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Analysis of the determinants of the sustainability of cattle marketing systems in Zambezi Region of north-eastern communal area of Namibia

B. Thomas*, C. Togarepi and A. Simasiku

Department of Agricultural Economics and Extension, University of Namibia, Private Bag 5520 Oshakati, Namibia.

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This article aims to contribute to a better understanding of variables that influence the motivation behind the preferred choice of cattle marketing channels in north eastern communal area of Namibia. The data required for the study were collected through a small-scale survey, key informants in-depth interviews and review of secondary data were analysed using Multinomial Logistical Regression. The results showed that the majority (62%) of small scale cattle farmers preferred to trade through informal marketing channel (comprising open market, private sales and butcheries). The abattoir was the single most preferred channel for 38% and the only available formal market. Four factors are identified motivating cattle farmers to choose this marketing channel namely, the gender of the household head, marketing information received, education and number of livestock sold. The results also suggest that formal marketing is relatively relevant to farmers with large cattle numbers and meet the required standards from abattoirs. The study recommended that in order to increase the number of cattle marketed through the formal channels, there is need to improve overall herd size, as well as setting attractive prices coupled with reduced delays in making payments to the farmers for their livestock sold.

Key words: Formal market, informal market, factors, sales, agriculture, livestock.

INTRODUCTION

In many rural communities, cattle rearing and marketing makes an important contribution to family food supplies and provides critical support to agricultural production. Cattle farming is very important to farmers living in rural areas as it provides milk, meat, hides, horns and income to meet family financial needs such as school fees and other household expenses as well as source employment, collateral and insurance against natural calamities, dung for manure and draught power for cultivation of crops and transport of goods (Musemwa et al., 2008). In rural communities livestock farming is perceived as a symbol of wealth, social status, prestige and a safeguard against crop failure especially during drought or flood seasons. Socio-cultural functions of cattle include the use of cattle as bride price and to settle disputes (as fine) in communal areas (Chimonyo et al., 1999). Cattle are also reserved for special ceremonial gatherings such as weddings, funerals and circumcision (Musemwa et al., 2008). More importantly, indigenous cattle are valuable reservoirs of genes for adaptive and

*Corresponding author. E-mail: dengeinge@gmail.com or bthomas@unam.na. Tel: +264 65 223 5375.

economic traits, providing diversified genetic pool, which can help in meeting future challenges resulting from changes in production sources and market requirements (Chimonyo et al., 1999).

Moreover, livestock production especially cattle in communal areas in sub-Saharan Africa is constrained by a variety of factors that lead to low productivity. These include shortages of good quality livestock feed during the dry season, high incidences of diseases and mortality rates, unavailability of or access to healthy water (Mutibvu et al., 2012). Water points are sometimes limited and large numbers of animals use the same points leading to high chances of spreading diseases and land degradation. Other factors include the failure of government services to provide veterinary health services, poor housing, low soil fertility for forage production and weak market chains for livestock and livestock products (Mutibvu et al., 2012). Kapimbi and Teweldemedhin (2012) also added extreme climate conditions such as floods and droughts and manmade factors such as livestock theft and careless starting of fires.

In Namibia cattle, goats, sheep and pigs contribute 76% of the national agricultural output value, whereas 6% comes from communal areas (NDP4, 2012). According to the 2012 livestock census, Namibia has a total of 2.9 million cattle of which 1.4 million are found in the Northern Communal Areas (NCAs) of which Zambezi region has 136 221and the rest are south of the Veterinary Cordon Fence (VCF) which constitutes the World Organization for Animal Health recognized Foot and Mouth Disease (FMD) Free zone status (Meat Board of Namibia, 2012). Cattle farming in Namibia is the main agricultural production sector in the country of which the value of production is annually estimated at N$900 million, and of which approximately N$400 million is being contributed by live weaner exports to South Africa (Meat Board of Namibia, 2007).

