallholder farmer, especially in sub-Saharan Africa, are multifaceted. Tackling them requires interventions such as institutional reforms that facilitate efficient rural service delivery, development of markets, creation of physical infrastructure, and government policies that are supportive while ensuring a stable and conducive political environment. As the agricultural sector in developing countries transforms towards commercialization, smallholder farmers require systems that are responsive to their needs: access to markets, market information, market intelligence and effective farmer organization.

However, in most developing economies these farmers find it difficult to participate in markets because of numerous constraints and barriers. These are mostly reflected in the hidden costs that make it difficult to access input and output markets (Pingali et al., 2005). Transaction costs are the embodiment of access barriers to market participation for most resource-poor smallholders (Delgado, 1999; Holloway et al., 2000).

A fundamental transaction cost these farmers face is the cost of obtaining information (Shepherd, 1997). Though neoclassical economists essentially assume that information is costless, this assumption does not match reality, especially in developing countries (Stiglitz, 1988). The fact that information is not costless has important implications for contracts and transactions, as has been pointed out in work pioneered by Coase (1937) and later expanded in Coase (1960).

A number of studies, such as Goetz (1992), Key et al. (2000) and Makhura et al. (2001), have identified high transaction costs as one of the key reasons for smallholder farmers' failure to participate in markets. Most are located in remote areas with poor transport and market infrastructure, which adds to the high transaction costs they face. In addition, they lack reliable information on markets and potential exchange partners. In some instances, these transaction costs are so high that markets can be said to be 'missing' (Omamo, 1998; Key et al., 2000).

Few studies have empirically investigated the factors that influence smallholder farmers' participation in food markets in developing countries, yet the rural farming populations form the bulk of the poor (Goetz, 1992; Makhura et al., 2001; Alene et al., 2008; Omiti et al., 2009). This is in contrast to the extensive empirical work on the effects of transaction costs on labor market participation.

This study focuses on the marketing of bananas, a major staple in the Great Lakes region comprising Rwanda, Burundi and the eastern parts of the DRC. Globally, Rwanda and Burundi rank among the top 20 producers of bananas and plantains (FAOSTAT, 2008) and are among the largest banana producers in sub-Saharan Africa.

Bananas play a key role in Rwanda and Burundi, contributing to rural populations' household food security and revenue. The two countries are among the 20 leading banana producers in the world, with annual production estimated at 1.5 million metric tonnes in Burundi and 2.6 million metric tonnes in Rwanda (FAOSTAT, 2008). The two main banana types grown in the region are the cooking and beer types. Cooking bananas are largely produced for home consumption, while beer bananas are the main source of household income as they are made into banana beer for sale (Spilsbury et al., 2004). The importance of bananas to the rural populations of the two countries means that producing and marketing this crop could be a pathway to better rural livelihoods. A better understanding of the determinants of barriers to accessing the banana market, which are directly linked to transaction costs, is therefore critical in understanding why some farmers opt to participate as sellers while others opt out. This would make it possible to identify and generate appropriate intervention measures that would enable the rural populations to benefit from banana marketing.

The overall objective of this study was to examine how transaction costs and other factors affect farmers' participation in these markets, and specifically to examine the effects of transaction costs on a household's decision to participate and the extent of participation.

Our study tests the hypothesis that the household's decision to participate in a market and the intensity of participation are inseparable and are similarly affected by transaction costs. Transaction cost theory has in the past been used to explain the behavior of smallholder farmers in relation to markets (Goetz, 1992; Key et al., 2000; Makhura et al., 2001; Fafchamps & Hill, 2005). The farmers' decision to participate in markets and the extent of participation are determined by the magnitude of transaction costs.

In this study, 'smallholder farmers' means farmers with land-holdings of less than 10 hectares. 'Participation' means any situation which involves exchange of goods (in this case bananas) for money, regardless of location. 'Decision to participate' means whether the farmer engages in selling activities, regardless of the points of sales and quantities sold. 'Intensity of participation' means the quantity of the commodity sold by either party in a defined time period. 'Transaction costs' means the costs incurred in finding and negotiating with a trading partner, and making a contract and enforcing it. These costs could be in terms of money spent or the opportunity cost of time spent. 'Bananas' means all the types of banana and plantain produced and marketed in the study area: the cooking types, the dessert types, the beer types, and the roasting type or plantain.

