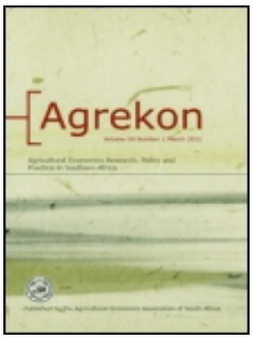

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Drivers of cattle commercialization in rural South Africa: A combined test of transaction cost and store-of-wealth hypotheses

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DRIVERS OF CATTLE COMMERCIALIZATION IN RURAL SOUTH AFRICA: A COMBINED TEST OF TRANSACTION COST AND STORE-OF-WEALTH HYPOTHESES

Jorine Tafadzwa Ndoro[1] and Patrick Hitayezu[2]

ABSTRACT

Empirical studies investigate micro-level determinants of livestock market participation among smallholders from either the transaction cost or the consumption smoothing perspective. Based on the sustainable livelihoods framework (SLF), this study proposes a unifying lens through which key insights from the two perspectives can be conceptually synthesized. Leveraging on the proposed unifying lens, a cross-sectional dataset from a survey of 230 cattle farmers in the Okhahlamba Local Municipality is employed in the analysis of a Double Hurdle model. In line with the transaction cost hypothesis, the preliminary results suggest that education and cattle productivity influence positively the decision to participate in cattle markets, and given positive decision, the supply volume increases with proximity to rural towns. Vindicating the store-of-wealth hypothesis, the results also show a negative effect of access to water sources on the market participation decision, coupled with a positive and negative effects of cattle productivity and expected price, respectively, on supply volumes. The article concludes with some implications for rural development policy in South Africa.

Keywords: market participation, transaction cost, store of wealth, sustainable livelihoods framework, South Africa.

JEL codes: Q12, Q13

1 INTRODUCTION

Market participation is an important ingredient for agricultural and rural development in developing countries. The commercialization of smallholder farming systems has a potential to exploit the comparative advantages of poor agricultural regions and transform their economies through backward and forward linkages (Barrett, 2008; Boughton *et al*., 2007). In addition to the static welfare

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effect of trade according to the comparative advantage school of thought, welfare gains of market participation accrues from (i) larger-scale production opportunities in the face of fixed production costs, (ii) technological change effects of market-based exchanges, and (iii) the associated total factor productivity growth (Barrett, 2008).

The appeal of market participation for fast tracking rural development has attracted the attention of policy makers in South Africa, leading to the development and implementation of strategies to transform the rural livestock sector towards a full-fledged commercial industry (Republic of South Africa, 2010; 2006). However, the policy strategies have scored limited success (Van Schalkwyk *et al*., 2012). Empirical evidence has shown that cattle markets in South Africa are still characterized by low participation rates among smallholder farmers (Coetzee *et al*., 2006; Groenewald and Jooste, 2012; Lehloenya *et al*., 2007; Musemwa *et al*., 2010, 2008). Yet, an estimated 40 % of the total cattle herd size is owned by communal and emerging farmers (Republic of South Africa, 2011), and livestock-based livelihood strategies remain particularly important in marginal and remote areas, with degraded lands and meagre economic opportunities.

Despite this developmental challenge, empirical studies investigating micro-level factors influencing cattle marketing in South Africa remain scanty. A handful of studies such as Bahta and Bauer (2007), Montshwe (2006) and Uchezuba *et al*. (2009) have approached the empirical investigation from a transaction costs perspective (Bellemare and Barrett, 2006; Goetz, 1992; Key *et al*., 2000). Nevertheless, the line of research underscoring the importance of motivational aspects for the determination of livestock market participation outcomes (Doran *et al*., 1979; Dorward *et al*., 2009; Jarvis, 1980; Kazianga and Udry, 2006; Kinyua *et al*., 2011; Lybbert *et al*., 2004; McPeak, 2004; Siegmund-Schultze *et al*., 2011; Turner and Williams, 2002) has been empirically underexploited, despite the widely documented multifunctionality of livestock farming in South Africa (Lehloenya *et al*., 2007; Schwalbach *et al*., 2001; Shackleton *et al*., 2005; Stroebel *et al*., 2011). Moreover, no efforts have been made to draw a conceptual synthesis between these complementary lines of analysis in order to spur the understanding of how motivations interact with market distortions to predict livestock market outcomes.

