International Journal of Agricultural Economics and Extension Vol. 1 (1), pp. 010-016, February 2013. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full length Research Paper

Sheep market price determinants in the Central Rift Valley of Ethiopia

Aklilu Nigussie[1,2]*, Dawit Alemu[1] and Ayalineh Bogale[3]

[1]Ethiopian Institutes of Agricultural Research, P. O. Box 2003, Addis Ababa Ethiopia.
[2]Department of Agricultural Economics, Haremaya University, P. O. Box 138, Dire Dwa Ethiopia.
[3]School of Agriculture, Earth and Environmental Sciences, University of KwaZulu-Natal Pietermaritzburg, Scottsville 3209, South Africa.

Received 06 November, 2012; Accepted 05 February, 2012

This study has attempted to identify determinants of sheep price per kilogram live weight using a log-linear regression model. The estimated model explains about 48% of the variation in market prices of sheep. Price per kilogram live weight increases with animal characteristics such as age, live weight and grade. Type of sellers, buyers' purposes, and buyer type are also important variables in affecting prices. Pastorals, agro-pastorals, and farmers tend to sell their animals at price discounts as compared to trader sellers. Sellers suffer from price discounts in selling to buyers with business purposes in comparison to selling to ultimate consumers. 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 producers and/or sellers need to pay attention to animal characteristics, seller types, and buyers' purposes. It is vitally essential to train keepers on the above issues. Provision of reliable market (price) information to market participants, and investment in different sheep marketing facilities (like weighing scale), and services need to be given due attention in order to avoid unrewarding sheep-pricing practices.

Key words: Sheep, live weight, body condition, age, central rift valley.

INTRODUCTION

There are about 26.1 million sheep population heads in the Ethiopia (CSA, 2008). They are an important component of the livestock subsector, are sources of cash income; and play a vital role as a source of meat, milk and wool for smallholder keepers in different farming systems and agro-ecological zones of the country (Getahun, 2008).

Livestock perform multiple functions in the Ethiopian economy by providing food, input for crop production and soil fertility management, raw material for industry, cash income as well as in promoting saving, fuel, social functions, and employment. Various estimates show that the livestock sub-sector contributes 12 to 16% of the total and 30 to 35% of agricultural gross domestic product (GDP), respectively (AAPBMDA, 2009). The sector's contribution to national output is underestimated because traction power and manure for fertilizer are not valued. Contributing 12 to 15% of total export earnings, the sub-sector is the second major source of foreign currency through export of live animals hides and skins (MoFED, 2009).

Small ruminants are an integral part of livestock keeping in Sub-Saharan Africa (SSA) that are mainly kept for immediate cash sources, milk, meat, wool, manure, and saving or risk distribution (Kosgey, 2004). They are also sources of foreign currency (Berhanu et al., 2006). Moreover, due to their high fertility, short generation interval, adaptation in harsh environment and their ability to produce in limited feed resource they are considered as investment and insurance (Tsedeke, 2007). According to (Delgado et al., 1999), "livestock revolution" can be expected to allow the rural poor in developing countries to contribute to the growing market.

However, there has been very limited empirical information on determinates of market prices of livestock in Ethiopia. Only a few studies have been undertaken on

*Corresponding author. E-mail: aklil2002@yahoo.com.

the issue after Ethiopia's market liberalization (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 sheep. The objective of this work was to identify determinants of market prices of sheep in Central Rift Valley of Ethiopia. We have tested various hypotheses on animal and market characteristics that were

Objective

To identify factors determining sheep market price in the selected market places in the Central Rift Valley of Ethiopia and to examine the level sheep markets price determinants in central rift valley of Ethiopia.

METHODOLOGY

Description of the study area

Amibara woreda

Amibara woreda is one of the 30 woredas in the Afar Region and part of the Administrative Zone 3, it is bordered on the south by Awash Fentale, on the west by the Awash River which separates it from Dulecha to the southwest then on the northwest by the Administrative Zone 5, on the north by Gewane, and on the east by the Oromia Region. Towns in Amibara include Awash Arba, Awash Sheleko, Melka Sedi and Melka Were (the sample market area) . Based on figures published by the Central Statistical Agency (CSA) in 2008, this woreda has an estimated total population of 63,280, of whom 35,301 were males and while 27,979 females. From the population 16.37% are farmers both raise crops and livestock, while 1.7% only grow crops and 81.93% only raise livestock.

