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IN EAST POKOT, KENYA

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Abstract

One of the major challenges facing the state-owned Kenya Meat Commission (KMC) in Kenya has been the inadequate supply of quality live animals for meat processing. It has been observed that the live animal throughput is inadequate and, as a result the existing meat processing facilities operate at less than 50% of their operational capacities. This has increased the fixed costs of operation thereby decreasing the export abattoirs competitiveness in the domestic and export markets. Overcoming the constraint of supply shortage of quality live animals requires, among other things, understanding the livestock producers' marketing behaviour. This study was conducted with the main objective to assess the determinants of market off-take rates for cattle and shoats in the pastoral areas of East Pokot District, Kenya. The multinomial logit model was used for econometric analyses using both primary and secondary data obtained from different sources covering the pastoral areas of Kenya. It was observed that in general, many pastoralists do not participate in the livestock market. Furthermore, for those pastoralists who participate in the market, the size of transaction (sale or purchase of cattle or shoats) was found to be very small. The implication of limited market participation is that under the production and marketing conditions, livestock production systems do not provide regular and adequate market supply of quality live animals at competitive prices, which adversely affect the efficient utilization of meat processing capacity and hence their competitiveness in the domestic and export markets.

Keywords: *pastoralists, livestock markets, market participation, east Pokot, Kenya*

Introduction

East Pokot district is characterized by poor soils and by low and highly variable rainfall patterns, and is ill suited to crop cultivation. Livestock production systems predominate because animals can be moved in response to spatiotemporal variability in economic, environmental, epidemiological and security conditions. (Little *et al.* 2001). Livestock provide herders not only with meat, milk and blood for sustenance, but also, through livestock sale, with a means for financing basic needs expenditure such as grains, school fees or medical expenses.

Pastoralists' herders residing in the arid and semi-arid lands (ASAL) of East Pokot district are among the poorest subpopulations in sub-Saharan Africa by standard income or expenditure measures they suffer high rates of malnutrition and illiteracy, and they are vulnerable to regular drought, civil unrest and other serious shocks. So the producer population of East Pokot district is of considerable interest to government and to international donors and charities for humanitarian reasons.

Horn of Africa, including East Pokot livestock markets pose a significant inefficiencies due to high transaction costs, difficulties in contract enforcement, physical insecurity and poor infrastructure. The extremely low market off take rates among ASAL pastoralists typically languish between 1.5 and 3.5 percent of beginning period cattle stocks and are basically nonresponsive to variation in mortality risk or rangeland carrying capacity (Desta and Coppock 2004, Mcpeak and Barret 2001, Barret *et al.* 2004). Given the difficult and unpredictable environment in which pastoralists pursue their livelihoods, low market off take rates result in considerable loss of wealth through livestock mortality. More frequent and severe climatic shocks in the past two decades have pushed an increasing number of pastoralists deeper into abject poverty, prompting huge flows of international humanitarian aid into the ASAL (McPeak and Barret 2001). It appears puzzling that pastoralists do not make extensive use of livestock markets to offload animals when climatic shocks, temporarily reduce the carrying capacity of local rangelands, and then use markets to restock their herds when local conditions recover.

Objectives of the study

The main objective of this study is to assess the market off-take rates of livestock in the pastoral areas of Kenya in order to complement the limited empirical information related to the off-take rates. The specific objectives are;-

- (a) To estimate extent and nature of market participation by pastoralists and identify factors affecting the nature and extent of market participation for livestock.
- (b) Quantify the extent of demand for livestock for domestic and export markets.

Methodology of study

Study Area

East Pokot District lies between latitude 10° 7' to 20° 49' N and longitude 34° 47' to 35° 49' E is largely a dry land area experiencing erratic climatic conditions and difficult terrain. Annual rainfall varies from less than 400mm in the lower areas (1150-2000m altitude) to slightly over 1500mm in the high altitude areas (2439-3570m altitude). Soils are generally poorly drained clays with occasional hard pans. The dominant vegetation is *acacia-commiphora* woodland. The Pokot people are a community inhabiting the East Pokot District. Traditionally, the Pokot people are pastoralists who depend heavily on livestock for sustenance, through blood, meat and especially milk.