It is against this background that this study aims to contribute to the understanding of the working of cattle markets in rural South Africa by testing the transaction cost and the consumption smoothing/wealth storage hypotheses in an integrated analytical fashion. To that end, this study proposes an integrating analytical framework for the theoretical predictions of both hypotheses. This unifying lens draws upon the sustainable livelihoods framework (SLF), an analytical framework for poverty analysis that explicitly accounts for farmers'

endowments and their motivations (Chambers and Conway, 1992). This unifying lens is illustrated empirically using the case of Okhahlamba Local Municipality (OLM) in the province of KwaZulu-Natal (KZN). Based on survey data of 230 smallholder cattle farmers, a Double Hurdle econometric technique is used to analyse livelihood factors influencing cattle market participation and supply volumes decisions.

The remainder of this article is subdivided into four sections. Section 2 reviews the two theoretical foundations of livestock market participation and draws an analytical synthesis. Section 3 outlines the empirical strategy to illustrate the proposed unifying framework. Section 4 discusses the results of the empirical model. Section 5 draws concluding remarks with some policy implications.

2 CONCEPTUAL FRAMEWORK

2.1 Livestock market participation under transaction cost

Conceptual studies of transaction cost in smallholder agricultural systems' commercialization emerged out of the realization of failing or missing markets. Starting from the concept on non-separability between consumption and production decisions, studies such as Goetz (1992) and Key *et al*. (2000) attempt to model household marketing behaviour in the context of market failure. The basic idea is to determine the market participation outcome by comparing the utilities obtained from buying, remaining autarkic or selling. Key *et al*. (2000) show how farm households delay their decision to sell until the expected decision price (increasing in the production) is sufficiently high to compensate for fixed transaction cost (pertaining to imperfect information such as the cost of search for customers with good terms and conditions, negotiations, bargaining, screening, enforcement, supervision), leading to higher production threshold levels. They further explain how this situation occurs within the context of an upward shift in supply schedule caused by proportional transaction cost such as transportation and marketing costs.

Within this framework, empirical studies show that shadow prices eventually received are endogenous to farm households themselves. As Barrett (2008) summarizes, the extent of these costs largely depends on household's capability, as defined by its endowment (education, physical infrastructure, social networks) and access to public goods such as extension, roads, and information broadcasting. This endogeneity in price results in an economic system characterized by a coexistence of commercial farmers and subsistence-orientated smallholders who are prevented from fully responding to market incentives (Barrett, 2008).

2.2 Motivation effect in livestock commercialization

In this line of analysis, the focus is given to the indirect relationship between farmers and markets through broader motivations behind livestock farming and market off-take, not just consumption and income generation. Doran *et al*. (1979) and Siegmund-Schultze *et al*. (2011) contend that when the main purpose of livestock farming is not beef or milk production, valuation of livestock is based on the economic functions using investment criteria such as security, profitability, liquidity and tax reduction, or cultural functions such as prestige and status.

So far, under this line of analysis, two major strands exist. On the one hand, the consumption smoothing hypothesis focuses on livestock as a consumption risk mitigation strategy based on its relatively high liquidity. The thrust is meant to spur the understanding of how households adjust the livestock holding through markets, to compensate for fluctuations in incomes caused by socio-economic and environmental hardships (Kazianga and Udry, 2006; Kinyua *et al*., 2011; Lee and Sawada, 2010; Lybbert *et al*., 2004; McPeak, 2004; Turner and Williams, 2002). Therefore, the implicit assumption is that livestock farmers aspire to maintain their current welfare, or livestock farming is a "hanging in" livelihood strategy (Dorward *et al*., 2009).

On the other hand, there is a strand that bases itself on the understanding that livestock is a highly productive and prestigious asset. It contends that livestock farming is a wealth accumulation strategy, and as such, animals can only be sold to allow the farmer to meet his/her pressing cash needs. This reality explains negative relationship between the price and livestock sales (Bellemare and Barrett, 2006; Doran *et al*., 1979; Jarvis, 1980). This point of view supports the "stepping out" or/and the "stepping up" aspirations in the livestock farming, as explained by Dorward *et al*. (2009).

2.3 Sustainable livelihoods framework: A unifying conceptual framework

The two lines of livestock marketing research outlined above, however, are not mutually exclusive, since the effects of the motivation do not introduce market distortions (Jarvis, 1980). As Jarvis (1980) explains, livestock producers choose one benefit over the other, based on their objectives, and without welfare loss. Therefore, the two lines of research can be analytically synthesized in order to exploit their complementarities.

The theoretical predictions of market participation touch different aspects of farmers' livelihoods. The consumption smoothing and/or store-of-wealth hypothesis touches farmers' vulnerability to socio-economic and environmental stresses and shocks (vulnerability context) and the achievement of their livelihoods objectives

(livelihood outcomes), whereas the transaction cost is mainly determined by farmers' endowments/assets. In the rural development scholarship, these aspects constitute the key components of the sustainable livelihoods framework (SLF), an analytical tool used in poverty research and interventions (Chambers and Conway, 1992).