The rest of the paper is organized as follows. We first explain transaction cost theory and describe the economic model, the econometric estimation and the data to be used. We then present the empirical results, and conclude by outlining some policy implications.

2. Transaction cost theory

Transaction cost theory is based on the work of Coase (1937, 1960), who attempted to define the relationship between the firm and a market. The 'New Institutional Economics' approach is based on the premise that institutions are transaction cost minimizing arrangements which may change and evolve with changes in the nature and sources of transaction costs (Williamson, 1985). Transaction costs, occasionally referred to as 'hidden costs', are the observable and non-observable costs associated with the exchange of goods and services. Coase (1937) emphasizes that market exchange is not costless. Costs are incurred because of the friction involved in the exchange process, as it entails the transfer and enforcement of property rights.

Past studies such as Key et al. (2000) have categorized these costs into fixed and variable transaction costs. Fixed transaction costs (FTCs) are invariant to the volume of output traded and affect smallholder farmers' market participation decisions. They include the costs of (a) searching for a trading partner, (b) negotiating and bargaining, particularly when there is imperfect information about prices, and (c) enforcement of contracts and supervision, particularly when credit sales are involved, as the sellers have to screen the buyers for reliability and lower the likelihood of defaults (Kirsten & Vink, 2005). Variable or proportional transaction costs (PTCs), on the other hand, are per unit costs of accessing markets that vary with the volumes traded and may affect the decision to participate in the market as well as the quantity traded. They include costs associated with transferring the output being traded, such as transport costs and time spent delivering the product to the market. These costs are largely unobservable or cannot be easily recorded in a survey. In essence, the variable transaction costs raise the real price of the commodity purchased and lower the real price received for commodity sold.

2.1 Economic model

Incorporating transaction costs into an agricultural household model framework, market participation is conveniently specified as a choice variable. In addition to deciding how much of each good i to consume (c_i), produce (q_i), and use as input (x_i), the household also decides how much of each good to sell (m_i). When the household sells the goods it produces, m_i assumes a positive sign. However, when the household purchases such goods, m_i assumes a negative sign. Supposing there were no transaction costs, the household's problem would be to maximize the utility function (1), subject to conditions (2) to (5):

(1) $u(c; z_u)$ the utility function,

(2) $\sum_{i=1}^{N} p_i^m m_i + T = 0$ the cash constraint,

(3) $q_i - x_i + A_i - m_i - c_i = 0$ the resource balance (where $i = 1,...,N$),

(4) $G(q, x; z_q) = 0$ the production technology, and

(5) $c_i, q_i, x_i \geq 0$ the non-negativity condition,

where p_i^m is the market price of good i, A_i is endowment in good i, T is exogenous transfers and other incomes, z_u and z_q are exogenous shifters in utility and production, respectively,

and *G* represents the production technology. The cash constraint (2) states that expenditures on all purchases must not exceed revenues from all sales and transfers.

The resource balance (3) states that, for each of the *N* goods, the amount consumed, used as input and sold is equal to what is produced and bought plus the quantity of the good the household owns. The production technology (4) relates inputs (e.g. land, labor) to outputs.

PTCs raise the price paid by a buyer and lower the price received by a seller. These costs may include transport and marketing costs (Key et al., 2000). However, FTCs are invariant to the quantity transacted. Hence they are generally unobservable, though factors z_t^s and z_t^b with coefficients δ_i^s and δ_i^b, respectively, can explain these costs. When both the FTCs and PTCs are incorporated into the cash constraint, equation 2 is re-written as equation 6, where the household pays the fixed cost t_{fi}^s if it sells good *i* and pays t_{fi}^b if it buys good *i*:

$$\sum_{i=1}^{N}\left[(p_i^m - t_{pi}^s(z_t^s))\delta_i^s - (p_i^m + t_{pi}^b(z_t^b))\delta_i^b\right]m_i - t_{fi}^s(z_t^s)\delta_i^s - t_{fi}^b(z_t^b)\delta_i^b + T = 0 . \qquad (6)$$

To solve for the household problem, a Lagrange expression can be derived and first order conditions for the consumption goods obtained from expressions (1) to (6).

