

# Determinants of Livestock Commercialization in Rural Area of Oromia Region: In Case of Pastoral Area of Borena Zone

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## Abstract

This study analyzed the major determinants of livestock commercialization in farm household of Oromia Region taking evidence from of pastoral area of Borena zone. In order to achieve these objectives demographic and socio-economic data were collected from 150 randomly selected households. Three -stage sampling procedures were used to select sample farmers as a result a total of 150 household heads were selected randomly from the respective list of farmers using probability sampling techniques. Tobit regression model has been employed so as to identify the major determinants of livestock commercialization. The dependent variables, livestock sales rate of households were regressed against ten explanatory variables, among ten explanatory variables nine (sex of the household, household family size, access to market information, , size of grazed land, distance from the market, alternative source of income, Total livestock unit, price of livestock and state of road ) of them were found to be statically significant at 1% and 5% level of significance and the remaining one variable (access to education level of the household) is significant at 10%. Therefore, policy need to focus on supporting households in delivering services in the area of the livestock commercialization in the study area. Especially, focus should be given to the significant variables which determinate the livestock commercialization in farm households of the study area.

**Keywords:** livestock commercialization, Oromia, Borena, Determinant variable, Tobit.

## 1. Background of the study

Ethiopia is the second-most populous country in Africa with a population of 99.4 million, and population growth rate of 2.5% in 2015. One of the world's oldest civilizations, Ethiopia is also one of the world's poorest countries. The country's per capita income of \$590 is substantially lower than the regional average (Gross National Income, Atlas Method). The government aspires to reach lower-middle income status over the next decade (WB, 2016). The economy has experienced strong and broad based growth over the past decade, averaging 10.8% per year in 2003/04 - 2014/15 compared to the regional average of 5.4%. Expansion of the services and agricultural sectors account for most of this growth, while manufacturing sector performance was relatively modest. Private consumption and public investment explain demand side growth with the latter assuming an increasingly important role in recent years (WB, 2016).

Agriculture is an important driver of the nation's growth, as well as its long-term food security. It contributes 85 percent of the population's livelihoods, 38.5 percent of Gross Domestic Product, and 80 percent of export revenue of Ethiopia (MoFED, 2016).

Livestock production as one component of the agriculture industry plays important role in economic and social development of Ethiopia at national and household level. At a national level, livestock contributes a significant amount to export earnings. It contributes 10 percent of all formal export earnings (US\$ 150 million per annum) and US\$ 300 million per annum to the informal market. Moreover, livestock accounts for 15 to 17 percent of total GDP, and 35 to 49 percent of agricultural GDP. At the household level, livestock contributes to the livelihood of approximately 70 percent of Ethiopians (Sintayehu.G, etal, 2010).

According to FAO (2010) Ethiopia ranks 9<sup>th</sup> in the world in terms of total number of ruminants. However, local experts argue that comparable statistics for Sudan and Nigeria are inflated, which would give Ethiopia the largest livestock herd in Africa, with seventh place globally (Sintayehu. G, etal, 2010).

In addition, The livestock population census (CSA, 2008) shows that Ethiopia has about 49.3 million heads of cattle, 25.0 million sheep, 21.9 million goats, 1.8 million horses, 5.4 million donkeys, 335 thousand mules, 760 thousand camels and 38.1 million poultry. This does not include livestock population of three zones of Afar and six zones of Somali regions.

Livestock is the main household asset and a key productive resource for pastoralist communities living in the border areas of Ethiopia. However, recurrent droughts are eroding pastoralists' livestock base and weakening their livelihoods and their resilience to climatic shocks (Sintayehu. G, et'al, 2010).

Livestock is a source of food and income for majority of households in Ethiopia. In addition, it provides social security and serves as mobile banks, wealth accumulation, and social esteem. However, these contributions are predominantly in the non-monetary sector because of limited commercialization of livestock production.

## 2. Objectives of the Study

The main objective of this study was to examine the major factors that determine commercialization of livestock production in Borana Zone.