Integrating both concepts of livestock marketing in the SLF can ensure a holistic assessment of the livelihood factors constraining market participation among smallholder farmers, thereby enabling the microeconomic frameworks to extend the range of their contribution, from a narrow focus to agricultural marketing, to the wider field of rural development.

Within this framework, an explicit emphasis on the markets was introduced into the sustainable livelihoods approach by Dorward *et al*. (2003) in order to identify the livelihood opportunities and constraints emerging from critical market processes. Although the analytical synthesis of Dorward *et al*. (2003) reflects only the core macro or meso-level influences and processes, its innovative thinking can be used as a starting point to adjust the SLF for the micro-level theoretical predictions of livestock market participation as schematized in Figure 1.

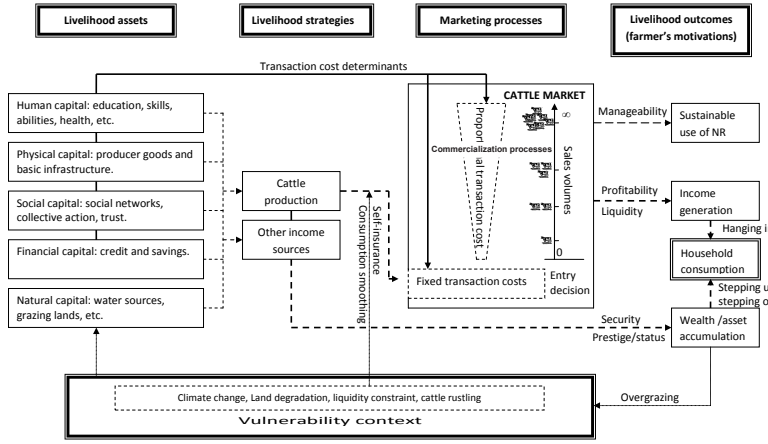

Figure 1: Sustainable livelihoods framework for livestock market participation analysis

Source: Adapted from Dorward et al. (2003)

The arrows represent the core influences within the framework. They are differentiated by the styles. The solid arrows represent the theoretical predictions under the transaction cost perspective, and the dashed arrows stand for the consumption smoothing hypothesis. The square-dotted arrows represent influences that are out of scope of this study.

The figure encompasses five components of the SLF. The vulnerability context includes the external sources of livestock farmers' stresses and shocks. The livelihood assets (pentagon) include the endowments upon which cattle farmers make their living. The livelihood strategies sphere encompasses production of livestock and availability of other sources of incomes. The livestock commercialization process is characterized by constrained access in the form of unobservable fixed and proportional transaction cost. The livelihood outcomes (or farmers' motivations) consist of the economic functions of livestock production proposed by Siegmund-Schultze *et al*. (2011). Profitability is defined in terms of returns on investment (sale price and yield minus production and transaction costs), liquidity in terms of ease of converting the stock into cash, and security as the preservation of the nominal value invested in the livestock. To these economic functions, the framework adds prestige/status (cultural function) (Doran *et al*., 1979) and manageability (Bellemare and Barrett, 2006) .

The core influences and processes in the framework are depicted by arrows. The dashed arrows, on the one hand, depict the influence of farmers' motivations on their relationships to the market. The five motivations and their respective objectives are drawn in the livelihood outcomes sphere. The theoretical expectations are as follows: (i) livestock farmers use market outlets as a stock regulation mechanism, based on prevailing characteristics of their biophysical environment (Lybbert *et al*., 2004; Turner and Williams, 2002); (ii) if livestock is farmed for commercial purposes (such as beef or milk production), the prevailing market price determines the number of animal to be sold in order to maximize the profitability; (iii) the relatively high liquidity of livestock induces farmers to use livestock as buffer stocks against unforeseen stresses and shocks accruing in the livelihood vulnerability context, causing farmers to sell their livestock to meet immediate consumption needs whenever a risk unfolds; (iv) when livestock is the main investment that generates streams of incomes in the future, or when herd sizes are important determinants of prestige and social status, the presence of alternative income sources will divert farmers out of the markets.

In unpacking the commercialization process, on the other hand, the solid arrows in the framework depict the indirect effect of farmers' livelihood assets on market participation and supply volumes decisions, via transaction cost. The

extent of (unobservable) transaction costs is endogenously determined by the level of access to livelihood assets such as human, social, and financial capitals, as farmers capitalize on these assets to access market information, search for customers, negotiate better conditions and enforce the contracts (Barrett, 2008).