Sampling Procedure

Two hundred and fifty pastoralists were randomly selected through a combination of cluster and stratified sampling procedures and individually interviewed. The sampling procedure was based on a random sampling across divisions, taking into consideration the geographic distribution and economic situation of the households.

Data collection method

The study involved individual interviews with pastoralists based on questionnaires as well as focus group discussions. Data was collected between July 2009 and September 2009 in the Kollowa and Tangulbei Divisions of East Pokot District, Kenya. The questionnaire consisted of open and closed question; all of which were translated into Pokot, the local language. Enumerators were trained and a pre-test was carried out before the survey was conducted. The secondary sources for the data used in this study were from journals, government papers, online materials and periodicals.

Data analysis

The statistical package for social scientists was used to generate both descriptive and econometric analyses using both primary and secondary data obtained from different sources.

Conceptual framework and empirical model

The pastoralists can buy or sell livestock. Based on the various combinations of sales and purchases transactions in which the livestock producers might be engaged, there are four mutually exclusive and exhaustive market participation regimes or categories to which one pastoralist can belong; those who only sell; those who only buy; those who both sell and buy; and those who neither sell nor buy. Once the grouping of pastoral households into different

market participation regime is made, the next important empirical is to investigate what factors affect a pastoralists' choice of given market participation regime. For example, what factors increase a pastoralists' likelihood to be a seller, buyer, or both a seller and a buyer? In such situations, the factors influencing the pastoralists discrete choice behaviour among different alternatives is usually modelled using a multinomial logit model.

The multinomial logit model is derived from random utility function (McFadden 1973). In random utility model it is assumed that individuals maximize their utility by choosing one of the alternatives. In this case it is assumed that the pastoralist maximizes their utility by choosing one among the four mutual exclusive market participation regimes. One of the critical assumptions of the multinomial logit model is the independence of irrelevant alternatives, which means that the odds are independent from the other outcomes available (Wooldridge 2002).

The multinomial logit model allows the estimation of a set of probabilities of four market participation regimes for households with given characteristics. The effects of the independent variables are allowed to differ for each outcome as opposed to ordered probit model where only one coefficient is estimated for all the outcomes.

Specification of multinomial logit model

The specification of multinomial logit probability model for pastoralists' market participation regime is given below. First, let j denote a given discrete market participation regime for pastoralists, which takes the value from 0 to 3 whereby: $j = 0$ (no market participation regime) represent households who neither sell nor buy; $j = 1$ represents households who only sell; $j = 2$ represents household who only buy; $j = 3$ represents households who both sell and buy. Then, choosing the $j = 0$ as standard or base market participation regime and assuming that the sum total of probabilities of all the four market participation regimes must be unity, the logistic probability functions for the four market participation regimes are given as follows:-

In general, the multinomial logit model is considered as a simultaneous estimation of binary:

$$P_0(j = 0/x) = \frac{1}{1 + \sum_{j=1}^3 e^{\beta_j x}} \quad (1)$$

$$P_1(j = 1/x) = \frac{e^{\beta_1 x}}{1 + \sum_{j=1}^3 e^{\beta_j x}} \quad (2)$$

$$P_2(j = 2/x) = \frac{e^{\beta_2 x}}{1 + \sum_{j=1}^3 e^{\beta_j x}} \quad (3)$$

$$P_3(j = 3/x) = \frac{e^{\beta_3 x}}{1 + e^{\beta_1 x} + e^{\beta_2 x} + e^{\beta_3 x}} \quad (4)$$

Logit model for all possible comparisons among alternatives. In this case, with four market participation regimes, you simultaneously estimate three binary logits, which are given as follows;-

$$\ln \Omega_{j/0}(x) = \ln \left(\frac{P_j(x)}{P_0(x)} \right) = x\beta_{j/0}, \quad \text{for } j=1 \quad \text{to} \quad 3 \quad (5)$$

Where $\ln \Omega_{j/0}(x)$ is the natural log of odds ratio of a market participation regime j relative to the base participation regime ($j = 0$), x is a vector of independent variables and $\beta_{j/0}$ is a vector of parameters to be estimated for different market participation regimes.

