

Determinants of Market Prices of Cattle in Eastern Ethiopia

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Abstract

This study has attempted to identify determinants of cattle price per kilogram live weight using a log-linear regression model. The estimated model explains about 48% of the variation in market prices of cattle. Price per kilogram live weight of cattle increases with animal characteristics such as age, live weight and grade. Type of sellers, buyers' purposes, festivals, time of transaction and a time trend are also important variables in affecting cattle prices. Farmers tend to sell their animals at price discounts as compared to trader sellers. Cattle sellers suffer from price discounts in selling to buyers with business purposes in comparison to selling to ultimate consumers. Sellers tend to benefit from animal sales during festivals, as they tend to receive price premium compared to selling during non-festival periods. Cattle price per kilogram live weight increases with the time of transaction suggesting that sellers tend to obtain higher prices by selling at later hours of a market day.

The policy implications of these empirical results are that efforts to benefit cattle producers and/or sellers need to pay attention to animal characteristics, sellers' type, buyers' purposes and festivals in preparing animals for market and/or during actual transactions. It is vitally essential to train cattle keepers on the above issues. Provision of reliable livestock market (price) information to market participants, and investment in different livestock marketing facilities (like weighing scale) and services need to be given due attention in order to avoid unrewarding cattle-pricing practices.

Key words: Cattle, price variation, live weight, animal characteristics, market characteristics, Eastern Ethiopia

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1. Introduction

Ethiopia ranks first in Africa and tenth in the world with respect to livestock population. Estimates for the fiscal year 2000/01 put it at 35.38 million cattle, 11.40 million sheep and 9.6 million goats (CSA, 2002). Most smallholder farms in the country tend to depend on livestock as sources of products (milk, meat, hides and skins and manure) and services (traction, transport, prestige). Livestock production also provides wide and year-round employment opportunities for surplus family labour (MEDaC, 1999) and generates rapid increase in smallholder farms' cash income. Empirical studies reveal that poor farmers and landless, especially women, get a higher share of their income from livestock than do the better-off rural people (Delgado et al., 1999). This is further confirmed by Thornton et al. (2002) in that livestock rearing employs the majority of people in many rural areas and it is by far the largest source of revenues in such areas.

The primary reason for selling livestock in the highlands is the generation of income to meet unforeseen expenses (Jabbar and Ayele, 2003). Pastoralists also, besides using livestock as sources of food and as a form of saving and wealth, sell animals at times of cash needs to purchase food and other necessities (Jabbar and Ayele, 2003). Moreover, beneficial income diversification is likely to be based on initial capital generated by livestock sales (Little et al., 2001). This implies that livestock markets and price levels in these markets have a very important impact on the welfare of livestock keepers.

Prices not only impact livestock keepers through their levels, but also in their variation over time. Variable producer prices for livestock rank high among the concerns of East African

pastoralists (Barrett, 2001; Coppock, 2001). It is likely that this is also a concern of livestock keepers in the highland setting considered in this study. Finally, a focus on prices is important as prices are central measure of livestock market performance and efficiency, an indicator of producer incentives and a basis of government revenues from livestock market related services (Jabbar and Ayele, 2003). Understanding price formation allows insight into these issues, and also provides information critical for forecasting future trends.

However, there has been very limited empirical information on determinants of market prices of livestock in Ethiopia. Only a few studies have been undertaken on the issue after Ethiopia's market liberalization (Kebede and Brokken, 1993; Beshargo, 2002; Tilahun, 2004). The current knowledge on livestock pricing is poor and inadequate for designing pricing procedures, policies and institutions meant to improve the livestock marketing system (Solomon et al., 2003). We are not thus able to sufficiently identify factors that determine the formation of market prices of livestock and the relative importance of these factors. In order to address these issues and narrow the current information gap, we initiated this study to empirically investigate formation of market prices of cattle. The objective of this work was to identify determinants of market prices of cattle in Eastern Ethiopia. We have tested various hypotheses on animal and market characteristics that were believed to influence cattle prices.