The square-dotted arrow depicts a feedback loop in the model (a consideration that is beyond the scope of this study). For example, livestock accumulation for the store of wealth motive leads to overgrazing, particularly in the communal grazing systems (Doran *et al*., 1979), causing severe land degradation, thereby affecting the productivity of livestock in the long run (Jarvis, 1980).

3 EMPIRICAL ILLUSTRATION

3.1 Data

To illustrate the unifying analytical lens schematized in the previous section, this study uses household survey data collected in the Okhahlamba Local Municipality, a 344 000ha municipality in the uThukela district of the KwaZulu-Natal province. The 2007 population census indicates that the municipality is inhabited by 151 414 people or 28 508 households, the majority of which are traditional households (56%), illiterate (38%), and communal lands dwellers (Okhahlamba Local Municipality, 2012). As reported in various municipality's reports, economic conditions are harsh in this area, such that around 36% of households do not receive any income, while 37% earn less than R9 600 (around US$1 100) per annum (Okhahlamba Local Municipality, 2012).

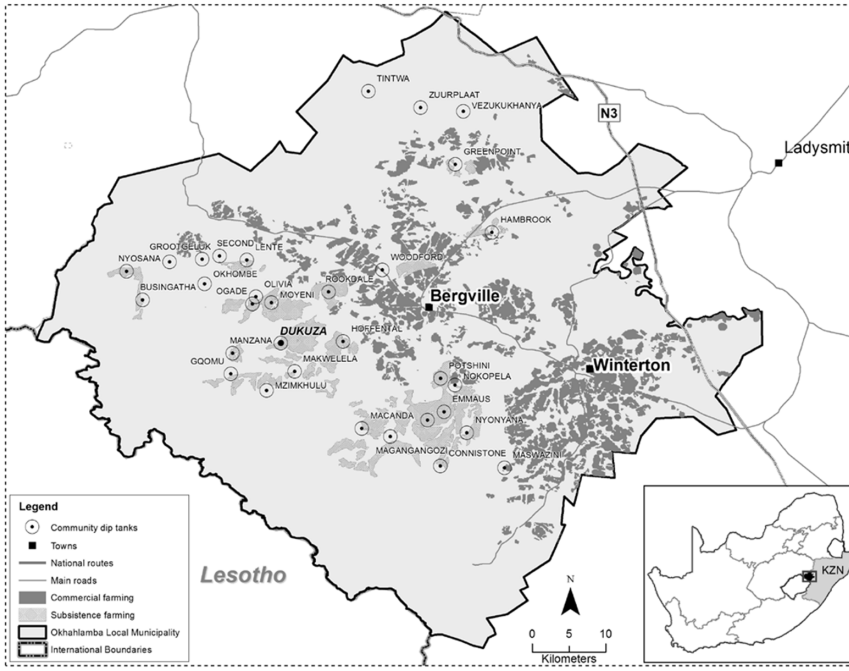

Figure 2. Land use map of the Okhahlamba Local Municipality showing dip tanks

Source: Authors - based on land cover dataset provided by the Ezemvelo KwaZulu-Natal Wildlife (http://www.bgis.sanbi.org/kzn/landcover.asp).

As the land use map in Figure 2 shows, commercial and subsistence farming coexist in this region, although geographically separated (a legacy of the segregationist apartheid regime). Smallholder farmers mainly engage in maize, vegetable, and livestock production, and occupy the marginal areas around the foothills of the Drakensberg mountain chain. These areas are characterized by low-fertility lands (Elleboudt, 2012). Although only 22% of the economically active population engage in agriculture (Okhahlamba Local Municipality, 2012), 55% of households living on communal land reportedly engage in livestock farming, mainly consisting of cattle, goats and sheep (Elleboudt, 2012).

Mixed livestock-crop farming system is a particular feature of agriculture on the foothills of the Drakensberg. A common grazing system is scheduled such that cattle is sent uphill during the cropping season (summer), while all the land becomes grazing land off-season (winter) (Elleboudt, 2012). This pattern creates overstocking tendencies. The area also experiences harsh climatic conditions,

characterized by an interchange of drought conditions in the summer season and heavy snow during winter (Elleboudt, 2012).

Extension workers from the provincial Department of Agriculture (DoA) play a major role in the livestock sector development in the area. Their interventions include the development of livestock farmers' organizations, pastures, veterinary services, dip-tanks, and marketing facilities. Under the auspices of the livestock extension office at the DoA, around 31 dip-tanks have been constructed and are currently operational in the area (see Figure 2). All cattle farmers are members of the Dip-tank Users Associations (DUAs), although the use of the facility is charged minimally. Extension workers are also responsible for the scheduling of cattle auctions (also known as "dip-tank sales") at the Dukuza dip-tank.