The decision price p_i is thus defined as

$$p_i^m - t_{pi}^s \qquad \text{if } m_i > 0, \text{ for the selling household,}$$

$$p_i^m + t_{pi}^b \qquad \text{if } m_i < 0, \text{ for buying household, and}$$

$$\tilde{\tilde{p}}_i = \frac{\mu_i}{\lambda} \qquad \text{if } m_i = 0 \text{ for self sufficient households.}$$

The supply curve in the absence of transaction costs would be $q(p^m, z_q)$.

However, when transaction costs are incorporated, the supply curves for the selling, buying and non-participating households are

$$q^s = q(p^m - t_p^s, z_q) \qquad \text{for sellers,}$$

$$q^b = q(p^m + t_p^b, z_q) \qquad \text{for buyers, and}$$

$$q^a = q(\tilde{\tilde{p}}, z_q) \qquad \text{for autarkic households (non-participating).}$$
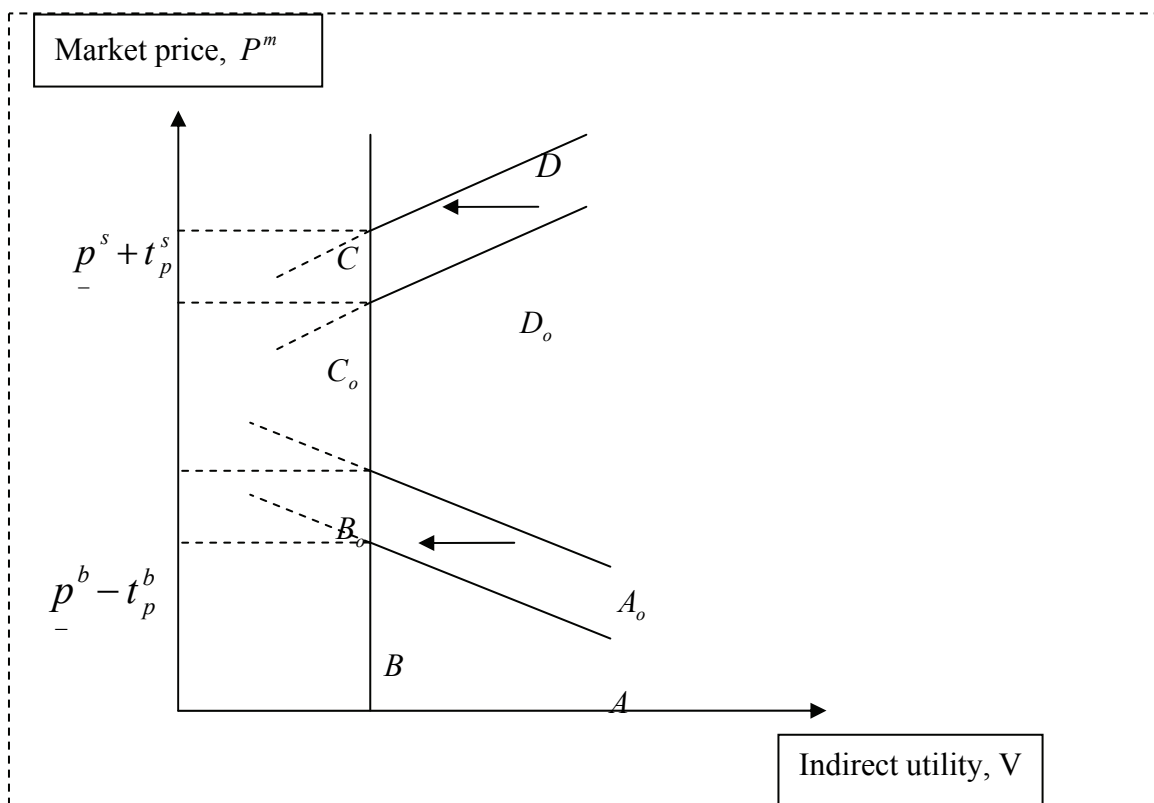
Figure 1: Indirect utility of a household under proportional and fixed costs

The optimal participation of a household follows the path ABCD (Figure 1). A household will buy when market prices are below $\underline{p}^b - t_p^b$ or be self-sufficient when $\underline{p}^b - t_p^b < p^m < \underline{p}^s + t_p^s$ and will sell when market prices are above $\underline{p}^s + t_p^s$, where $\underline{p}^s$ and $\underline{p}^b$ are the threshold or decision selling and buying prices, respectively.

