Small ruminant pricing analysis in Ethiopia

Desk research report

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Mulugeta Yitayih[1] and Girma T. Kassie[1*]

[1]International Center for Agricultural Research in the Dry Areas (ICARDA)

***Send correspondence to Girma T. Kassie (PhD), Email:**
g.tesfahun@cgiar.org

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Small ruminant production system in Ethiopia is predominantly traditional where only small proportion of the producers adopts market oriented production system. Despite possible variations among different agro-ecologies, primarily, small ruminants are produced to fulfil unmet financial demand of households, for home consumptions, and as store of assets. Small ruminant marketing activity incorporates different marketing channels that may include farm gate sales, primary markets, secondary and terminal markets. In these markets, farmers, farmer traders, small traders, and large traders participate at different level. Price of animals at different marketing channels mainly determined by one-to-one bargaining depending on the characteristic of the animals (Kocho et al., 2011, Terefe et al., 2012). In some areas, brokers may mediate the bargaining process between buyers and sellers (Ayele et al., 2006). In additions to animals attributes, mostly price of small ruminants is affected by the overall supply and demand of the animals in a specific season and relative price of similar animals in other nearby locations (Ayele et al., 2006, Kassa et al., 2011, Andargachew and Brokken, 1993).

Relative price satisfaction among different parties

As indicated above, small ruminants marketing is mainly based on buyers and sellers one-to-one bargaining where mostly an actor who has better market information may take better posotion in the bargaining process. However, especially in rural markets, due to limited market information and greater supply than demand, most of the time traders have better bargaining position than farmers to influence price and sometimes farmers are considered as price takers (Gizaw et al., 2010, Kocho et al., 2011, FAO, 2015). This would affect price satisfaction level of the smallholder producers in rural markets. Moreover, a study conducted by Kocho et al. (2011) indicates that higher interference of brokers during price negotiation and higher service commisssion request as the major constraints for small ruminants marketing in their study area. Other studies have also reported that mostly farmers sell small ruminants with lower price than expected prices (Doelamo and Assefa, 2017, Addis and Ginda, 2015).

Efforts to analyze price and pricing mechanisms of small ruminant market in Ethiopia

Key pricing and consumer-behavior related theories

Price of small ruminants is based on new consumer utility theories that assumes goods are not the source of satisfaction but different attributes embodied in the goods . The new consumer utility theory assumes that the good itself does not give utility to consumers, but the characteristics it's possess. Moreover, it also assumes that a good possesses more than one characteristic and some of the characteristics may be shared by other similar goods. Therefore, a good or goods in combination may possess some characteristics that differentiate from other goods. This implies that revealed price of goods is the reflection of implicit prices of different attributes that provide different utilities.

Key econometric models used and key justifications for model choice

Emperical studies on price of small ruminants used limited econometric models. Though it is widely applied in house price analysis, the most common model used in livestock price analysis is Hedonic price model, which is based on consumer utility-theory (Rosen, 1974, Lancaster, 1966). This model has been used by various studies to identify the most important attributes of animals, buyers, sellers, and other location and season related characteristics that would affect prices of animals (Ayele et al., 2006, Woldu et al., 2016, Terfa et al., 2013, Teklewold et al., 2009). The major assumption in this model is that goods are sold as a package of inherent attributes and as a result price of a good is estimated from the sum of all marginal or implicit prices of different attributes estimated from regression analysis (Chin and Chau, 2003). Moreover, in this model it is assumed that implicit prices of attributes are considered as a major factor that guides buyers and sellers decision and prices do not indicates demand or supply of market . This would indicate that market price of animals is mainly depende on buyers judgment on these attributes. However, most

of the emirical studies modeled price not only a function of attributes, but also as a function of buyers, sellers, ad market charteistices (Ayele et al., 2006, Andargachew and Brokken, 1993).

Despite its wider use in modeling attributes price, economists critize hedonic model for its different limitations that may include perfect equilibrum assumption, incorrect function specification, spatial heterogeneity, spatial autocorrelation, multicollinearity, and heteroscedasticity (Parmeter et al., 2007, Xiao, 2017).