Awsh fentale woreda

Awash Fentale Woreda is located in the northeastern parts of Ethiopia within the rift valley area of the country and covers a total land area of 180,000 ha. The altitude ranges from 750 to 1040 m.a.s.l. Rainfall amount varies between 400 to 500 mm per annum. Regarding the temperature of the Woreda, the maximum temperature is 42°C and the minimum is 21°C, the average temperature falls between 30 to 32°C. The climatic condition is characterized as arid and semi-arid. According to (CSA, 2008) the total population number of the Woreda is estimated to be 40,359 of which 20,329 are males and 19,630 are females.

The livelihood of the pastoralists of the Woreda is highly dependent on livestock production. According to the Woreda Agricultural Development Bureau, the livestock resource is estimated to be 34,945 heads of cattle, 9,242 camels, 28,690 goats, 18,690 sheep, 1,097 donkey and 3,321 chickens in 2011. A few pastoralists have started to cultivate crops like onion, tomato, and maize by using the available irrigation water. They use livestock products mainly for household consumption and as a source of generating additional income for the household. The major source of feed for their stock is the rangeland, which is commonly owned and has low grazing capacity especially in dry season due to over grazing and other factors.

As far as the socio-economic structure is concerned, most of the populations of the area are pastoralists, which account 85% of the total population, who engaged on rearing camel, cattle, goat and sheep. About 5% of the population is engaged in crop production activities by using the available irrigation water. There are permanent rivers like *Kebena* and *Bulga* crossing some of the Kebles, which can be used for irrigation to cultivate crops. This is because they are accustomed to pastoralism. Among the six Kebles of the Woreda, Saboure, *Kebena* and *Boloita* have easy access to irrigation to exercise crop production activities.

Fentale woreda

Fentale is one of the 180 woredas in the Oromia Region of Ethiopia. Part of the Misraq Shewa Zone located in the Great Rift Valley, Fentale is bordered on the southeast by the Arsi Zone, on the southwest by Boset, on the northwest by the Amhara Region, and on the northeast by the Afar Region. The administrative center of Fentale is Metehara; other towns include Addis Ketema. The Fentale woreda has an estimated total population of 82,225 of which 43,510 are male and 38,715 are female (CSA, 2008).

Adama Woreda

Adama is one of the 180 woredas in the Oromia Region of Ethiopia. It is named after the woreda capital Adama, also known as Nazaret. Part of the Easter Shewa Zone located in the Great Rift Valley. Adama is bordered on the south by the Arsi Zone, on the southwest by Koka reservoir which separates it from Dugda Bora, on the west by Lome, on the north by the Afar Region, and on the east by Boset; the Awash River, the only important river in this woreda, defines the woreda boundaries on

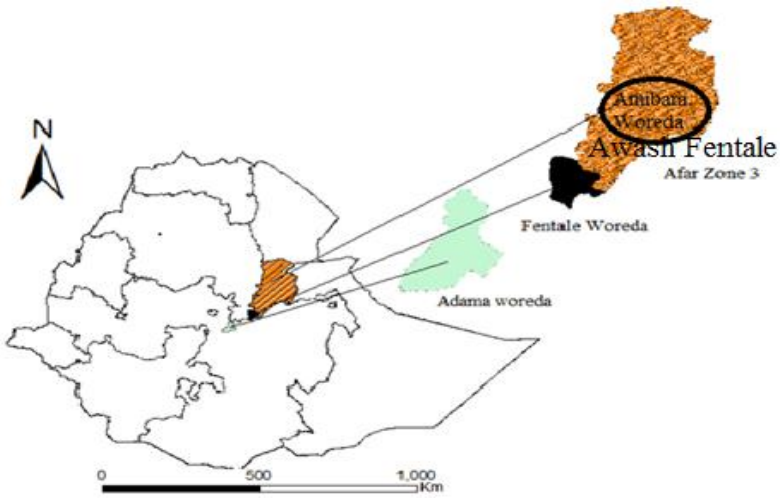

Figure 1. Sample area.