2. Methodology

2.1. The data set

This study used data collected through a survey of Alemaya livestock market on weekly basis for 53 weeks (7 October 2002 to 13 October 2003). The variables recorded included cattle prices and factors that potentially affect these prices, mainly animal and market characteristics.

2.2. Methods of analysis

A multiple regression model was used in order to identify animal and market characteristics that influence variations in cattle prices and evaluate their relative importance. The regression model specified to explain cattle prices has the following form:

$$\text{Ln}(P_i) = \alpha + \sum \beta_i X_i + \sum \gamma_i X_i X_j + e_i$$

Where: $\text{Ln}(P_i)$ is natural log transformation of the nominal price per kilogram live weight of i^{th} animal. The dependent variable (P_i) is a continuous one representing observed price per kilogram live weight of cattle (Kebede and Brokken, 1993; Beshargo, 2002; Tilahun, 2004) constructed from observed price per head, as animals are commonly sold in the area, divided by the animal's live weight estimated on the basis of measure of its heart girth using a meter (MOA, 1984); α is constant, β_i and γ_i are vectors of parameters to be estimated. X_i is a matrix of explanatory variables that include: age, sex, live weight, grade, type of sellers, buyers' purposes, festivals, time of transaction in a market day and a time trend (Tsigae, 1988; Kebede and Brokken, 1993; Jabbar, 1998; Beshargo, 2002; Tilahun, 2004; Ward and Schroeder, 2004). The interaction terms of some explanatory variables where i and j are different were also considered. Finally, e_i is a disturbance term with mean zero and constant variance.

3. Empirical results

3.1. Results of descriptive analysis

There were 1722 observations for most of the variables. Some variables had some missing values. For instance, live weight was estimated on the basis of heart-girth measures of sample animals using a meter. However, it was not possible to get equivalent weight for heart-girth measures less than 130 cm. This has reduced the number of valid observations that were used for the analysis of live weight and price per kilogram to 1505 (Table 1). The weekly mean price per head of traded animals was Birr² 922. The price ranged between Birr 100 and Birr 3500 with a standard deviation of Birr 440. Table one summarizes some of the key descriptive variables.

Table 1: Descriptive Statistics of Key Variables

Variable	Mean	Minimum	Maximum	Std. deviation	N
Price per head	921.56	100.00	3500.00	440.10	1716
Live weight	290.93	160.00	397.00	42.01	1505
Price per kilogram	3.39	1.02	9.72	1.11	1505
Age	4.18	1.00	7.00	0.90	1714

Live weight of sample of traded animals ranged from 160 kilograms to 397 kilograms with an average of 291 kilograms and a standard deviation of 42 kilograms. Average price per kilogram live weight was Birr 3.39 with a standard deviation of Birr 1.11. This variable ranged between Birr 1.02 to Birr 9.72.

² During the market survey period the exchange rate was 1 USD = 8.61 Birr.

Age of animals in the sample varied between one and seven years with the average being 4.18 years. Ninety-five percent of cattle transactions involved animals aged five years or less. These proportions reveal that most of the animals offered for sale in the Alemaya livestock market were of a relatively young age. Males and females account for 70% (1212) and 28% (481) of the cattle recorded as being sold. Considering animals by body condition (grade) reveals that 41.39% (699) of animals were categorized as good, 48.50% (684) were categorized as fair, with the rest 18.12% (306) being categorized as poor.

Turning to the question of the characteristics of the seller, sellers categorized as farmers formed the majority at 80% (1381) with the remainder being identified as traders. Categorizing sample transactions with respect to buyers' purposes reveals that 34% (590) of animals were bought for home consumption, 31% (527) for resale, 29% (496) for fattening, 4% (63) for butchering, 2% (30) for breeding and 1% (11) for use in local restaurants. Finally it is of note that 39% (666) of sales recorded in the sample are defined as having occurred during festival periods.