The collection of data in this area was performed in two phases spanning from May 2012 to February 2013. In the first phase, the researchers conducted participatory rural appraisals (PRA), consisting of key informant interviews with the extension personnel and focus group discussions with some knowledgeable members of various DUAs, through their parent cooperative, the Okhahlamba Livestock Cooperative (OLC). The information gathered during this phase was used to structure a household survey questionnaire that was pilot-tested and administered by trained field enumerators.

A two-stage random sampling procedure was used to select the interviewed households. Twelve DUAs were first randomly selected, and then members of each selected DUA were randomly sampled with probability proportional to size. In total, 230 heads of cattle farm households were interviewed. The selected sample turned out to be representative of other regions of the country, as 48% of interviewed farm households had reportedly engaged in the cattle market as sellers over the past three years. This market participation rate is consistent with the figure reported by surveys conducted in other parts of South Africa (e.g. Musemwa *et al*., 2010).

3.2 Econometric model

Sample selection models are appropriate to the empirical analysis of agricultural market participation behaviours under transaction cost (Alene *et al*., 2008; Bellemare and Barrett, 2006; Goetz, 1992; Key *et al.*, 2000). Therefore, to estimate the influence of livelihood factors on the participation and supply outcomes, this study adopts the Double Hurdle (DH) econometric technique proposed by Cragg (1971). Under this empirical strategy, a cattle farmer has to cross two hurdles to become a participant in the cattle market. First, the farmer becomes a "potential participant" after crossing the first hurdle, that is, after making a positive decision; and given that he/she is a potential participant, livelihood factors will determine his actual/observed level of participation (the second hurdle). Therefore, the DH

model is a two-equation framework (Hitayezu *et al.*, 2014; Matshe and Young, 2004; Moffatt, 2005), as depicted in the equation (1).

Let I_i^* denote a binary choice variable. Let Q_i^{s*} be a latent variable reflecting the number of cattle sold (therefore the observed variable, Q_i, being determined as $Q_i = I_i^* \cdot Q_i^{s*}$). In equation (1), Z and α are vectors of factors explaining the decision of participation and their relative influences, respectively, whereas X and β are vectors of factors explaining the intensity of participation and their relative influences, respectively. The DH model can be written as follow:

$$\begin{aligned} I_i^* &= Z_i'\alpha + \varepsilon_i \quad \text{first hurdle} \\ Q_i^{s*} &= X_i'\beta + \mu_i \quad \text{second hurdle} \end{aligned} \tag{1}$$

where the error terms (ε_i and μ_i) are such that $\begin{pmatrix} \varepsilon_i \\ \mu_i \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & 0 \\ 0 & \sigma^2 \end{pmatrix}\right]$, i.e. assumed to be independently distributed.

Following Moffatt (2005), the log-likelihood function for the DH model is:

$$LogL = \sum_0 \mathbf{h}\left[1 - \Phi(Z_i'\alpha)\Phi\left(\frac{X_i'\beta}{\sigma}\right)\right] + \sum_+ \mathbf{h}\left[\Phi(Z_i'\alpha)\frac{1}{\sigma}\phi\left(\frac{(Y_i - X_i'\beta)}{\sigma}\right)\right] \tag{2}$$

The analysis of marginal effect helps to assess the impact of the exogenous variables on the dependent variable. To do so, the unconditional mean is decomposed into the effect on the probability of participating and the effect on the conditional level of participation and differentiating these components with respect to each explanatory variable. The unconditional mean can be written as:

$$E[Q \mid X_i] = P(Q_i > 0) \cdot E(Q_i \mid Y_i > 0) \tag{3}$$

The probability of market participation and the expected number of cattle sold conditional on participation are:

$$P(Q_i > 0) = \Phi(Z_i'\alpha)\Phi\left(\frac{X_i'\beta}{\sigma}\right) \quad (4)$$

and

$$E(Q_i \mid Q_i > 0) = \Phi\left(\frac{X_i'\beta}{\sigma_i}\right)^{-1} \int_0^{\infty}\left(\frac{Q_i}{\sigma_i\sqrt{1+\theta^2 Y_i^2}}\phi\left(\frac{T(\theta Q_i) - X_i'\beta}{\sigma_i}\right)\right) Yd_i \quad (5)$$

3.3 Model estimation

To estimate the effects of livelihood factors on market participation decisions (Equation 4), this study uses a Probit regression model. The intensity of participation levels, the second stage (Equation 5), is estimated using a truncated regression model (Wooldridge, 2002). Prospective explanatory variables were short-listed based on the information gathered during the PRA phase as well as theoretical predictions of both transaction cost and wealth storage hypotheses. While observing the principle of parsimony and randomness, a prospective variable was selected for the regression based on the significance of its contribution to the improvement of the model's fit, that is, the Log-Likelihood ratio (LR) test (Wooldridge, 2002). This technique is meant to ensure that the selected variables give the best model fit.