2.2 Econometric estimation

The econometric specification of the preceding model consists of market participation decision equations and banana supply equations estimated separately. The focus of the analysis is on the selling decision. Equation (6) shows that market participation depends on both fixed and variable transaction costs, while the supply decision, conditional on market participation, depends only on the variable transactions costs.

For empirical analysis, mostly focusing on the selling households, a linear expression is assumed for the supply functions and the PTCs as follows;

$$q(p, z_q) = p\beta + z_q \beta_q \text{ and } t_p^s = -z_t^s \beta_p^s \text{ whereas } t_p^b = -z_t^b \beta_p^b .$$

This leads to linear expressions for supply by sellers as follows:

$$q^{s*} = p^m \beta_m + z_t^s \beta_t^s + z_q \beta_q .$$

The linear expressions for the production threshold levels are thus

$$\underline{q}^s = z_t^s \alpha_t^s + z_q \alpha_q^s + z_c \alpha_c^s,$$

where z_t are exogenous characteristics that affect transaction costs when selling, z_q are production shifters, z_c are consumption shifters and α_q^s, α_c^s are their coefficients respectively and β_t^s, β_q^s are coefficients of z_t^s and z_q, respectively.

The econometric specification can thus be obtained by adding an error term as follows:

$$q^{s*} = p^m \beta_m + z_t^s \beta_t^s + z_q \beta_q^s + u \ . \tag{7}$$

q^{s*} is the latent supply if a household is a seller and it is observed when it is higher than the threshold for market participation $\underline{q}^s$,

$$q^s > \underline{q}^s \equiv \mathrm{Prob}(Y = 1) = X_i \beta_i + u \ .$$

Thus if $q^{s*} > \underline{q}^s$ then the household is participating in the market as a seller. The expression (equation 8) therefore allows for the identification of parameters β_i using the probit analysis. The factors that affect a smallholder farmer's decision to participate in banana markets can be determined on the basis that:

$$q^{s*} > \underline{q}^s \equiv \mathrm{Prob}(Y = 1) = X_i \beta_i + u \ . \tag{8}$$

The estimation of coefficients $\beta_m, \beta_t^s, \beta_q^s$ shown in equation (7) caters for the aspect of the intensity of participation of the smallholder farmers.

For a household to be a seller,

$$\varphi(\beta X_i) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{\beta X_i} e^{\frac{-t^2}{2}} \, dt \ . \tag{9}$$

The continual decisions made by the smallholder farmers as regards the intensity of participation is captured by the factors that affect the amount of commodity traded m_i. We assume an expression to link back to equation (6) and this is given as:

$$m_i = f\left(p^{\alpha}, p^{\sigma}, t_{fi}^{b}z_t^{b}, t_{pi}^{b}z_t^{b}, t_{fi}^{s}z_t^{b}, t_{pi}^{s}z_t^{b}, K, L\right),$$ (10)

where m_i represents quantities of bananas sold (as shown in equation 10) and the z's represent the factors capturing the transaction costs incurred in buying and selling of the commodity, whereas K represents other costs and L represents other factors.

An econometric form is adopted as shown in equation (11), and the estimates β_i for the vector of variables capturing the factors determining m_i, which include transaction related factors (i.e. access to information, transport, distance, status of infrastructure), are obtained.

$$m_i = \sum_{i=1}^{i=n}(X_i\beta + u_{1i}), \ i=1,\ldots,n.$$ (11)

m_i = banana sales of a household in the reference period denoted by BANANA SALES,

X_i = independent variables which affect banana sales and include those capturing transaction costs for the j observations,

β = coefficient estimates of the independent variables, and

u_{1j} = the error term for the regression equation.