In the above formulation, the other three market participation regimes are compared with the no market participation regime. The dependent variable in the logit model is the log of the odds of a given market participation regime to the standard market participation regime. The logit estimate allows the analysis of the effects of independent variables on the odds and the probabilities of different market participation regimes.

The likelihood function for logit model is given as a product of the above four probability density function as follows:

$$L(\beta_1, \beta_2, \beta_3/x) = \prod_{j=1}^3 P_j \quad \text{For } j=0,1,2, \quad 3 \quad (6)$$

Where, N is the sample size, P_j is the probability density function for j^{th} market participation regime, and $\beta_1, \beta_2, \text{ and } \beta_3$ are parameter estimates to be estimated by using the maximum likelihood estimation method. One of the problems in the multinomial logit model is the problem of independence of irrelevant alternatives. However, in this case the four market participation regimes are mutually exclusive the problem of independence of irrelevant alternatives does not arise.

There are two important ways in which the effects of the independent variables are interpreted. The first is the effect of the independent variables on the probability of the different market participation regimes. This is given as;-

$$\frac{\partial P_j(j = j/x)}{\partial x_k} = P_j(j = j/x) [\beta_{kj} - \sum_{l=1}^3 \beta_{kl} P_l(j = l/x)] \quad (7)$$

The second is the effects of a given independent variable on the odds ratio. This is how a given variable affect the odds of a household choosing a given market participation regime. This is obtained by taking the partial derivatives of the odds ratio with respect to a given variable. In addition, the effects of variable x_j on the market participation regime for $j=2$ relative to the market participation regime $j=1$ where the base market participation regime is $j=0$ is given as;-

$$\frac{\partial \ln \frac{\pi_2 / \pi_0}{\pi_1 / \pi_0}}{\partial x_j} = \beta_2 - \beta_1 \quad (8)$$

If none of the independent variables affect the odds outcome 2 relative to outcome 1, then outcome 2 and 1 are indistinguishable with respect to the variables in the model. The effect of a given independent on the market participation is conducted using the likelihood ratio test. The null hypothesis is that all parameter estimates associated with a given variable for all regimes are jointly zero; the rejection of the null hypothesis indicates that a given variable does not have effects on the pastoralists' choice of market participation regime.

Results and Discussions

The results of multinomial logit regression estimation of pastoralists' discrete choice market participation decision for cattle and shoats are given in table 1 and 2 respectively. For estimation purpose, the base category used is non-market participation regime. Thus the multinomial logistic regression assesses the effects of various independent variables on the odds of various market participation regimes vs. not participating in the market. The model chi-square indicates that overall goodness of fit the model is statistically significant at a probability of less than 1% for both cattle and shoats. Furthermore, the Hausman specification test fails to reject the null hypothesis of the independence of irrelevant alternatives.

It can be seen from table 1 that the main factors influencing the household's discrete choice of cattle market participation decision are that the total livestock owned as measured by tropical livestock unit (TLU). The TLU is positively associated with pastoralists' participation in cattle market as a seller only and both as a seller and buyer. As the TLU increases, the probability that the household participate in cattle market as a seller only increases while the probability of non-participation in cattle market decreases. Households with larger herd size have higher ability to generate surplus animals and are therefore more likely to sell.

Table 1. Results of multinomial logit estimation for cattle.