Reported determinants of market price of the small ruminants and their patterns

Empirical evidences on determinants of small ruminant price used either live animal price or price per/kg as the dependent variable and animal attributes and buyers, sellers, and market characteristics as independent variables. Most of available studies indicate that animal characteristics such as age, body condition, weight, sex, tail condition, lumbar width, and color are among the most important animal characteristics that would affect price of animals. For instance, findings on the relation between age of the animal and price indicate a non-linear relationship, where the price of animals increases up to certain age level and then decrease again at older age (Ayele et al., 2006, Terfa et al., 2013). This was identified by including both age and age-square as independent variables in the regression model.

Most studies indicate that weight of animal and price has positive relationship. However, in some studies such as Andargachew and Brokken (1993), quadratic relationship, where price first decrease and then increase, was observed. As it is expected, the relationships between price of animal and body condition is positive. Most of the studies indicate castrated male animals or fatty animals fetched higher premium price than animals with average body condition. The relation between sex of animals and price also indicate that mostly male animals have higher premium price than female animals.

Color is one of the important reported attributes that determine price of animals. Mostly, animals with white or brown coat color have higher premium price than black coat color animals. Some studies have also shown positive relationship between size of heart girth and price of sheep, sheep with larger heart girth have better price than sheep with smaller heart girth. Moreover, strong relationship between tail type and price of sheep was observed in some studies. For example, according to Ayele et al. (2006), fatty and ramped tail sheep had greater premium price than fat or thin tailed sheep.

Table 1: Summary of small ruminants attributes that affect price

Independent variables	Sources
Age (+) and Weight (+)	(Tesfaye, 2010)
Age (+) and body condition (+)	(Teklewold et al., 2009)
Weight (+); sex-male(+)	(Kassa et al., 2011)
body condition (+) season (+/-); color-white (+)	
Weight (+); age (+/-); sex –male(+); color--white (+/-)	(Andargachew and Brokken, 1993)
Body weight (+); body condition (+)	(Woldu et al., 2016)
Age (+); Age^2; Sex-male(+); Heart girth(+); body condition (+); Fatty ramped tail (+); color-red/brown (+); breed (+ crossbreed); origin (+/-)	(Ayele et al., 2006)
Age (+); Age^2 , color -white (+); body size (+), and tail condition-medium & fat (+)	(Terfa et al., 2013)
Class seep, body size (+), age(+); Age^2(+); (coat color-white or red (+)	(Bihon, 2009)
Sex-male(+); good body condition (+); age (+); Age(+)	(Gebreselassie, 2015)

Buyer characteristics

Few of the available studies included some buyer characteristics as explanatory variable in small ruminant price models. For example, using export abattoirs as a reference, Teklewold et al. (2009) reported that all other buyers paid lower price for sheep and goats. Similarly, Ayele et al. (2006) reported that compared to traders, consumers, and butchers/ restaurants, farmers paid significantly lower price. Moreover, according to Teklewold et al. (2009), buyers who had access to market information paid significantly lower price than those who did not have.

Table 2: Summary of buyer characteristics that affect price

Independent variables	Sources
Export abattoirs (+)	(Teklewold et al., 2009)
Farmers	(Ayele et al., 2006)
Farmer trader (+)	(Terfa et al., 2013)
Buyer purpose – reproduction; primary consumption (+)	(Bihon, 2009)
Education of buyer (not significant)	(Gebreselassie, 2015)

Seller characteristics

Like to buyers, seller characteristics have also identified as among important factors that affect price of small ruminants. Ayele et al. (2006) and Gebreselassie (2015) reported that compared to others, farmers who sold goat received lower price than traders or others. However, this relationship in sheep price was not statistically significant.

Table 3: Sellers characteristics that affect price

Independent variables	Sources
Cooperatives & small traders (+)	(Teklewold et al., 2009)
Farmer	(Ayele et al., 2006)
Farmer trader (+); Middlemen (+)	(Gebreselassie, 2015)

Market and season specific characteristics

In additions to animal, buyer, and seller specific characteristics, market and season of sale have also found significant effect on price of sheep and goats. Most of the empirical studies indicated that mostly price of small ruminants increase during religious holydays, which may indicates possible association with season of sale. Similarly, market locations have showed significant effect (+/-) on price of small ruminants and different studies reported significant effect of marketing place related indicators.