The dependent variable for observation i, is observed only if the selection expression is

$(z_i\gamma + u_{2i}) > 0$, which implies $m_i > 0$.   (12)

z_j = the independent variables which determine whether a household engaged in selling of bananas in the reference period or not (including   those capturing transaction costs),

γ = the coefficient estimates of the independent variables of z_i, and

u_{2i} = the error term for the selection equation.

For both expressions (11) and (12),

$$u_1 \approx N(0,\sigma)$$

$$u_2 \approx N(0,1)$$

$$\text{corr}(u_1, u_2) = \rho.$$ (13)

When $\rho \neq 0$, standard regression techniques such as OLS would yield biased estimates when applied to equation (11) since they do not take into account the process generating the observed banana sales of households. A Lee-Heckman type two-step process has therefore been applied to correct for the possibility of bias due to sample selection (Lee, 2003; Maddala, 1983). The model is estimated using an extension of the Heckman two-step procedure. The first step involves the estimation of the relationships in equations (8) and expression (12), using a probit model.

3. Data description

The secondary data used in this analysis were made available by the Consortium for Improving Agriculture-based Livelihoods in Central Africa (CIALCA), a project administered by the International Institute for Tropical Agriculture (IITA). The data were collected between June 2006 and February 2007 from Rwanda, Burundi and parts of the DRC, using purposive sampling, targeting banana producing areas. A total of 2,666 households were interviewed, 912 from nine districts of three provinces of Rwanda (Eastern, Western and Southern), approximately 494 from five communes of three provinces of Burundi (Cibitoke, Gitega and Kirundo), and 1,260 from three territories of the DRC (North Kivu, South Kivu and Bas-Congo).

Information from these households was gathered through questionnaire interviews. The questionnaire covered a range of topics including household systems and socioeconomic structures, farming system agronomics, access to markets and marketing patterns of the focus crops, post-harvest handling and processing of these crops, social structure of the households, households' embedding in social structures within the sites, status and determinants of food security, and health and nutritional status of the household.

Table 1 presents the definitions and sample statistics for the variables used in the estimations.

Table 1: A description of variables and their summary statistics

Variable name	Description of variables	Mean	Standard deviation	% for [yes=1]
LAND SIZE	Average land holdings (in ha)	3.93	11.4	-
CHILDREN6-17YRS	Household members aged 6–17yr	2.21	1.89	-
MALE HEADED	Household headed by male (yes=1, no=0)	-	-	80.96%
BICYCLE	Household owns a bicycle (yes=1, no=0)	-	-	32.48%
FARMER GROUP	Household member belonging to a farmer group (yes=1, no=0)	-	-	29.64%
MARKETING GROUP	Household member belonging to a marketing group (yes=1, no=0)	-	-	4.16%
EXPERIENCE	Period of existence of farm (yrs)	20.1	13.5	-
MARKET	Distance to nearest market (km)	3.08	4.17	-
HOSPITAL	Distance to nearest hospital (km)	11.59	10.08	-
PRICEINFO_NONE	Households not accessing price information (yes=1, no=0)	-	-	6.18%

PRICE_NEIGHBOR	Price information is mainly from neighbors (yes=1, no=0)	-	-	19.61%
COOKING BANANA PRICE	Selling price of cooking bananas in the ref. period (US$/bunch) [a]	1.36	0.78	-
BEER BANANA PRICE	Selling price of beer bananas in the ref. period (US$/bunch) [b]	0.55	0.26	-
BANANA SALES	Banana sales (KG) [c]	637.9	1889.2	-
BANANA SELLING	Households that sold bananas in the ref. period (yes=1, no=0)	-	-	52.58%
CIBITOKE	Household is located in Cibitoke Province, Burundi (yes=1, no=0)	-	-	3.79%
GITEGA	Household located in Gitega Province, Burundi (yes=1, no=0)	-	-	7.39%
KIRUNDO	Household located in Kirundo Province, Burundi (yes=1, no=0)	-	-	7.35%
NORDKIVU	Household located in North Kivu, DRC (yes=1, no=0)	-	-	14.74%
SUDKIVU	Household located in South Kivu, DRC (yes=1, no=0)	-	-	17.44%
BASCONGO	Household located in Bas-Congo, DRC (yes=1, no=0)	-	-	15.08%
EAST	Household in Eastern Province of Rwanda (yes=1, no=0)	-	-	22.96%
WEST	Household in Western Province of Rwanda (yes=1, no=0)	-	-	7.46%
SOUTH	Household in Southern Province of Rwanda (yes=1, no=0)	-	-	3.79%