Currently the VCF split Namibia into distinct animal disease control zones. The VCF divides the north central which is FMD protected and the north east which is FMD prone area from the south which is FMD free zone. Meat and livestock cannot pass freely over the VCF into southern FMD free zone which makes the marketing of cattle very difficult (Düvel and Stephanus, 2000). Approximately, 60% of livestock in Namibia remain north of the VCF as a result they are excluded from the lucrative world markets such as that of European Union (EU) (NDP4, 2012).

Moreover, marketing should play a vitally important role in the process of transforming small scale farmers into commercial producers (Coetzee et al., 2005). Yet it is important to note that the marketing channels available to small-scale producers are still limited due to their relative small size (Schmitz et al., 2003). According to Kruger and Lammerts-Imbuwa (2008) cattle producers in the NCAs have an option to sell their cattle to the formal (mainly to the government-owned parastatal MeatCo) or informal market (indigenous market) (De Bruyn et al., 2001). Formal marketing channel includes selling at abattoirs and auctions while informal marketing includes selling to small butcheries, fellow farmers, individual speculators and bush marketing. The decision to sell in the informal market, formal market or combinations depends on the transaction costs incurred during the sale of animals (De Bruyn et al., 2001). Notably, the participation in the marketing system has more to do with the number of cattle owned (Hangara et al., 2012; Enkono et al., 2013). According to Nkosi and Kirsten (1993) the apparent reason for selling cattle amongst farmers in developing countries is emergency sales. This is so because cattle sales emerge from economic circumstances that compel owners to sell in order to obtain sufficient money to purchase pressing needs (Nkosi and Kirsten, 1993). There is a need, however, to promote informal market participation in order to increasingly recognize the efforts of bringing about agricultural change in Namibia since traditionally, farmers sell cattle when they need money (Shiimi et al., 2010).

For cattle producers in the NCAs to qualify to market their cattle to formal market e.g. MeatCo, it is a prerequisite that their cattle have to be kept in quarantine camps for diseases (mainly FMD and Contagious bovine pleuropneumonia (CBPP) or lung sickness) inspection for a period of 21 days before slaughtering and their meat products enters the south of VCF in Namibia or the Republic of South African market. However, access to formal markets is limited by a number of factors, chiefly of which are the distance from the market and inadequate marketing infrastructures. For example only two MeatCo abattoirs, at least 1000 km apart exist in NCAs which are certified for beef export to mainly South Africa namely Oshakati in north central and Katima Mulilo in north east of the country (Kruger and Lammerts-Imbuwa, 2008).

Cattle quarantine is associated with high transaction costs in the formal markets because cattle often lose condition (that is, weight and grading in the quarantine camps due to insufficient feed causing low prices (Kirsten, 2002) as well as due to long distances producers have to transport animals to quarantine camps (Kapimbi and Teweldemedhin, 2012). Makhura (2001) argues that poor condition of livestock also results in farmers getting low farm gate prices especially during dry conditions (drought years). The age of animals is also important as farmers tend to sell older animals and equally contributes to poor prices (Nkosi and Kirsten, 1993). Cattle farmers prefer selling older cattle because the younger ones (females) are used for breeding purposes. Due to lower livestock prices in rural areas farmers more often, refuse to sell their cattle to formal markets. The biggest challenge to livestock farmers in the communal area is lack of capacity building in satisfying the buyers' quality expectations and understanding the marketing system in general (Kapimbi and Teweldemedhin,

2012). In Namibia the lack of disease-free status in the NCAs and limited market access also restricts farmers to informal marketing of cattle and their products (MCA Namibia, 2013). Animal health issues are barriers to trade in livestock and their products, whilst specific diseases decrease production and increase morbidity and mortality (Düvel and Stephanus, 2000). The main diseases include anthrax, FMD, black-leg and CBPP. Furthermore, farmers often have inadequate or no insurance coverage on livestock. Additionally, as earlier stated meat and livestock cannot pass freely through the VCF into the southern FMD free zone of Namibia. As a result this complicates the domestic marketing of livestock (cattle) from the NCAs. The estimated average off-take rate in the NCAs is only 7%, compared to 25% in the regions south of the VCF (MCA Namibia, 2013).