3.2. Results of econometric analysis

In order to empirically identify determinants of cattle prices, an effort was made to estimate the multiple regression model described above. The log-transformed version of the dependent variable fit the data better than an untransformed version. As the dependent variable is log transformed, the coefficients can be interpreted as a percent change in the price per kilogram brought about by a unit change in the respective independent variable. Table 2 reports estimation results. The F-value of the model is significant at 1 percent level. The value of

adjusted R^2 shows that about 48% of the variation in the natural logarithm of price per kilogram live weight of cattle is explained by the explanatory variables included in the model.

The coefficients for the age variables are statistically significant. Price formation in the livestock market transactions studied here takes into account the age factor, consistent with results of Jabbar (1998) on the determinants of sheep and goats prices per head, Kebede and Brokken (1993) on price per kilogram live weight of sheep and Beshargo (2002) on price per kilogram live weight of cattle. The quadratic result indicates that the impact of age is increasing until five years of age, then decreases. As noted earlier, about 95% of sales were five years or less, suggesting that sellers are aware that value declines after age five. However, as the majority of sales are of animals below four years of age, there may be a role for an extension program to sell animals later than the current average of four years.

The weight of animals has a statistically significant impact on price as found in Jabbar (1998), Beshargo (2002), Kebede and Brokken (1993) and Tilahun (2004). Analysis of this quadratic term indicates price per kilogram decreases over lower weights, reaching a minimum at just under 300 kilograms before increasing again. Recalling that the mean weight is 291 kilograms suggests price per kilogram increases as animals deviate in either direction from the mean in weight.

The coefficient of dummy variable representing females was negative and statistically significant as predicted. This implies that selling female cattle results in a significant price

discount compared to selling castrated male animals. The coefficient of dummy variable representing noncastrated is statistically insignificant. It would appear that there is no significant difference between price per kilogram received for a castrated male and that of a noncastrated one, suggesting the main benefit of this technique lies in production (faster weight gain an easier management) rather than in terms of marketing.

Table 2: Estimated Parameters of Factors Affecting Cattle Price

Explanatory variable	Ln (price per kilogram live weight)	
	Coefficient [#]	t-value
Constant	0.879***	2.640
Age	0.461***	6.786
Age Squared	-4.489E-02***	-6.439
Female	-0.163***	-6.383
Not Castrated	-7.827E-03	-0.353
Weight	-8.088E-03***	-4.316
Weight Squared	1.352E-05***	4.294
Age-weight interaction	2.464E-04	1.148
Fair grade	-0.128***	-8.459
Poor grade	-6.088E-02**	-2.052
Seller is farmer	-5.109E-02***	-3.195
Buyer will resell	-9.736E-02***	-5.499
Buyer will butcher	-7.973E-02**	-2.455
Buyer will fatten	-6.803E-02***	-4.516

Buyer will breed	5.095E-02	1.029
Buyer for restaurant	-3.194E-02	-0.406
Sale during festival	9.390E-02***	7.422
Time of day	2.678E-06**	2.098
Time trend	3.533E-03***	7.694
Adjusted R ²	0.48	
F-value (18, 1482)	78.22***	

*** and ** indicate statistical significance at the 1% and 5% level.

Animal body condition has a significant overall effect on cattle prices. As expected, price per kilogram decreased when animals were in fair or poor condition. Fair condition cattle registered a significant price discount as compared to good condition cattle as the former assumed statistically significant negative coefficient. These results tend to agree with the original hypothesis that price discounts are associated with animals of lower grades and are consistent with other studies (Tsigae, 1988; Kebede and Brokken, 1993; Beshargo, 2002; and Tilahun, 2004). This suggests that cattle prices are likely to increase with improvement in the body conditions of animals. However, it is interesting to note that the discount for fair condition is higher than that for poor condition. This might happen as buyers are more likely to obtain higher price discounts on animals of better conditions than the poor conditioned ones for the transactions are not on weight basis.