[a] Cooking banana bunch weight estimated at 20kg
[b] Beer banana bunch weight estimated at 10kg
[c] Calculated for households that participated in banana markets during the reference period
Exchange rates: 1 US$ = 1008 Burundi francs; 550 Rwandan francs; 480 DRC francs

The parameters of the model were estimated using the Stata econometric software package version 9.1. The independent variables included those theoretically expected to influence market participation decisions (i.e. whether to participate and the extent of participation). A number of variables were included to proxy fixed and variable transaction costs.

The variables BEER BANANA PRICE and COOKING BANANA PRICE, which refer to the selling prices (in US dollars) of these crops, enter the analysis as key independent variables determining household supply function. A positive relationship is expected between each of them and market participation as per economic theory (Key et al., 2000; Alene et al., 2008).

The dummy variable BICYCLE was included to assess households' ease of transport to the market and it captures the proportional variable costs associated with the per-unit costs of accessing markets. Access to transport equipment reduces transport costs and is therefore expected to positively influence market participation (Eswaran & Kotwal, 1986; Key et al., 2000).

The variables HOSPITAL and MARKET, which refer to the distances to the nearest hospital and market, are included in the analysis to capture the extent of isolation of farming households and level of access to marketing infrastructure. The variables are associated with the per-unit costs of accessing markets, as pointed out by Key et al. (2000) and hence a negative relationship with market participation is expected.

Considering the fixed transaction costs associated with searching for a trading partner, negotiating, bargaining, contracting and enforcing the contract, the variables FARMER GROUP and MARKETING GROUP were included in the analysis. Kirsten and Vink (2005) argue that belonging to a group empowers farmers to bargain and negotiate for better trading terms. Groups are also platforms for farmers to exchange information, especially in places with weak physical infrastructure. A positive relationship between these two variables and market participation is therefore expected.

The variable MALE HEADED is included in the analysis to capture the gender aspect with respect to market orientation. Cunningham et al. (2008) argue that men are likely to sell more due to their acumen in bargaining and in negotiating and enforcing contracts. A positive relationship with market participation is therefore expected for this variable.

The variable EXPERIENCE is included in the analysis to capture aspects relating to social networks and links with market players, which accrue over time. The existence of such links reduces the fixed transaction costs involved in searching for trading partners, contracting, negotiating and enforcing contracts. A positive relationship between the farming experience of the household and market participation is expected.

Other variables which are expected to affect market participation are LAND SIZE and CHILDREN6-17YRS. The land-holdings of the households are mainly linked to the ability to produce a marketable surplus, as pointed out by Key et al. (2000) and Goetz (1992). A positive relationship is expected between farm size and market participation. However, the intensity of land use and productivity may reveal a different relationship. The labor resource endowment of households is critical in determining their ability to produce a marketable surplus. Alene et al. (2008) and Omiti et al. (2009) postulate that household size affects labor supply for production and assume that more food is produced than is consumed. However, only the age bracket 6–17 years is considered in order to avoid the endogeneity biases which may occur as a result of the relationship between market participation and ability to hire labor, presumably of adults above 18 years of age. Since household members in this age bracket can engage in production and marketing activities without pay, a positive relationship is expected between this variable and market participation.

The variables PRICEINFO_NONE and PXINFO_NEIGHBOR, which refer to households having no access to market information and households having access to market information mainly through neighbors, capture the fixed transaction costs associated with information access. A negative relationship is expected between both of these variables and market participation, as argued by Omiti et al. (2009). The two variables are used to identify the Heckman model, such that they enter the selection regression but not the underlying regression (Heckman, 1979; Maddala, 1983).