The importance of looking for ways to successfully contribute to insights in livestock production and marketing has been covered by several studies in NCAs of Namibia (Düvel and Stephanus, 2000; De Bruyn et al., 2001; Teweldemedhin and Conroy, 2010; Shiimi et al., 2010; Kapimbi and Teweldemedhin, 2012; Enkono et al., 2013). The objective of this study was to contribute to a better understanding of variables that influence the preferred choice of cattle marketing channels in north eastern communal area of Namibia. Thus, the paper will suggest sustainable cattle marketing strategies that would help to improve a supportive institutional environment that ensure agricultural development and economic performance of farmers in communal areas.

MATERIALS AND METHODS

Description of study area

The study was conducted in two villages of Bukalo and Ngoma in Katima Mulilo Rural Constituency of Zambezi region. The Katima Mulilo Rural Constituency surrounds the administrative town, Katima Mulilo in Zambezi region. The constituency has an estimated population of around 16200 people and covers an area of 1952 km^2 (NSA, 2012). The natural environment is mainly dominated by wetlands, woodlands and wildlife. The average annual rainfall in this region is between 600 and 800 mm. Droughts and floods are common in the region. The main farming activities include fishing, cultivation of crops, livestock production (mainly cattle, goats and chicken) and harvesting of indigenous plant products that is, fruits. The region is also dominated by high incidence of cattle diseases such as FMD and CBPP.

Data collection

The data required for the study were collected through a small scale survey, key informants in-depth interviews and review of secondary data. A structured questionnaire consisting both open and closed types of questions to generate detailed information on factors that could influence farmers cattle marketing choices was used. The survey questionnaire was designed to cover the following topics with respect to the study objective: household characteristics, number of cattle owned, farming experience and cattle marketing opportunities and constraints in the interview. A total of 50 farming households who are small scale cattle farmers (owners) were interviewed using a purposive sampling "snowballing" method. The snowballing method identifies cases of interest from people who know people that are information-rich, that is, good examples for study and good interview subjects (Patton, 1990, cited by Milagrosa, 2007). Although the purposive sampling method has some disadvantages such as being highly prone to researcher bias and the sample may not represent the entire population, this method was deemed appropriate given the lack of a farmer database system for the study units.

In addition to the questionnaires, secondary sources of data both published and unpublished information were reviewed. These desk review sources included scientific journal articles, books, newspapers articles and reports. In order to augment the survey data and secondary data, discussions were held with key informants (experts) to get more insight into the study area and to understand previous conducted research and development works. This list included traditional leaders, extension officials, marketing agencies, cattle buyers and researchers.

Data analysis

The quantitative data collected by the structured questionnaire survey were systematically coded and analysed using descriptive statistics of the International Business Machines (IBM) Statistical Package for Social Sciences (SPSS) version 21.0 for windows (2013). As earlier stated the qualitative data generated by the discussions with key informants (experts) were used to substantiate and augment the results from the survey data. The study used the Multinomial Logistical Regression (MLR) to determine the factors that are likely to influence the choice of farmers on whether to use formal or informal livestock marketing channels. MLR can create a profile of factors likely to influence the choice of a particular market. The model was specified as:

$$f(k,i) = \beta_{0,k} + \beta_{0,k}X_{1,i} + \cdots + \beta_{m,k}X_{m,i} \quad (1)$$

MLR uses linear predictor function to predict probability that observation *i* has outcome *k*, where $\beta_{m,k}$ is a regression coefficient associated with the m^{th} explanatory variable and the k^{th} outcome. The general empirical model is specified as follows:

$$\ln \frac{Pr}{Pr}\left(\frac{Y_i=K-1}{Y_i=K}\right) = \beta_{k-1}.X_i \quad (2)$$

There are four possible dependent outcomes namely, open market, abattoir, private sales and butcheries. The abattoir is chosen as the pivot outcome K, while open market, private sales and butcheries (K-1) are the outcomes regressed against the pivot outcome. B_{k-1} are the regression coefficients for the possible outcomes and X_i are the independent explanatory variables.