Table 1. Survey data description for the average price determinants.

Labels	Name
Average price paid in Eth. Birr	P
Weight per kilogram	W
Sex	S = Male and female
Age categories	A = Ag ≤ 1, 1< Ag ≤2 and Ag > 2
Body grade or condition	G = Emaciated, thin, moderate and fat
Color	C = Black, red, white and others
Buyer's purpose	Bp = Breeding, fattening, consumption and resale
Buyer's type	Bt = Butchers, farmers, pastorals, agro-pastorals, restaurants, part time traders and traders
Seller's type	St = Farmer, pastoral, agro-pastoral, part time trader and trader.

Source: survey questioners, 2011.

the east and south. Other towns in this woreda include Awash Melkasa, Shewa Alemtena, Sire Robi, Sodere and Wenji Gefersa (Figure 1).

Data set

This study used data collected through a survey of sample markets on weekly basis for 20 weeks (November 2011 to March 2012). The variables recorded included sheep prices and factors that potentially affect the prices.

Methods of data analysis

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

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

$$P_i = \beta_0 + \beta_i W + \beta_i W^2 + \sum_{i=1}^{2} \beta_i S_i + \sum_{i=1}^{3} \beta_i A_i + \sum_{i=1}^{5} \beta_i G_i + \sum_{i=1}^{4} \beta_i C_i + \sum_{i=1}^{4} \beta_i Bp_i + \sum_{i=1}^{7} \beta_i Bt_i +$$

$$\sum_{i=1}^{5} \beta_i St_i + \sum_{i=1}^{2} \beta_i (W*S_i) + \sum_{i=1}^{3} \beta_i (W*A_i) + \sum_{i=1}^{5} \beta_i (W*G_i) + \sum_{i=1}^{4} \beta_i (W*C_i) + \sum_{i=1}^{4} \beta_i (W*Bp_i) +$$

$$\sum_{i=1}^{7} \beta_i (W*Bt_i) + \sum_{i=1}^{5} \beta_i (W*St_i) + \varepsilon_i$$

In the model, live weight price was the dependent variable. The advantage of using live weight price instead of price per head as a dependent variable is that, it is possible to capture the wide variation in weights and within. Moreover, live weight price could give us more useful market information. The explanatory variables in the model were defined as seen in Table 1. G, C, B_p, B_t, and S_t were dummy variables, while β_is were structural parameters of the equation, and $\boldsymbol{\varepsilon_i}$ represented the error term.

Table 2. Description used to measure live weight grades.

Grade	Backbone	Hipbone	Ribs	Tail head	Outline
Fat	Not visible	Not visible	Not visible	Slightly bumpy	Rounded
Medium	Not visible	Visible	Not visible	Recessed slightly	Almost smooth
Thin	Visible faintly	Visible faintly	Visible faintly	Recessed slightly	Undulating
Emaciated	Visible	faintly Prominent	Clearly visible	Recessed	Irregular

Source: esap.awardspace.com/? and guestbook.

Table 3. Percentage market structure of the study markets by buyers' purpose.

Buyers purpose	Market name			
	Werer	Awash	Addis ketema	Adama
Breeding	6.0	2.0	8.0	2.0
Fattening	16.0	20.0	20.0	24.0
Consumption	18.0	26.0	18.0	24.0
Resale	60.0	52.0	54.0	50.0
N	100	100	150	200

N = Sample size. Source: survey data, 2011.

Determination of the age of an animal

The sheep age in the sample markets was determined by the type and number of teeth erupted. According to some literature, the rates of development and decay of animal teeth vary due to sheep breed differences and their strains, condition of their husbandry, and physiological variation of the individual within the same type. Carles (1983) argues that, for determination of age, an examination of the development and condition of the eight lower permanent teeth is a better method. He further emphasizes that the association of the development of the incisors with changes in age is least affected by environmental differences; breed differences are much less than other differences.