### 3. Methodology of the study

#### 3.1 Source and Method of Data collection

The data in the survey were collected by using structured questionnaires, which were prepared and pre-tested for the purpose of the project entitled “Determinants of livestock commercialization of Oromia regional state in the case of Borena zone. Ten enumerators who speak the local language were recruited from the study area and trained. The enumerators were employed to administer the structured questionnaires. The questionnaires were pre-tested and on the basis of the results obtained necessary modification were made. The formal survey was conducted by administering a structured questionnaire to collect data from 200 randomly selected farmers.

#### 3.2 Sample size Determination

In order to determine sample size, the researcher was applied a simplified formula provided by Yamane (1967), statistically estimated at 95% confidence level, degree of variability = 0.05 and level of precision =90%.

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size (total household size), and e is the level of precision. The researcher used central statistical agency’s population census data of Ethiopia, which is collected in 2007 to quantify the sample size. Based on the above formula the study was carried out on 150 respondents.

#### 3.3 Sampling technique

Three-stage sampling procedures were used to select sample farmers. In the first stage, four wereda from Borana zone were selected purposively based on the prevailing information socio-economic, climatic, abundance of livestock, and other conditions. In the second stage, from four weredas 16 rural kebeles were selected randomly. Finally, from 16 kebeles 150 respondents were selected using probability proportional to sample size sampling techniques.

#### 3.4 Methods of Data Analysis

The farm household data were analyzed using both descriptive and econometric procedures of data processing. Descriptive statistics like mean, variance, standard deviations, and frequency distributions, ratios, and percentage, graphical and tabular analysis were used to examine and understand the socio economic situations of the sample respondents. Beside to this econometric estimation of variable was carried out by using STATA 12 software.

##### 3.4.1 Theoretical Model

The study applied the Tobit model to estimate the factors that affect the livestock commercialization in the study area. An important characteristic of the data set is that the dependent variable (the proportion of the livestock sold over the past one year) is censored at the lower limit. The appropriate analytical approach is therefore the Tobit model using the maximum likelihood regression technique (Tobin, 1958). The study followed Makhura (2001) and Bellemare and Barrett (2004) who used Tobit model to specify a market participation decision function. The Tobit model is specified in Hobbs (1997) as follows:

$$y^* = \beta X + e \text{----- (1)}$$

Where  $y^*$  is the latent variable, and  $x$  is a vector of independent factors,  $\beta$  is the corresponding vector of parameters and  $e$  is the error term. The observed sales rate ( $y$ ) is the actual proportion of livestock over the past one year, which can be denoted as,

$$Y=L_o \text{ if } y^* \leq L_o \text{----- (2)}$$

$$=y^* \text{ if } y^* > L_o$$

Where  $L_o$  is the unobserved lower limit of zero (i.e. no livestock is sold). The likelihood function for this model is

$$L(\beta, \delta / y, x, L_o) = \prod_{y_i=L_o} \frac{\phi(L_o - \beta'x)}{\phi} \prod_{y_i=y'} \frac{1}{\delta} \phi \frac{y - \beta'x}{\delta} \text{----- (3)}$$

$\prod_{y_i=L_o}$  Product of lower limit observations or no sale of livestock

$\prod_{y_i=y'}$  Product over the non-limit observations reflecting different proportions of livestock sold

After maximizing the log of equation 3, to calculate the effects of changes in explanatory (independent) variables on the dependent variable (sales rate), the expectation of  $y$  (the observed proportions of cattle sold) can be derived.