The variable recording whether the seller is a farmer exhibits a significant and negative coefficient. This implies that farmer sellers are more likely to sell their animals at price discounts compared to trader sellers confirming our hypothesis. This could be associated

with a relatively weaker farmers' bargaining ability resulting from their desire to meet immediate cash needs accompanied with lack of up to date cattle market information.

Many of the dummy variables recording the purpose of purchase are significant, which is consistent with the findings of Kebede and Brokken (1993), Jabbar (1998), Beshargo (2002), and Tilahun (2004). The dummy variables signifying cattle bought for resale and butchering took negative and significant coefficients suggesting that such animals tend to assume lower prices in relation to animals purchased for direct home consumption. Animals meant for fattening were also purchased at significant price discount in relation to those bought for home consumption in line with the hypotheses. The coefficients of dummies signifying breeding and restaurant buying purposes had insignificant positive and negative coefficients, respectively, implying that they exhibited neither significant price discounts nor premiums in relation to the home consumption purpose. These empirical results suggest that buyers with business purposes in mind do obtain lower prices than do buyers with other purposes in mind.

The variable representing religious festivals has significant positive coefficient implying that cattle are likely to be sold at significant price premiums during festivals. This suggests that selling cattle during holidays is more likely to be advantageous for the sellers. This finding is consistent with previous studies (Jabbar, 1998; Tilahun, 2004).³

³ The effect of festivals remained robust when two different variables were separately used to represent this explanatory variable. One was a dummy variable taking the value of one for market days one week before and market days on the holidays and zero otherwise. The other was a dummy variable taking the value of one for

The time of day when the transaction occurred has a positive and significant coefficient implying that the variable has an appreciable effect on price per kilogram live weight of cattle consistent with the findings of Beshargo (2002) and Tilahun (2004). This result suggests that there are significant price differences at different times of transaction within a given market day, although the magnitude of the coefficient suggests the impact is not all that large. Cattle prices tend to increase at the later hours of the market day. This confirms one or both of the following arguments: first, the most desperate sellers vend and go early or traders who face fixed transport costs and want to have a truck-herd or trek-quota for the day were likely to pay higher prices near the end of the market day. Our discussions with some of the sellers during the survey period suggested that most of them were likely to take their animals back home if they do not get the prices they have expected, which would favor the latter interpretation.

The time trend variable has a positive and significant coefficient. This would suggest that the long-term upward trend in prices is not related to changing characteristics of the animals sold, but rather reflects a long-term upward trend in prices due to external factors.

4. Summary and policy implications

An analysis was conducted in this paper to identify factors influencing formation of market prices of cattle. Price per kilogram live weight of cattle is influenced by animal characteristics,

market days one week before and market days on the holidays and one week following the holidays and zero otherwise. This confirms the general expectation that prices rise before a holiday and then decline at some point after the holiday.

like age, sex, live weight and grade suggesting that cattle price formation takes into account these characteristics. Furthermore, market characteristics like the type of sellers, buyers' purposes, festivals, time of transaction in a market day and a time trend are also found to have significant effects on cattle prices.

These pieces of information are useful in designing appropriate cattle pricing as well as cattle marketing procedures and provision of services like reliable marketing information to avoid unfair cattle-pricing practices. These measures could enhance the efficiency of cattle pricing system and consequently improve the livelihoods of cattle keepers and handlers. These people should be trained on the procedure of estimating the live weight of animals they intend to sell on the basis of heart-girth measures so that, given market information on price per kilogram live weight, they could pre-estimate what they could obtain from the sales of their respective animals. Finally, as the scope of this study was limited to one primary livestock market, for sound and broader policy formulations, further study on the formation of cattle prices is necessary on more number of sample markets that would include primary, secondary and terminal markets.

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