Therefore, for age determination the following approximation was used:

1. If only one pair of milk teeth or molars has erupted, the animal's age is said to be nine months used as less than one year in this study.
2. If two pairs of two milk teeth or molars have erupted, the animal's age is 1 year, and if three pairs of milk teeth (molars) have erupted, the animal is 2 years of age, which is used as one up to two years of age in this study.
3. If the first pair of permanent incisors has erupted, the animal is 2½ years old; if three pairs of permanent incisors have erupted, the animal is 3 years; and if four pairs of permanent incisors have erupted the animal's age is considered to be more than 4 years, which is used as greater than two years of age in the study.

Weight (condition scoring) determination (Table 2)

RESULTS AND DISCUSION

Results of descriptive analysis

Sheep play a major role in the livelihood of smallholders in the central rift valley. Producers and traders generally consider inter market price differences as major problems constraining benefits from market price. So with this the price determinants in the sample are signified using two tailed value. This study can determine whether the correlation is significant. The null hypothesis is that the correlation coefficient is zero (or close enough to be taken as zero), and we reject this at the (5%) level if the significance is less than (0.05).

Sheep bought at all the four market places were different in some ways by buyers' purposes. The four market places where large proportions of sheep were bought for profit by individuals especially traders had the following attributes. Awash, and to some extent Adama, bought for consumption purpose. At the same time Awash, Adis ketema and Adama market places bought sheep for fattening purpose on the surveyed days. Purchasing for reproduction purpose had the lowest proportion in all the market places (Table 3).

Considering Table 4 at Awash market place, both male and female sheep had lower overall average weight which is 22 and 20 kg correspondingly, but yet premiums in live-weight price offered were better when compare to Werer market where the average live weights were 22

Table 4. Maximum and minimum weight and average weight sex.

Markets	Maximum live weight	Minimum live weight	Average live weight of male	Average weight of female
Werer	33	12	22	27
Awash	31	14	22	20
Adis ketema	35	13	24.5	24
Adama	34	15	26	20

Source: Survey data, 2011.

and 27 kg for males and females, having a correspondence for the price model. At Addis ketema and Adama market places, male and female sheep had an overall maximum weight higher compared to the others. In these market places, live weight prices of sex categories were rising as weights increased. One can only guess as to why the relationship between live-weight price and weight were so different from the other two market places.

Results of econometric analysis

F-test was used to test the null hypothesis in the price factor determination. The null hypothesis stated that there was no linear relationship while the alternative hypothesis depicted the existence of linear relationship with a significance value of (Prob>F) less than (0.05). So this study provides evidence to reject the null hypothesis having significant relationship with sheep price in the sampled market places. Applying multiple regression analysis on the data collected in 2011 at the market spots, the adjusted R^2 squared values for live weight price paid were 0.52, 0.47, 0.55, and 0.55 for Werer, Awash, Addis ketema and Adama market places respectively (Table 5).

Interpretation of the rest of the results of regression analysis can be done using reduced form of the econometric model. For Werer market place, substituting the values of coefficients from Tables 5 and 6 to the reduced form, the following equation is obtained for sex effect.

$$P = 5.02 + 0.09W_i + 0.06W^2$$

Considering the market spot mean weight of Werer market in the above equation, for the average weight of a ram weighing 22 kg, other variables being constant, a whole ram would be Birr 36.04 which is cheaper than ewes.

For Werer market, the equation for a sheep of yearling (sheep aged less than or equal to one year) would be as follows:

$$P = 5.02 + 0.01W_i + 0.06W^2$$

With consideration of the minimum average price of the live weight of the sheep, which is 12 kg, substituting in the above model the sheep yearling less than or equal to one year at Werer market place, at the time of the survey it cost Birr 13.78, keeping other factors constant.