Variables	Market participation regimes		
	Only sell	Only buy	Both sell and buy
Sex (1=male,0=female)	0.211(0.272)	1.084(0.548)**	1.363(0.617)**
Age (years)	0.003(0.007)	0.002(0.011)	-0.022(0.011)*
Size of household	-0.060(0.059)	0.131(0.080)	0.065(0.079)
Children≤15years old (number)	0.143(0.075)*	-0.082(0.103)	-0.088(0.102)
Tropical livestock unit (TLU)	0.267(0.034)***	0.037(0.051)	0.212(0.047)***
Land holding (ha)	-0.219(0.104)**	0.318(0.103)***	-0.027(0.132)
Communal grazing land (ha)	0.001(0.001)	-0.002(0.002)	0.002(0.001)
Livestock product income	0.000(0.000)	-0.002(0.001)	-0.000(0.001)
Off-farm income	-0.000(0.000)	0.000(0.000)**	0.000(0.000)
Weighted price of cattle	-0.000(0.001)	-0.001(0.001)	0.001(0.001)
Weighted price of sheep	-0.003(0.003)	0.000(0.006)	-0.006(0.005)
Constant	-2.358(0.512)***	-4.334(0.881)***	-4.108(0.876)***
N	250		
McFadden's R ²	0.057		
Cragg-Uhler R ²	0.213		
Model Chi-square	210.94		
Significance level	0.000		

Base category is neither sells nor buy regime. Figures on parentheses are standard errors

***, **, * indicate significance at a probability of less than 1, 5 and 10%, respectively.

It is observed that male-headed households are more likely to participate in cattle market as buyer only and as a seller and a buyer as compared to female-headed households. Off-farm

income is observed to be positively associated with the household's participation in cattle market as a buyer only indicating the importance of off-farm income to farm households in building livestock assets. It is interesting to note that the effects of cattle and shoats prices are not significant, indicating that prices are not important factor in the household's discrete-choice market participation decision in the cattle market. The negative and statistically significant coefficients on constant term indicate that there are other variables, which decrease the likelihood of household participation in cattle market but, which are not accounted for in this analysis.

Table 2. Results of multinomial logit estimation for shoats.

Variables	Market participation regimes		
	Only sell	Only buy	Both sell and buy
Sex (1=male,0=female)	0.340(0.252)	0.073(0.432)	0.461(1.113)
Age (years)	-0.011(0.007)	0.019(0.013)	-0.001(0.026)
Size of household	0.102(0.054)*	-0.069(0.104)	0.200(0.173)
Children≤15years old (number)	0.051(0.066)	0.088(0.128)	-0.290(0.246)
Tropical livestock unit (TLU)	0.132(0.030)***	0.070(0.050)	0.053(0.105)***
Land holding (ha)	-0.211(0.098)**	0.072(0.136)	0.013(0.332)
Communal grazing land (ha)	0.000(0.001)	0.004(0.002)**	0.001(0.003)
Livestock product income	0.002(0.001)***	0.002(0.001)***	0.003(0.001)**
Off-farm income	0.000(0.000)	-0.000(0.000)	-0.002(0.001)*
Weighted price of cattle	0.003(0.001)	-0.001(0.001)	-0.002(0.002)
Weighted price of shoats	-0.009(0.003)***	0.011(0.006)**	-0.060(0.050)***
Constant	-1.654(0.470)***	-0.808(0.882)	-0.097(2.122)
N	250		
McFadden's R ²	0.030		
Cragg-Uhler R ²	0.163		
Log likelihood	-750.040		
Model Chi-square	145.40		
Significance level	0.088		

Base category is neither sells nor buy regime. Figures on parentheses are standard errors. ***, **, * indicate significance at a probability of less than 1, 5 and 10%, respectively.

The results of econometric analysis for shoats are presented in Table 2 above. Similar to the results for cattle, the main factors influencing the household's discrete-choice decision to participate in shoats market are TLU and landholdings. The TLU is positively associated with household's participation in shoats market as a seller only. As the TLU increases, the probability that the household participate in shoats market as a seller only increases while the probability of non-participation in shoats market decreases. However, the effect of TLU on the other market participation regimes is found to be not significant. The effect of land holding is found to be negative and significant only in the case of market participation as a seller only. As the size of land holding increases, the probability that the household participate in shoats market as a seller decreases.