Thus three empirical independent binary regressions can be derived as:

$$\ln \frac{Pr}{Pr}\left(\frac{Y_i=1}{Y_i=K}\right) = \beta_1.X_i \quad (3)$$

$$\ln \frac{Pr}{Pr}\left(\frac{Y_i=2}{Y_i=K}\right) = \beta_2.X_i \quad (4)$$

$$\ln \frac{Pr}{Pr}\left(\frac{Y_i=3}{Y_i=K}\right) = \beta_3 . X_i \quad (5)$$

Where $\ln \frac{Pr}{Pr}\left(\frac{Y_i=1}{Y_i=K}\right)$ is the logarithm of probability of choosing the type of marketing channel, either Y=1 (open market), or Y=2 (butcheries) or Y=3 (private sales). β_{1-3} are the regression coefficients for the Y respectively. X_i represent the explanatory variables, HHG is the gender of household head, EDU is level of education, MINFO is type of marketing information given, LFO is livestock farmers organisation membership, PSDM is method used to set price during marketing while NCS is the number of cattle sold, age of head of household, source of income and employment status of head of household. Table 1 shows the explanatory variables descriptions and hypothesised effect in the model.

RESULTS

Table 2 indicates that more farmers (62%) use informal marketing channels than formal cattle marketing channels (38%). However, the most single used channel is the abattoirs (38%) to market cattle compared to open market (12%), butcheries (22%) and private sales (28%). There are more options for informal marketing (open market, butcheries and private sales) compared to formal marketing channels (abattoir). The majority of farmers obtained secondary education (58%). The results further reveal that of the farmers that sell to the formal market, 76% sell more than 10 cattle while 92% of farmers that sell to informal markets, sell 5 or less cattle per year. The results further indicate that most farmers negotiate the selling prices (64%) regardless of choice of marketing channels. The regression analysis (Table 3) indicates that the explanatory variables that are significant at 10, 5 and 1% in the model account for 99% of the total variation.

DISCUSSION

The model successfully predicted 98% of the observations, with number of cattle highly significant and increasing the likelihood of farmers selling their livestock to the formal market. The model indicated a low log likelihood which is acceptable, with a significant chi-square (X^2) ($p<0.05$). The logit results from the model for the choice of marketing channel are discussed below.

Open market relative to Abattoir

The log odds for open market relative to abattoir was 1.085 and positive indicating increase in preference of the open market relative to abattoir. With reference to being a member of a livestock organisation, increasing educational level, household head gender being male, cattle sales, and marketing information the logit would be expected to increase while holding all other variables constant. Thus preference for abattoir would be expected to increase. Price setting, age of household head, and income source from livestock whose logit are negative would be expected to decrease the preference for open market relative to abattoir when other variables are held constant. However, education and gender of household head have the most significant log odds ratio to increase probability for preference for abattoir compared to open market.

Butchery relative to abattoir

The coefficient is negative and decreases the likelihood for preference of butchery relative to abattoir. Education, and more than 6 but less than 10 cattle, have positive log odds ratios greater than 1 and are expected to increase probability of preference for abattoir relative to sell to butcheries when all other variables are held constant. However, source of income and price setting method had negative log odds ratios of less than 1 and are likely to decrease preference for butchery relative to abattoir.

Private sales relative to abattoir

The logit of preferring private sales relative to abattoir is positive thus it would be expected that it would increase the likelihood of preferring abattoir over private sales. Education log odds ratio is greater than 1 and would be expected to increase the likelihood for preference of abattoir relative to private sales. When a farmer is a member of a livestock organisation as well as increase, in numbers of cattle, the likelihood to use abattoirs increases as well when other variable are held constant. However, method of price setting, source of income and whether one receives market information, have log odds that are less than one which would likely decrease the probability of preference for using abattoirs.