The conditional expectation of  $y$  based on the information that  $y^*$  lie above the limits is,

$$E(y / y' > L_o) = \beta' x + E(\mu / L_o \beta' x < \mu) = \beta' x + \sigma \frac{\phi}{\Phi} \quad (4)$$

Where  $\Phi = \Phi(L_o - \beta' x) / \sigma$  with the corresponding definition

The unconditional expectations of  $y$  (the observed proportions of cattle herd sold) without restricting  $y^*$  (the potential proportion of the cattle herd that can be sold) lies below the lower limit, is

$$E(y) = P(y = L_o).L_o + P(y' > L_o).E(y / y > L_o) \quad (5)$$

$$\Phi L_o + \beta' x \Phi + \sigma \phi$$

Substitution in the values for  $L_o$  (zero/ where no livestock is sold), the effect of changes in the explanatory variables on the dependent variable becomes

$$\frac{\partial E(y)}{\partial x} = \Phi \hat{\beta} = (prob[y^* > 0]) \hat{\beta} \dots$$

This followed Roncek (1992) and Leclere (1994) where marginal effects were computed to determine the effects of the explanatory variables on the probability and proportion of the cattle herd sold. Equation (6) gives the marginal effects of changes in the explanatory factors on the sales rate, given the censoring of the dependent variable (Roncek, 1992). The effect of a change in the explanatory factors on sales rates consists of two parts. Firstly, it is the change in the dependent variable of those observations over the limits, weighted by the probability of being over the limits; secondly, the change in the probability of being above the limits, weighted by the expected value of the dependent variable if above the limits (Kennedy, 1993; Hobbs, 1997).

### 3.4.2 The Empirical Model

Decision on the variables to be included in the analysis is first step in constructing a model for a specific purpose or for a particular sector of an economy. In doing so, it is usually important to take into account what economic theory has to say about the relations between the variables of interest; unfortunately, economic theory is not often rich enough to provide a dynamic specification that identifies all of these relationships.

Based on the reviewed literatures, some of the common predictors that are expected to influence commercialization of livestock in the study area are the following:

Based on equation 1 and specified explanatory variables above, the study estimated an empirical model for livestock commercialization. The empirical model is

$$LSC = \beta_0 + \beta_1 SEX + \beta_2 FS + \beta_3 AMKT + \beta_4 AEDUC + \beta_5 SGL + \beta_6 DFM + \beta_7 AI + \beta_8 TLU + \beta_9 PL + \beta_{10} SR + \mu$$

Where

LSC= livestock commercialization, SEX=Sex of household, FS= Family Size, AMKT= Access to Market, AEDUC = Access to Education, SGL= Size of grazed land, DFM= Distance from the Market, AI = Alternative Income, TLU= Total livestock unit, PL= Price of Livestock, SR =State of Road

$\beta_0$  = the intercept

$\beta_1 - \beta_{10}$  = Are the coefficients associated with the independent variables and  $\mu$  = Random term.

Note: livestock commercialization (LSC) is proxied by sales rate and sales rate further measured as follow. Sales rate will be measured as the net commercial off-take rate to represent the level of commercialization of the livestock following Asfaw and Jabbar (2008)

$$\text{Net commercial off take rate takes (sales rate)} = \frac{\text{sales-purchases}}{0.5(\text{opening stock} + \text{ending stock})} * 100$$

## 4. Empirical findings

### 4.1 Results of Tobit Regression Analysis

Econometric analysis results of the Tobit model estimating the factors affecting cattle sales rate among the Borena Zone pastoral cattle keepers are presented in Table 1. Of the 10 independent variables hypothesized to affect sales rate; sex of the household head, road condition, household family size, price of livestock, size of grazed land and market information had a positive and significant effect while alternative source of income, distance from the market and Access to Education were significant and had negative effect.

**Table 1. Tobit Model Estimate for Factors affecting cattle keepers' sales rates**

Explanatory Variable	Coefficient	Robust SE	P value
Sex of head of household *	0.2035	0.2589	0.003*
House Hold family size	0.5281	2.5413	0.014**
Access to market information*	0.3556	0.9854	0.006*
Access to Education *	0.2309	5.5731	0.092***
Size of grazing land	0.3872	2.8741	0.016**
Distance from the market	-0.3625	18.5162	0.018**
Alternative source of income*	-0.1554	4.1564	0.025**
Total livestock Unit	0.1903	6.8562	0.032**
Price of livestock	0.2159	10.1546	0.012*
State of road*	0.4453	0.3576	0.031**
Constant	-5.1586	9.4308	0.002
<b>Pseudo R<sup>2</sup> = 0.4853 ; * 1 %, ** 5% *** 10% level of significance</b>			

Source: Model output, own calculation from the survey data. The star on the top of the predictor variables reflect that the predictors are discrete while the remaining refers to continuous ones. The stars on the top of p-value such as \*, \*\*, \*\*\* reflects that they are statically significant at 1 percent, 5percent and 10 percent respectively.