There is statistically significant negative price effect on shoat's market participation in all cases. This indicates that contrary to the cattle market, in the shoats' market price is an important factor in the household's decision to participate in the market. Negative response to price on the probability to sell may indicate that when prices are higher, fewer sales may generate needed revenue for family cash needs.

Conclusion and recommendations

The main objective of this study was to assess the market off-take rates for cattle and shoats in the highland and pastoral areas of Kenya. Several significant conclusions are drawn from the analyses, which may provide useful insights towards the designing and implementation of strategies to alleviate the shortage of quality live animal supply in the market

It is observed that pastoralists have limited market participation. The implication of limited market participation is that under the current production and marketing conditions pastoral livestock production systems do not provide regular and adequate supply of quality live animals to the market, which adversely affect utilization of meat processing capacity of the existing export abattoirs. Furthermore, this result also indicate that the plan for the establishment of new export abattoirs in different parts of the country has to proceed with great caution and careful assessment of the availability of live animals suitable for export abattoirs.

It appears that in response to the emerging market opportunities, the capacities and methods of livestock production and marketing practices of pastoralists and agricultural extension and marketing practices of pastoralists and agricultural extension services have changed very little. Therefore, in order to take advantage of the emerging export market opportunities, there is a need to explore different alternative strategies of increasing the supply of quality live animals for export abattoirs. The social and economic feasibilities of alternative strategies need to be carefully evaluated and there is a need to identify and assess on ways to effectively and efficiently integrate pastoralists to the high value domestic and export markets value chains for live animals and meat value chains in order to identify the constraints and opportunities to improve the supply of quality live animals.

Given the importance of livestock in the livelihood of pastoralists household in several ways and given the importance of livestock in national output and income generation, strategic improvement of extension delivery is essential to improve productivity and quality of animals and market orientation of pastoralists. Along with dissemination of technology for better feeding and health management practices, educating pastoralists about the benefits and the desirability of selling animals at optimal age and weight will be necessary to significantly increase the quality and quantity of off-take. This is not the responsibility of public sector only. If abattoirs are interested in the regular supply of better quality animals by pastoralists, they should be active partners in this strategy. Use of contracts as an instrument will provide the scope for the application of such extension and informal education strategy in the production and marketing behaviour of pastoralists.

In the long run, specialized ranches and feedlots may be developed by abattoirs or others interested in commercial livestock production for producing quality animals in large numbers. But this need not necessarily be self-contained enterprises doing everything from breeding to finishing. Rather large number of pastoralists can be linked with such enterprises as supply sources of young animals for fattening provided attractive prices are paid to pastoralists to encourage them to get into such activities as income generating business. Research is required in the area of feedlot development in Kenya and on how to incorporate pastoralists into the feedlot operations.

There is lack of reliable baseline data to support the business and policy decision making in the livestock subsector in Kenya. For example, adequate information on what is demanded in the domestic and export markets and the production and marketing practices of livestock producers in different production system is lacking. Even export statistics are not recorded and managed in ways to allow accurate aggregation and quick analysis to support private business and public policy decision making. For the purpose of monitoring the dynamics of livestock production and marketing there is a need for regular collection of production and marketing data and their dissemination in user friendly format.

Analysis of the detailed cost structure of export abattoirs, their procurement mechanisms and procurement areas was within the scope of this research. However, it is very important that the export abattoirs examine their operational efficiency, cost structures and develop sound procurement policies and practices to improve their overall efficiency rather than just concentrating on the supply side constraints. In the future, detailed study of cost structure for export abattoirs and a detailed analysis of the current livestock value chains will be required to identify entry points to increase purchase of animals and reduce costs of operation.

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