Table 1. Description of independent variables and T test of equality of means

Variable category, SLF component, and variable name	Variable description	Measurement	Value labels	Mean (117 Non-participants)	Mean (113 participants)	Independent-samples T-test (p-value)
Dependent variables						
MARKPART	Decision to participate in cattle market during the last three years	Dummy	1 = the household has participated in cattle market as a seller, and 0 = otherwise.			
TOTSOLD	Number of cattle sold over the period spanning from 2010 to 2013	Count				
Independent variables						
Vulnerability context						
SNOWLOSS	Experience with cattle deaths resulting from heavy snow over the period spanning from 2010 to 2013 (an indicator of income smoothing)	Dummy	1= the household experience cattle death attributable to heavy snow fall over the last three years; 0= otherwise.	0.40	0.50	.031
Access to asset						
GENDERHHH	Gender of the head of the household	Dummy	1= male headedness; 0=female headedness	0.77	0.77	.896
SIZEHH	Number of persons living in the homestead – an indicator of cash needs	Count		9.05	9.35	.447
EDUCHHH	Level of education achieved by the head of household	Categorical	0= Never went to school; 1= Went to primary school; 2= Went to secondary school; 3= Matriculated; 4= Received tertiary education	1.23	1.55	.000
VEHICLEOWN	Vehicle ownership	Dummy	1= the household owns a vehicle; 0= otherwise	0.37	0.35	.584
DISTAUCT	Road distance (in km) from the dip-tank used to the cattle auction market	Continuous		20.42	21.39	.111
DISTBERGVILLE	Road distance (in km) from the dip-tank used to the Bergville town	Continuous		23.96	24.26	.346

DISTWATER	Walking distance (in minutes) between the homestead and the nearest cattle water source	Continuous		13.35	22.89	.000
Livelihood strategies						
CATTLEBREED	Type of breed owned by the farmer	Categorical –Ordinal	0= Pure Ngunis; 1= Mixed	0.74	0.73	.766
HERDSIZE	Total number of cattle owned at the time of survey	Count		8.96	14.55	.000
UNEARNEDINCR	The importance of remittances and pensions among 5 regular sources of income (including incomes from cattle sales, sales of other farm products, non-farming activities wages, non-farm self employment)	Categorical – Ordinal	1 = least important ~ 5= most important	3.42	2.68	.408
Livelihood outcome						
EXPPRICE	The sum of community's cattle revenues from farm gate and speculator sales divided by the number of cattle sold by that community	Continuous		5592.31	5485.44	.755
Inverse mills ratio (IMR)	The standard normal probability distribution function over the standard normal cumulative distribution function of the predicted probabilities	Continuous				

Source: Authors' survey, 2012-2013

Following the design of the SLF, the variables selected for empirical estimation are described in Table 1. Based on the T-test for equality of means, the table shows that interviewed farmers in the market participant group had more experience with cattle deaths resulting from heavy snow and were more educated than their counterparts. The table further shows that interviewed participants walked about 8 more minutes to a nearest source of water and owned about 6 more animals compared to non-participants. SPSS 15.0 and Stata 11 software packages were used for data management and data analysis, respectively.

4 RESULTS AND DISCUSSIONS

The estimation results of the Double Hurdle model are presented in Table 2. Overall, the variables used in the model seem to give a good fit. The null hypothesis that "the influence of all variables are jointly or simultaneously equal to zero" is rejected at 0% significance level (Prob > chi2 = 0.000). For the intensity model, self-selection bias is corrected for each participating household by generating an Inverse Mills Ratio (IMR) from predicted probabilities of the Probit model and subsequently including it as an explanatory variable in the truncated regression (Wooldridge, 2002). The coefficient of the IMR variable turns out to be insignificant in the intensity model, suggesting that self-selectivity bias is not an issue. Multicollinearity is tested based on the correlation matrix in Table 3. As the table suggests, multicollinearity is not a serious problem in the data.