We can also present the above table in equation forms as follows.

$$LSC = -5.1586 + 0.2035SEX + 0.5281FS + 0.3556AMKT + 0.2309AEDUC + 0.3872SGL - 0.3625DFM - 0.1554AI + 0.1903TLU + 0.2159PL + 0.4453SR + \mu$$

The model result in table 1 of the Tobit regression model estimate indicates that out of the 10 explanatory variables included 10 variables (sex of the household, household family size, access to market information, access to education level of the household, size of grazed land, distance from the market, alternative source of income, Total livestock unit, price of livestock and state of road ) were found to have a significant influence on the livestock commercialization at 1%, 5% and 10% and it also verified that most explanatory variables in the model had sign that confirmed to the prior expectations and hypotheses of this study .

#### 4.2 Discussion of determinants of livestock commercialization

In this section, the Tobit regression results of variables were examined and interpreted in accordance with its effects on livestock commercialization.

##### Sex of the household (SEX)

The sex of the household head had a positive and significant (1%) effect on the sales rate. If the household head was male ceteris paribus, the probability of having a higher sales rate would increase by 0.2035. This is consistent with earlier studies conducted by Wurzinger et al. (2008) Hodgson (1999) and Godfrey (2010). However, this result differs from Makhura's (2001) findings where female cattle keepers tended to sell more of their livestock than male cattle keepers which he attributed to the non applicability of keeping livestock as a measure of social status to cattle keepers in the Northern Province of South Africa. Although this reaffirms the gender inequality existing in the pastoral communities most especially with regard to making economic decisions, it is important for beef commercialization. The targeted households should be those families dominated by males or any intervention in the area targeting livestock should be initiated through men.

##### Household family size (FS)

The result showed that the family size of the household is statistically significant at 5% probability level. If all other things are held constant, family size increases by one person or one adult equivalent the sale rate would increase by 0.5281. This is consistency with the finding of Wurzinger et al. (2008) and Makhura's (2001). Where they found that as household family size increases the participation of livestock sellers in the market would increase also.

##### Access to market information (AMKT)

Agricultural development has been limited in developing countries due to lack; poor/ nonexistent agricultural information (Bailey et al., 1999). Access to market information was significant (1%) and positively influenced the cattle keepers' sales rate. A unit increase in the access to market information increases the probability of increasing the cattle keepers' sales rate by 0.3556 amounts. This is consistent with the findings of Goldfrey (2010), Montshwe et al. (2006) and Nkhori (2004) where they found that price information significantly increased the participation of small scale cattle keepers in the formal markets of Uganda, South Africa and Botswana.

##### Access to Education Level of the household (AEDUC)

The size of grazed land available has positive and significant at 10% influenced the sales rate. If the household head was educated ceteris paribus, the probability of having a higher sales rate would increase by 0.2309. This is consistency with the finding of Nkhori (2004).

### **Size of grazed land ( SGL)**

The size of grazed land available has positive and significant at 5% influenced the sales rate. Holding other factors constant, an increase of the size of graze land by one hectare would increase the probability of sale rate by 0.3872. This is consistency with the finding of Asfaw and Jabbar (2008) where they found that the size of grazed land increases the participation of livestock sellers in the market.

### **Distance from the market (DFM)**

Distance to the nearest livestock market negative and significantly (5%) influenced the sales rate. Holding other factors constant, an increase of the distance to the market by 1 kilometer would decrease the probability of raising sales rate by 0.3625. This is consistency with the finding of (Isabella and Steve, 2007) where they found that long distances and travel time are correlated to the transport costs; high transport costs increase the transaction costs thus deterring market participation by a pastoral household among the cattle keepers.