These results have possible policy implications especially in terms of informing policy makers and decision makers on what factors they should focus on to improve access of formal markets. As much as most people in the study area prefer the formal market, those with higher numbers of cattle were shown in the model to increase probability to use abattoir. Therefore, it would help policy makers to come up with strategies that would increase livestock numbers and abattoirs would likely be the market of choice. A possible explanation of these results is that since most farmers' sales are due to emergency cash needs and also due to the fact that they do not have large numbers of livestock, they would probably be forced by circumstances to sale to informal markets. However, those who receive market information, and are educated are likely to come together and sell

Table 1. Descriptive statistics and expected hypothesised effect.

Variable	Mean	Sign	Hypothesised effect
Type of marketing channel (dependent)	1.61	n/a	
Household head gender	1.186	+/-	It is hypothesized that based on traditional norms males own the livestock thus make the decisions on whether to sale or not and which channel to use since they provide for the families
Education level	1.814	+/-	It is hypothesised that the higher the education one receives the better understanding and rational decision making in terms of choices and are as such expected to use more formal channels as they actively seek information
Given market Information	7.093	+	When market information is given, farmers make decisions on based on the information given, if it is favourable they would act on it
Livestock farmers organisation membership	0.047	+	Farmers organisations assist farmers in marketing and thus would be able to access information and markets that would otherwise not be available to them
Number of cattle sold	1.93	+	The more the livestock one has the more likely one is to sell to formal markets
Method of price setting during marketing	1.744	+/-	Farmers are likely to sell their livestock through the markets where they can negotiate the price
Age of head of Household		+	The age of the head of household is expected to influence the decision positively as the older the farmer the more likely he is to have a lot of cattle and experience of the markets and more likely to use formal marketing channels
Employment status		+/-	Employment status is expected to influence choice of market as unemployed are likely to need cash incomes to cover emergency requirements and employed would likely use the formal markets as they have other sources of income
Source of income		+/-	The ones who have other sources of income are likely to choose a market that gives best price that is a market where they can negotiate

their livestock as a collective to the formal markets even when they have fewer cattle.

CONCLUSIONS AND RECOMMENDATIONS

Livestock contributes in different ways to the livelihood of the Namibian people ranging from cash income to meet family financial needs such as school fees, provision of draught power for cultivation of crops and transport of goods, the consumption of animal products as well as source of employment, collateral and insurance against natural calamities and dung for manure. In rural communities livestock farming especially cattle are perceived as a symbol of wealth, social status, prestige include the use of cattle as bride price and to settle disputes (as fine) and also reserved for special ceremonial gatherings such as weddings, funerals and circumcision.

Moreover transforming small scale farmers into commercial cattle producers in northern communal areas of Namibia has not achieved its full potential due to various factors including shortages of good quality livestock feed during the dry season, high incidences of diseases and mortality rates, unavailability of or access to healthy water as well as long distance travelled to the market, poor infrastructures, in adequate institutional support, insufficient training and markets information and high transaction costs and so on. Cattle producers in the NCAs have an option to sell their cattle to the formal (mainly to the government-owned parastatal (MeatCo) or informal market (indigenous market). In order to develop small scale cattle industry the issues that exist need to be jointly addressed by all stakeholders such as government, farmers, producer organisations and private sector alike.

The findings of this study indicated that the majority (62%) of small scale cattle farmers preferred to trade

Table 2. Summary of descriptive variables and choice of marketing channel.

Variable	Type of market		Total
	Formal	Informal	
Gender			
Male	15(30)	24(48)	39(78)
Female	4(8)	7(14)	11(22)
Total	19(38)	31(62)	50 (100)
Education			
None	1(2)	2(4)	3(6)
Primary	3(6)	7(14)	10(20)
Secondary	10(20)	19(38)	29(58)
Tertiary	5(10)	3(6)	8(16)
Total	19 (38)	31(62)	50(100)
Number of cattle sold			
Grouped 1 to 5	2(4)	24(48)	26(52)
Grouped 6 to 10	3(6)	1(2)	4(8)
More than 10	14(28)	6(12)	20(40)
Total	19(38)	31(62)	50(100)
Price setting			
Negotiation	12(24)	20(40)	32(64)
Market driven	3(6)	7(14)	10(20)
Decide by buyers	1(2)	0(0)	1(2)
Decide by sellers	3(6)	4(8)	7(14)
Total	19(38)	31(62)	50(100)
Marketing channel			
Abattoir	19(38)		19(38)
Open market		6(12)	6(12)
Butcheries		11(22)	11(22)
Private sales		14(28)	14(28)
Total	19(38)	31(62)	50(100)

Numbers in brackets indicate percentages.