Table 2. Double-Hurdle Estimation Results

	Participation in cattle market (equation (4))		Quantity of cattle sold (equation (5))	
Variable	Marginal effects	P-value	Coefficient	P-value
Vulnerability context				
SNOWLOSS	0.0304	0.679	-0.210	0.926
Livelihood assets				
GENDERHHH	-0.095	0.248	-2.848	0.442
SIZEHH	0.003	0.636	-0.235	0.321
EDUCHHH	0.074	0.049	2.502	0.180
VEHICLEOWN	-0.112	0.138	2.340	0.457
DISTAUCT	-0.002	0.512	0.062	0.561
DISTBERGVILLE	-0.006	0.306	-0.407	0.020
DISTWATER	0.003	0.014	0.004	0.951
Livelihood strategies				
CATTLEBREED	-0.113	0.161	0.965	0.797
HERDSIZE	0.019	0.000	1.189	0.001
UNEARNEDINCR	-0.086	0.000	-1.409	0.506
Livelihood outcomes				
EXPPRICE	-0.000	0.122	-0.005	0.013
IMR			19.757	0.203
Constant			4.704	0.712
	Number of obs	= 229	Number of obs	= 114
	Wald chi2(12)	= 47.57	Wald chi2(14)	= 50.73
	Prob > chi2	= 0.000	Prob > chi2	= 0.000

Data source: Authors' survey (2012 – 2013)

Table 3. Correlation matrix for independent variables used in the econometric model

	SNOWLOSS	GENDERHHH	SIZEHH	EDUCHHH	VEHICLEOWN	DISTAUCT	DISTBEGVILLE	HERDSIZE	CATTLEBREED	DISTWATER	UNEARNEDINCR	EXPPRICE
SNOWLOSS	1.000											
GENDERHHH	0.073	1.000										
SIZEHH	0.047	-0.088	1.000									
EDUCHHH	-0.024	0.038	0.069	1.000								
VEHICLEOWN	-0.111	-0.005	0.159	0.120	1.000							
DISTAUCT	-0.081	-0.164	0.097	0.042	-0.061	1.000						
DISTBERGVILLE	0.130	0.195	-0.183	-0.010	0.019	-0.409	1.000					
HERDSIZE	0.213	0.145	0.113	0.179	0.176	-0.037	0.158	1.000				
CATTLEBREED	0.043	-0.025	0.104	0.028	0.011	-0.036	0.011	0.122	1.000			
DISTWATER	0.010	0.072	-0.093	0.059	-0.097	-0.176	0.078	0.078	0.185	1.000		
UNEARNEDINCR	0.001	0.006	0.000	-0.021	-0.045	-0.198	0.015	-0.134	0.003	0.057	1.000	
EXPPRICE	-0.033	-0.055	0.151	0.017	-0.016	-0.219	-0.326	-0.007	0.019	0.091	-0.009	1.000

Data source: Authors' survey (2012 – 2013)

On livelihood assets, Table 2 shows that the estimated effect of education is positive and significant in the Probit model. As the marginal effect suggests, completing one extra level of education increases a farmer's chance of participating in cattle markets as a seller by 7%, *ceteris paribus*. The significant negative effect of the distance to Bergville in the truncated model suggests that, once a positive participation decision is made, supply volume increases with proximity to rural towns. Consistent with the theoretical predictions of Goetz (1992) and Key *et al*. (2000), as well as the empirical findings of Bellemare and Barrett (2006) and Uchezuba *et al*. (2009), these results infer that smallholder cattle farmers in OLM do capitalize on their skills base (including the managerial, financial, bargaining, and supervision skills) and market and infrastructure amenities when deciding to participate in the cattle market and the number of cattle to be sold, respectively. These two effects verify the fixed and proportional transaction costs hypotheses.

On natural capital, the results of the Probit model show a positive and significant coefficient of the walking distance (in minutes) to the nearest source of water, suggesting that farmers facing the challenge of access to water have more chances of participating in the cattle market as sellers. This result infers that market participation serve as a tool to regulate the herd size, that is, smallholder farmers sell their cattle in order to limit the herd to manageable sizes (Bellemare and Barrett, 2006). This finding is consistent with empirical evidence showing that livestock markets facilitate destocking of animals during periods of harsh environmental conditions such as droughts (Turner and Williams, 2002).