### **Alternative source of income (ASI)**

Alternative sources of income were significant (5%) and negatively influenced the household head's sales rates. Holding other factors constant, an increase of the alternative source of income by 1 would decrease the probability of decreasing sales rate by 0.1554. Livestock keepers with alternative income sources from trade, crop sales, and employment reported to have lower sales rates. This is consistent with the observations of Godfrey (2010), Asfaw and Jabbar (2008) who found that off farm income was negatively associated with the household's decision to participate in livestock market as a seller but was positively associated with the household's participation in the market as a buyer

### **Total livestock unit (TLU)**

The size of livestock owned by house hold has positive and significant at 5% influenced the sales rate. Holding other factors constant, an increase of the size of livestock number by one would increase the probability of sale rate by 0.1903. This is consistency with the finding of Nkhorh (2004). Where they found that the size of livestock increases the participation of livestock sellers in the market.

### **Price of livestock (PL)**

The price of livestock owned by house hold has positive and significant at 5% influenced the sales rate. Holding other factors constant, an increase of the price of livestock number by one would increase the probability of sale rate by 0.2159. This is consistency with the finding of Goldfrey (2010). Where they found that the attractive price of livestock increases the participation of livestock sellers in the market.

### **State of road (SR)**

Road condition was significant (5%) and positive influenced the sales rate of the cattle keepers in the study area. Good in the road condition increase on the number of animals offered for sale. This is consistency with the finding of Watson et al. (2006) Gebremedhin et al., (2007), Goldfrey(2010), Kgansti and Mokoene (1997) also noted that lack of properly maintained roads made it very costly for cattle keepers to market their livestock.

## **5. Conclusion and Recommendation**

### **5.1 Conclusion**

The result of the Tobit regression model indicates that alternative source of Income and distance from the market has a negative effect on livestock commercialization and significant (at 5% probability level). Moreover, sex of the household, household family size, access to market information, , size of grazed land, distance from the market, alternative source of income, Total livestock unit, price of livestock and state of road had positive and significant influence livestock commercialization.

### **5.2 Recommendations**

Based on the findings of the study the following issues are forwarded as recommendation to improve the improvement of pastoralists' participation in cattle marketing and commercialization of the livestock industry.

- Pastoralists of rural household should be sensitized on the importance of market oriented cattle production and the benefits of wealth storage diversification through workshops seminars, farmer – trader sharing platforms, radio programmes and extension education.
- Livestock holders should be encouraged to form associations/cooperatives for collectively marketing their cattle to abattoirs. This will help them to decrease transportation costs by collectively transporting their cattle, negotiating better prices and contracts to supply directly to the abattoirs.
- Finally, there is need for investment in areas such as transport systems, improvement of road networks and setting up modern market infrastructure through increased public investment.

### **References**

- Asfaw, N., Jabbar, M., (2008) "Livestock Ownership, Commercial Off-take Rates, and their Determinants in Ethiopia." Research Report 9 ILRI (International Research Institute) , Nairobi Kenya.
- Bailey, D., Barrett, C. B. Little, P. D., Chabari, F., 1999. Livestock Markets and Risk Management among East