The rest of the variables in the analysis, i.e. CIBITOKE, GITEGA, KIRUNDO, NORTH KIVU, SOUTH KIVU, BAS-CONGO, EAST, WEST and SOUTHERN, refer to the geographical locations of the households and are intended to capture advantages and disadvantages of the different locations with regard to market participation. The relationships revealed by the results are to be explained by the specific attributes of each of the locations.

4. Empirical results

Table 2 presents the results of the selection regression, which involved the probit analysis of the decision whether to participate in banana markets, and also the results of the underlying regression, which establishes the determinants of the extent of participation. The inverse Mills ratio, λ, is significant in the banana market supply equation, indicating that sample selection bias would have resulted if the banana supply equations were estimated without considering the decision to participate in banana markets.

4.1 The farmer's decision to participate in the market

The coefficients for prices of both the cooking and beer bananas were positive but not statistically significant. The coefficient for the land size variable was positive and statistically significant at the 1% level. This result suggests that there is a positive relationship between a household's land-holdings and its likelihood of participating in the banana market as a seller. This is as expected, since land is a critical production asset having a direct bearing on the production of a marketable surplus, ceteris paribus.

The coefficient for the farmer group membership variable was positive and statistically significant at the 1% level. This result implies that a positive relationship exists between a member of a household belonging to a farmer group and the likelihood of that household participating in banana markets as a seller. As expected, farmer groups can be good platforms for exchanging information, enabling farmers to link to buyers at a lower cost and thereby lowering the fixed transaction costs of market participation.

Table 2: Heckman coefficient estimates for participation in banana markets

The selection regression		The underlying regression	
Dependent variable: BANANA SELLING		Dependent variable: BANANA SALES	
Variable name	**Coefficients**	**Variable name**	**Coefficients**
COOKING BANANA PRICE	0.00948 (0.0621)	COOKING BANANA PRICE	355.54 (158.56)**
BEER BANANA PRICE	0.2075 (0.164)	BEER BANANA PRICE	60.26 (414.05)
LAND SIZE	0.03 (0.009)***	LAND SIZE	0.158 (18.44)
CHILDREN6-17YRS	0.0005 (0.0227)	CHILDREN6-17YRS	108.44 (67.31)*
FARMER GROUP	0.24 (0.098)***	FGRPMEMBSHP	-219.07 (283.3)
MARKETING GROUP	0.269 (0.247)	MARKETING GROUP	486.18 (608.7)
BICYCLE	-0.25 (0.11)***	BICYCLE	816.1(284.7)***
MALE HEADED	0.012 (0.121)	MALE HEADED	-47.17 (291.095)
MARKET	0.0086 (0.01)	MARKET	-25.09 (22.79)
HOSPITAL	-0.0074 (0.46)	HOSPITAL	13.16 (11.817)
EXPERIENCE	-0.044 (0.35)	EXPERIENCE	5.635 (8.803)
PRICEINFO_NONE	-0.62 (0.21)***	CIBITOKE	-648.16 (518.7)
PXINFO_NEIGHBOR	-0.28 (0.11)***	GITEGA	-612.57 (592.5)
CIBITOKE	-0.139 (0.183)	KIRUNDO	55.26 (769.75)
GITEGA	-0.61 (0.15)***	NORTH KIVU	-97.18 (578.57)

KIRUNDO	-0.75 (0.19)***	SOUTH KIVU	-336.74 (406.7)
NORTH KIVU	-0.64 (0.13)***	BASCONGO	-468.66 (938.1)
SOUTH KIVU	0.670 (0.17)***	EAST	234.84 (341.98)
BAS-CONGO	6.07 (0.21)***	WEST	1289.2 (340)***
EAST	0.63 (0.13)***	SOUTH	1199.6 (818.51)
WEST	0.73(0.16) ***		
SOUTH	-0.137 (0.33)		

N=868   (censored obs=395, uncensored obs= 473),   Mill lamba = -206.46 (51.46)***

Wald Test of indep. eqns (rho=0.08643), Wald chi^2 (33) = 136.03   Prob> chi^2 = 0.0000

Note: *, ** and *** denote significance at the 10%, 5% and 1% levels respectively.
Robust standard errors in parentheses.