At Awash market place, the regression equation for a sheep live weight price paid as a dependent variable and weight per kilogram as an explanatory variable, keeping constant other variables, considering Table (5 and 6), the model formation for sex effect would be:

$$P = 6.84 + 0.08W_i + 0.07W^2$$

For a ewe with an average live weight of 20 kg, substituting in the above model 36.44 Birr, assuming other variables are constant, which is cheaper than the rams. At the same market place, using age, the equation for a lamb (sheep aged between one or equal to two years), with assumption of keeping other things variables constant, would be as follows:

$$P = 6.84 + 0.03W_i + 0.07W^2$$

Considering the maximum average weight at the time when the study was conducted, keeping other explanatory variables constant and substituting in the above model 31 kg, the result would give 75.04 Birr, which is cheaper than the age less than or equal to one.

The effect of color on live weight price in the model for Addis ketema market can be expressed in the following reduced form:

$$P = 6.91 + 0.01W_i + 0.06W^2$$

For a sheep weighing 35 kg, other variables are constant; a white sheep would cost 80.76 Birr, which was more expensive than any sheep of other colors assigned to the base (other colors that were not included in the dummies).

The effects of weight per kilogram with consideration of maximum weight with considering live weight price as dependent weight per kilogram and the interaction of buyer purpose with weight as an explanatory to Adama market place for the ram using the average live weight

Table 5. Estimated parameters of main effects of live weight price equation.

	Werer	Awash	Addis ketema	Adama
Intercept	5.02***	6.84***	6.91***	8.45***
Weight	0.03	0.02	0.03	0.03
Weight^2 Sex	0.06	0.07	0.06	0.08
Male	0.64***	0.61***	0.86***	0.24***
Female@				
Age				
Ag ≤ 1	0.17**	1.98***	0.15**	0.42***
1< Ag ≤2	0.54***	1.34***	0.47***	0.37***
Ag> 2@				
Grade				
Emaciated	0.00	0.00	1.84**	0.00
Thin	0.08	0.94***	0.79***	0.03
Moderate	0.08	0.01	0.05	0.19
Fat@				
Color				
Black	0.02**	0.23	0.17**	0.03
Red	0.01*	0.01	0.00	0.04*
White	0.10***	0.13**	0.15***	0.12**
Others@				
Buyer purpose				
Breeding	0.08	0.01	0.02	0.24***
Consumption	0.05	0.02	0.03	0.03
Resale	0.03	0.00	0.08	0.00
Fattening@				
Buyers type				
Agro pastorals	0.25***	0.26**	0.03	0.05
Restaurants	0.77***	0.37***	0.14***	0.02
Part time traders	0.34***	0.25***	0.24***	0.82***
Traders	0.47***	0.19**	0.22***	0.02
Farmers@				
Sellers type				
Pastorals	1.38***	0.54***	0.82***	0.00
Agro pastorals	0.34**	0.30**	0.41**	0.00
Part time traders	0.31**	0.52***	0.63***	0.60**
Traders	0.00	0.07*	0.10*	1.14***
Farmers@				
N	100	100	150	200
Adjusted R^2 (liveweight price)	0.52	0.47	0.55	0.55
Standard error	0.59	0.55	0.47	0.59
F-value	41.73	41.23	56.12	74.42
Significance	< 0.01	<0.01	<0.01	< 0.01

Where *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. N = Sample size. Source: survey data, 2011.

Table 6. Estimated parameters of interaction effects of liveweight price equation.

	Werer	Awash	Addis ketema	Adama
Sex x weight				
Male	0.09***	0.08***	0.06***	0.08**
Female @				
Age x weight				
Ag ≤1	0.01***	0.06**	0.03***	0.02***
1< Ag ≤ 2	0.03***	0.03***	0.01***	0.03***
Ag>2@				
Grade x weight				
Emaciated	0.00	0.00	0.08***	0.00
Thin	0.13*	0.01***	0.06**	0.12*
Moderate	0.01***	0.02***	0.01***	0.02***
Fat@				
Color x weight				
Black	0.02	0.04	0.05	0.16*
Red	0 .09	0.11	0.04	0.01**
White	0.02**	0.05**	0.01**	0.07*
Others@				
Buyer purpose x weight				
Breeding	0.01	0.01	0.02	0.61
Consumption	0.05	0.04	0.08	0.01
Resale	0.17**	0.06**	0.03**	0.59**
Fattening@				
Buyers type x weight				
Agro pastorals	0.02	0.08	0.13	0.07
Restaurants	0.05**	0.10	0.08***	0.03
Part time traders	0.19*	0.02	0.11***	0.03
Traders	0.19	0.21***	0.03***	0.09***
Farmers@				
Sellers type x weight				
Pastorals	0.03***	0.06***	0.07**	0.01
Agro pastorals	0.05**	0.01	0.02***	0.19
Part time traders	0.02**	0.21***	0.08***	0.07***
Traders	0.02	0.01***	0.05***	0.01***
Farmers@				