- African Pastoralists: A Review and Research Agenda. GL-CRSP Pastoral Risk Management Project Technical Report No.03/99. Utah State University, Logan. 46pp.
- Barrett, C. B., Bellamere, M., Osterloh, S., (2004) "Household Level Livestock Marketing Behaviour Among Northern Kenya and Southern Ethiopian Pastoralists." Cornell University Ithaca, New York, USA.
- CSA (Central Statistical Agency). 2008. Livestock and Livestock Characteristics, Agricultural Sample Survey. Volume II, Statistical Bulletin, 446, 188p.
- FAO (Food and Agriculture Organization of the United Nations).2010.Ethiopia Range/Livestock Consultancy Report prepared for the Government of the People's.Democratic Republic of Ethiopia. Technical Report. AG/ETH/82/010 FAO, Rome. 94p.
- Gebremedhin, B., Hoekstra, D., Samson, J., 2007. Heading Towards Commercialization? The Case of Live Animal Marketing in Ethiopia. Improving Productivity and Market Success (IPMS) of Ethiopian Cattle Keepers Project Working Paper 5. ILRI (International Livestock Research Institute), Nairobi, Kenya. 73 pp.
- Godfrey K. (2010). Factors Affecting the Level of Commercialization among Cattle Keepers in the Pastoral Areas of Uganda .Mscthesis.
- Hobbs, J. L., (1997) "Measuring the Importance of Transaction Costs in Cattle Marketing." *American Journal of Agricultural Economics* 79: 1083-19095.
- Hodgson, D. L., 1999. Pastoralists, Patriarchy and History; Changing Gender Relations among the Masai of Tanganyika,1890-1940. *Journal of African History*. 40: 41-65.
- Isabella, B., Steve, S., 2007. Beyond One -Size Fits-All: Differentiating Market Access Measures for Commodity Systems in the Kenyan Highlands. *Journal of Agricultural Economics*, 58(3): 536-548.
- Kgansti, M., Mokoene, S., 1997. South African Farmer Support Services: An End User Perspective. Research Report. African Development Bank.
- Leclere, M. J., (1994) "The Decomposition of Coefficients in Censored Regression Models: Understanding the effect of Independent Variables on Taxpayer Behaviour." *National Tax Journal* 47 (4): 837-845.
- Makhura, M., (2001) "Overcoming Transaction Costs Barriers to Market Participation of Smallholder Cattle Keepers in the Northern Province of South Africa". Ph.D. Thesis, University of Pretoria, Pretoria.
- Ministry of Finance and Economic Development (MOFED) (2016). Growth and Transformation Plan II 2015/16-2019/20, Volume I: main text. Ministry of Finance and Economic Development, Addis Ababa, Ethiopia.
- Montshwe, B. D., Jooste, A., Alemu, Z. G., 2006. Participation in Mainstream Cattle Markets by Small- scale Cattle Keepers in South Africa. Proceedings of 40th Conference South African Society for Agricultural Extension 9-11 May 2006 Berg en-Dal Kurger National Park Mpumalanga South Africa.
- Nkhorri, P. A. J., 2004. The Impact of Transaction Costs on the Choice of Cattle Markets in Mahalapye District Botswana. MSc Thesis University of Pretoria, Pretoria South Africa.
- Roncek, D. W., (1992) "Learning more from Tobit Coefficients: Extending a Comparative Analysis of Political Protest." *American Sociological Journal* 57: 503-507.
- Sintayehu, G., Samuel, A., Derek, B. and Ayele, S.(2010): Diagnostic study of live cattle and beef production and marketing : constraints and opportunities for enhancing the system. Accessed at international livestock research institute web.
- Tobin, J., (1958) "Estimation on Relationship for Limited Dependent Variables." *Econometrics*. Vol 26: 26-36.
- Von Braun J, H, Bouis and E. Kennedy (1994)*Agricultural commercialization, economic development, and nutrition*. Johns Hopkin University Press, Baltimore, Maryland, USA. pp. 9–33.
- Watson, J., Van Binsbergen, J., 2006. Livestock Marketing in Turkana District, Kenya: Opportunities and Constraints Theme 2 – Targeting and Innovation Brief No.1, International Livestock Research Institute (ILRI), Nairobi, Kenya.
- World Bank (2016): Ethiopia overview: available at:  
<http://www.worldbank.org/en/country/ethiopia/overview>.
- Wurzinger, M., Ndumu, D., Okeyo, A. M., Solkner, J., 2008. Lifestyle and Herding Practices of Bahima Pastoralists in Uganda. *African Journal of Agriculture Research* 3 (8):542-548.
- Yamane, T., 1967. Statistics, An Introductory Analysis, 2nd Ed., New York.