With regard to the livelihood strategies, the estimation results in Table 2 indicate that cattle market participation and supply decisions are significantly and positively influenced by cattle productivity. Adding one animal to the herd increases the likelihood of participating in the cattle market as a seller by 2%, *ceteris paribus*. The positive effect of herd size in the participation model portrays the relatively high production threshold required to make cattle farmers better off selling their animals than remaining autarkic within the context of transaction cost (Key *et al.*, 2000). The effect of the herd size in the intensity model suggests that livestock marketing is used to regulate the stock size (Lybbert *et al*., 2004; Turner and Williams, 2002) and validate the effect of access to water in the participation model. These results vindicate previous empirical findings in South Africa (Bahta and Bauer, 2007; Makhura, 2001; Montshwe, 2006) and elsewhere (Bellemare and Barrett, 2006), showing that livestock market participation is associated with its productivity.

The results of the Probit model also show a negative marginal effect of unearned incomes. Its significance suggests that cattle farmers relying more on unearned incomes (such as transfers and social grants) for their livelihoods are not likely to participate in the cattle market as sellers. Although this result is contrary

to what Lapar *et al*. (2003) found in the Philippines, it is in line with the walking bank hypothesis of livestock marketing (Bellemare and Barrett, 2006). It suggests that market participation decisions are driven by the need to cater for pressing household needs when cash is not otherwise available.

Regarding farmers' motivations, the coefficient of the expected price variable is only significant in the supply model, suggesting that price responses only affect marketed volumes, but not the household's relationship to the market. Consistent with the findings of a previous study by Alene *et al*. (2008), the sample evidence therefore suggests that cattle farmers are likely to consider market price signals only when deciding upon the number of cattle to be supplied to the market. However, the effect of price on sales volumes turns out to be negative in the truncated model. This result infers that the store-of-effect effect is significant among cattle farmers in the area. It suggests that once a smallholder farmer has taken the decision to sale cattle, he/she will sell only as many cattle as are necessary to cater for pressing cash needs, given the prevailing price (Bellemare and Barrett, 2006; Doran *et al*., 1979). This result vindicates the findings of other studies within the livestock marketing research such as Doran *et al.* (1979), Bellemare and Barrett (2006) and Turner and Williams (2002). It supports the contention by Dorward *et al*. (2009) that livestock farming is a stepping-up strategy meant to expand livestock farming activity or to undertake other activities requiring lumpy investments costs in order to improve the livelihoods of the farmer.

5 CONCLUSION AND POLICY IMPLICATIONS

The integration of smallholder farmers in the market economy is a considerable challenge to the agricultural and rural development policy in South Africa. Although livestock production remains a key livelihood strategy for a significant portion of rural South Africans, empirical evidence shows that livestock markets are characterized by lower off-take rates among smallholder farmers in the communal land areas. This paper attempts to make a modest contribution to the understanding of micro-level drivers of cattle marketing by proposing the SLF as an integrative framework for analysing transaction cost and store-of-wealth effects on cattle commercialization. Based on household survey data collected in Okhlahlamba Local Municipality, this unifying lens is quantitatively tested using the Double Hurdle econometric estimation technique.

Leveraging on this unique lens, the preliminary results provide a unique insight into smallholder livestock commercialization behaviour in rural South Africa. On the one hand, the results show positive and significant effects of education and herd size in the Probit model, vindicating the fixed transaction cost hypothesis. The results also show positive and significant effects of proximity to rural towns in the truncated model, supporting the proportional transaction cost hypothesis.

On the other hand, the importance of store-of-wealth effect in cattle marketing is revealed by a significantly negative effect of access to water in the participation model, coupled with positive effect of herd size and negative effect of expected price variables in the truncated model. These findings thus suggest that in rural South Africa, wealth tends to be accumulated in cattle, but not immobilized, as commercialization helps smallholder farmers limiting their herds to manageable sizes, particularly when they face lower market transaction costs.

These findings have profound implications for the rural development strategy in South Africa. The empirical evidence that access to various livelihood assets has a positive effect on cattle market participation supports an integrated rural development approach to cattle commercialization in South Africa. This advocates for continued investments by stakeholders in the rural areas, with concurrent focuses on capacity building, infrastructure development, and natural resource management. Moreover, policy makers and other stakeholders need to be mindful of the wealth storage motive among cattle farmers in South Africa when designing livestock commercialization strategies. This requires the promotion of alternative and more attractive investment opportunities in the rural areas such as land title deeds.

Nevertheless, it is noteworthy that, given the limited scope of this study, the empirical basis of these recommendations needs to be furthered and reassessed in different ways. Methodologically, comparison of findings at different times and spaces sounds desirable for lending credence to the results and giving additional insights for policy. For example, although the results reveal that increased cattle productivity is expected to alleviate transaction costs, there is a need for empirical investigations into the cost-effective and efficient ways of combining resources in producing cattle in the rural South Africa. Such endeavours can validate the robustness of these findings.

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