Where *, ** and *** indicate statistical significance at 10%, 5% and 1% levels, respectively. Source: survey data, 2011.

price model, can be expressed in the reduced form as:

$$P = 8.45 + 0.59W_i + 0.08W^2$$

For a sheep weighing 34 kg, other variables being equal, one buying the purpose of resale would pay 120.99 Birr, which was more expensive than any other sheep sold at the sample market places.

RECOMMENDATIONS

The major purpose of this analysis was to generate baseline information on sheep price determinants in Central Rift Valley district for the selected sample market places. The study was conducted in one phase in order to generate information on sheep price paid and offered. This information was generated at the market spot at the day of exchange for the selected sample market places. The result of this study showed that there was a considerable variation in sheep live weight prices determinants. These variations could relate to variations in overall demand and on the characteristics of animals offered for sale. Animal characteristics that affect live weight price were weight, sex, age, grade, color, buyer's purpose, buyer's type and seller type. Therefore,

development practitioners (government and nongovernmental organizations) can take measures to help suppliers by constructing market infrastructures so as to reduce price disparities and instability. These measures might include:

1. Improving weight of the sheep for instance with the development of ranges and with community based selection of a good breed.
2. With infrastructural development it is possible to increase buyer types to participate in the marketing activity which create more competitive price.
3. Establishing market information systems will help increase know how among the sellers to have the price in other market places that high price disparity among market will minimize by that the arbitrage of market will decline.
4. Promotion of regional trade that sellers will supply good quality sheep with the demand of the buyers' purposes and their type in consideration the sheep sex, age, grade and color.

REFERENCES

AAPBMDA (Animal, Animal Products, and By-product Market Development Authority), 2009. Market Problems and Measures to be taken. AAPBMDA, Addis Ababa, Ethiopia, p. 19.

Berhanu G (2006). Improving the Competitiveness of Agricultural Input Markets in Ethiopia: Experiences since 1991. Paper presented at the Symposium on Seed-fertilizer Technology, Cereal productivity and Pro-Poor Growth in Africa: time for New Thinking 26th Triennial Conference of the International Association of Agricultural Economics (IAAE), August 12 – 18, 2006, Gold Coast, Australia.

Carles AB (1983). Sheep production in the tropics.

CSA Ethiopia (2008). Summery and statistical Report of the 2007 Population and Housing Census.

Delgado CM (1999). Livestock to 2020: the next food revolution. Food, Agriculture, and the Environment Discussion Paper 28. IFPRI, FAO and ILRI. IFPRI, Washington, D.C. p. 72.

Getahun L (2008). Productive and Economic performance of Small Ruminant production in production system of the Highlands of Ethiopia. Ph.D.dissertation. University of Hohenheim, Stuttgart-Hoheinheim, Germany.

Kosgey IS (2004). Breeding Objectives and Breeding Strategies for Small Ruminants in the Tropics. Ph.D. Thesis. Wageningen University, the Netherlands, 272 pp.

MoFED (2009). Report of Ethiopian Economy. Addis Ababa, Ethiopia.

Solomon (2003). Livestock marketing in Ethiopia: A review of structure, performance and development initiatives. Socioeconomics and Policy Research, Working Paper 52. ILRI (International Livestock Research Institute), Nairobi, Kenya, p. 35.

Tilahun (2004) Performance of Cattle Marketing System in Southern Ethiopia with Special Emphasis on Borena Zone, Unpublished M.Sc. Thesis, Alemaya University, Alemaya, Ethiopia.