Table 3. Multinomial Regression estimates of explanatory variables for market choice of open market, butcheries and private sales (informal market) with reference to abattoirs (formal market).

Marketing channel used to market livestock[a]		Coefficient	Std. Error	Odds ratio
Open market	Intercept	1.085	45.869	
	[organisation = not a member of organization]***	123.198	34.287	3.19E+53
	[priceset = negotiation]***	-83.223	31.447	1.00E-13
	[priceset = market drivers]***	-79.695	30.798	1.00E-13
	[priceset = dictated by the buyer]**	-73.173	35.855	1.00E-13
	[income = livestock]**	-19.183	9.201	4.67E-09
	[income = pension and remittance]**	63.072	30.145	2.47E+27
	[income = crop, livestock and remittance]**	-34.606	13.41	1.01E-13
	[education = no education]***	28.978	6.127	3.85E+12
	[education = primary school]***	15.989	5.631	8786679.876
	[education = secondary]***	11.129	1.972	68111.37
	[HHgender = female]*	7.805	4.282	2453.428
	[Age = 40-49]*	-58.076	35.353	1.00E-13

Table 3. Contd.

	[employment = part-time farmer]**	-94.256	37.244	1.00E-13
	[grouped cattle sales = 1-5]***	27.947	4.364	1.37E+12
	[market infor = no]***	10.613	3.352	40649.546
	Intercept	-30.178	47.255	
	[priceset = dictated by the buyer]*	-66.254	37.432	1.00E-13
	[income = livestock]*	-30.104	17.556	1.84E-13
Butcheries	[income = remittance]***	-56.096	21.643	1.00E-13
	[income = crop, livestock & remittance]***	-70.403	21.594	1.00E-13
	[education = primary]***	18.036	6.454	68044113.65
	[grouped cattle sales = 1-5]***	9.447	2.66	12669.059
	[grouped cattle sales = 6-10]*	-33.778	19.184	1.02E-13
	Intercept***	-107.403	34.49	
	[organization = no]***	73.734	11.413	1.05E+32
	[priceset = market drivers]***	-43.452	15.294	1.00E-13
	[income = salary and remittance]*	-21.95	11.943	2.93E-10
	[income = pension and remittance***	-23.6	8.008	5.64E-11
Private sales	[income = crop, livestock and remittance]*	-38.723	20.969	1.00E-13
	[education = no]***	32.898	6.544	1.94E+14
	[education = primary]***	26.391	2.026	2.89E+11
	[education = secondary]***	24.742	1.366	55624065202
	[grouped cattle sales = 1-5]***	33.692	2.595	4.29E+14
	[market infor = no]	-13.02	3.337	2.22E-06
	Log likelihood = 1.622			
	X^2 (df = 87) = 127.347***			
	Pseudo R^2 = 0.994			

*,**,*** Significant at 10, 5 and 1%.

through informal marketing channel compared to 38% who prefer the formal market. Four factors are identified motivating cattle farmers to choose this marketing channel namely, the gender of the household head, marketing information received, education and number of livestock sold. The results suggest that formal marketing is also relatively relevant to farmers with large cattle numbers and meet the required standards from abattoirs. The study recommended that in order to increase the number of cattle marketed through the formal channels, there is need to improve overall herd size, as well as setting attractive prices coupled with reduced delays in making payments to the farmers for their livestock sold. Through government extension officers, farmers should be supported with transport, training and market (prices) information on marketing of their cattle. There is also need to improve marketing infrastructures in the study areas.

Conflict of interests

The authors have not declared any conflict of interests.

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