The coefficient for the bicycle ownership variable is negative and statistically significant at the 1% level. This result is contrary to the expectation that owning a bicycle is positively linked to market participation. However, in a situation where transaction costs are extremely high, ownership of means of transport may not influence the decision to participate in banana markets.

The coefficients for the variables referring to having no access to market information or only accessing information from neighbors were negative and statistically significant at the 1% level. This result is an important indication that access to market information is extremely critical to the market participation decision, as was also observed by Omiti et al. (2009). Households with no access to market information or even those whose main source of market information is their neighbors are not likely to participate in banana markets.

With regard to the geographical locations of the households, negative and statistically significant coefficients at the 1% level were obtained for Gitega, Kirundo and North Kivu Provinces. These provinces are characterized by poor infrastructure, relatively low economic activity and political conflicts, especially North Kivu. These characteristics hugely reduce the likelihood of households participating in banana markets.

4.2 The intensity of market participation

A positive and statistically significant coefficient at 5% level is obtained for the cooking banana selling price variable. Consistent with economic theory (Key et al., 2000; Alene et al., 2008), the positive relationship confirms that price is an incentive to sell. The coefficient for the beer banana selling price is positive but not statistically significant.

The coefficient for the variable referring to the number of household members aged 6–17 years was statistically significant at the 10% level. This result accords with the findings of Alene et al. (2008) that members of a household in this age bracket can contribute to on-farm family labor supply, particularly during non-school-going periods, thereby helping to produce a marketable surplus. They may also engage in some marketing activities at a much lower cost, thus lowering the proportional transaction costs. This argument explains the positive relationship between this variable and the intensity of market participation.

The coefficient for the bicycle ownership variable was positive and statistically significant at the 1% level. This result is consistent with the argument by Key et al. (2000) that ownership of means of transport lowers the proportional transaction costs, thereby enhancing the intensity of market participation.

Turning to the variations in geographical location, we find a positive and statistically significant coefficient was obtained for the variable WEST. This result implies that there is a positive relationship between being located in this province and the intensity of participation. Although the Great Lakes region is generally characterized by high transaction costs, some parts, such as Western Province in Rwanda, have an advantage over the others. This province has Lake Kivu as its boundary on the western side and is located along the Rwandan and DRC frontiers. This strategic location offers this province some unique opportunities in terms of cheap water transport, relatively high economic activity, and greater access to neighboring markets. The cheaper transport option lowers the proportional transaction costs and the exposure to wider markets lowers the fixed transaction costs associated with banana marketing.

5. Conclusions and policy implications

The results of the analysis reveal that market participation is not only a function of the factors of production a household is endowed with; it is also affected by the transaction costs involved in accessing markets for both inputs and outputs. Transaction costs include the costs of searching for a trading partner and making and enforcing a contract.

A household's decision whether or not to participate in a market is largely influenced by fixed transaction costs. The proximity of the market place, source of information and the geographical location of the household in terms of provinces have a direct effect on fixed transaction costs and hence on this decision.

The intensity of participation is influenced mainly by proportional transaction costs. The price of the commodity, availability of family labor, ownership of means of transport and geographic location of the household significantly affect the households' intensity of participation in markets.

Policies geared towards improving physical access to marketplaces and easier access to market information could improve smallholder farmers' participation in markets. Such policies ought to help provide rural infrastructure and improve its quality. Attention should be paid to the following types of infrastructure: construction and maintenance of feeder roads and trunk road networks that connect these areas of production, radio and telecommunication to improve information flow among smallholder farmers, and marketplaces in rural areas. Since marketplaces play a central role in the exchange of goods, especially in developing economies, investments aimed at making such places more available and accessible to a greater portion of the smallholder producers would increase market participation.

Other interventions could include promoting collective action among smallholder farmers to help improve their economies of scale in input and output markets and the information flow among them. This would have a direct impact on their bargaining power and hence increase their participation in markets. Since such interventions can be ably organized by NGOs and

other service providers who support the farmers, policies that favor the operations of NGOs are likely to be effective in bringing more smallholder farmers into the markets.

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