Table 4: Market location and season specific characteristics that affect price

Independent variables	Sources
Special occasions –religious holydays (+)	(Teklewold et al., 2009)
Season (+/-); Mode of payment (Credit +)	(Teklewold et al., 2009)
Season (+/-)	(Kassa et al., 2011)
Season (+/-)	(Andargachew and Brokken, 1993)
Season (+/-); market location (+/-)	(Ayele et al., 2006)
Season (+/-); market location(+/-)	(Terfa et al., 2013)
Season (+/-), market location(+/-)	(Bihon, 2009)
Market location (+/-)	(Gebreselassie, 2015)

Moreover, when models are disaggregated by market level indicators, results indicate variations in the relationship between price and different attributes. For instance, Andargachew and Brokken (1993) reported that age of animals has different effect at intermediate and redistributive market than terminal markets. This may indicates consumers' preferences for different age groups at different channels of the market.

Critique of the scientific literature

- One of the most important challenge in modelling price of attributes is specification of correct functional forms (Cropper et al., 1988, Brown and Ethridge, 1995) . Some of the available studies do not have information on checking the model assumptions, especially information on homoscedasticity and correct functional relationship between dependent and independent variables. Moreover, most of the available studies adopted the linear specification/ parametric approaches, which may reduce the explanatory power of categorical attributes. Furthermore, various empirical and theoretical evidences strongly suggest the bias associated with using the linear specification and the presence of non-linear relationship between price and most of the attributes (Parmeter et al., 2007, Lisi, 2013, Halvorsen and Pollakowski, 1981).
- The other challenge is related with selection of independent variables. Even though, market information and infrastructures are widely reported as the major constraints in small ruminant

marketing, most of available empirical studies have not considered them in their modelling. Furthermore, most of the studies did not include important spatial/institutional indicators such as distance to market, distance to main road, access to market information, marketing infrastructure, and others.

- Specification of single model for spatially distinct markets, without including variables that capture differences, is also another challenge. Developing the same model for spatially distinct markets may lead to biased estimates due to heteroscedasticity problem arises from market specific factors. Moreover, some studies included market as an independent variable that may not give policy relevant information and considering market related attributes such as population characteristics, other factors related with infrastructures such as road or proximity to urban areas would be more meaningful. Therefore, variables should have been defined in a way that they would be relevant for policy formulation or at least appropriate justification need to be given why prices are related with such type of variables.
- It seems that purpose of buying plays significant role during price determination, as buyers mostly consider different animal attributes when they buy for reproduction and consumption purposes. For example, when farmers buy female small ruminants for reproduction purpose, they may enquire previous history of animals such as litter size and survival rate at weaning of animals. On the other hand, especially in terminal markets, where different breeds of small ruminants are sold, consumer mostly consider breeds/source of animals (i.e Menz vs Black head Somali) as important traits. However, most of the available studies did not include such type of indicators and considering such type of characteristics may improve robustness of estimated models.

Conclusions and key research questions that need to be addressed

- Except few descriptive studies, most of the available empirical studies on small ruminant price determination used hedonic linear regression model alone or together with heteroscedasticity consistent standard error estimation. Given the nature of the dependent and independent variables considered, this may indicate possible gaps in modelling price of small ruminants and the need for developing advanced econometric models the best describes both production and consumption characteristics of smallholder farmers .

- If the independent variables in the price model contain categorical/ordinal variables, appropriate care need to be taken when selecting the functional form and considering the non-linear/non-parametric approach may be more informative than the most commonly used parametric approaches.
- If the price data contains information from different marketing channels, considering multi-level models may be more informative.

Possible Research question

- Non-parametric approaches to determine factors associated with price of small ruminants.
- What are the effects of access to price information and marketing infrastructure on price of small ruminants?
- What is the impact of terminal market price on price of different lower level (farm gate sales, primary markets, and secondary) marketing channels? Terminal market price transmission
- What is the level of small ruminants marketing efficiency (price) and factors associated with it at different marketing channels?

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