HEDONIC PRICE ANALYSIS OF SHEEP AND GOATS IN BAUCHI STATE LIVESTOCK MARKETS: IMPLICATIONS FOR MARKETING STRATEGIES

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ABSTRACT
The study determined the factors that influence price of sheep and goats in Bauchi State, Nigeria Multi-stage sampling technique was used to select 321 sheep traders and 220 goat traders. Data were collected with aid of structured questionnaire. Hedonic price regression model was employed for the study. Data analysis was performed using SPSS version 22. Hedonic price models were fitted to a sample of 6,118 sheep and 4,518 goats, respectively, for which data were collected from 14 markets over a 12-month period. The result of the estimated hedonic price regression model explains 74.1% of the variation in prices of sheep and 88.4% of the variation in prices of goats. This shows that about 74.1% and 88.4% of the variation in the prices of sheep and goats was influenced by the combined effects of the independent variables (market location, age of animal, live weight, sex, body condition, breed, coat colour and season) included in the hedonic model. The remaining proportion can be attributed to error term. F-statistics was significant at $P<0.05$, this statistic suggest goodness of fit of the model. Durbin Watson p-value of 1.02 was also reported, which indicates there is a positive first order auto correlation. Based on the findings of the study, it was concluded that, market location, sex, body condition of animal and season significantly ($P<0.05$) influenced selling price of sheep and goats in the study area. The study recommended that sheep and goats breeding strategies and activities should duly consider the preferences expressed through the prices paid for animals, these could enhance the efficiency of sheep and goat pricing system and consequently improve the livelihoods of sheep and goat keepers and traders. It is vital to train producers on the importance of market oriented (commercial) livestock production system.

Keywords: Goat, Hedonic, Price and Sheep

INTRODUCTION
Hedonic models have been widely used to evaluate the implicit prices of many agricultural commodities, especially livestock (Ramesh *et al.,* 2012). The theoretical foundation of the hedonic price model is mainly made up of two parts: Lancaster preference theory and Rosen's characteristic supply-demand equilibrium model. American scholar Lancaster first put forward a new consumer theory. The theory was expanded from the consumer theory of classical economics, also known as Lancaster preference theory. From the product heterogeneity, Lancaster analyzed basic "element" spaces that formed the product, and argued that the demand for the product was not based on the product itself, but on its characteristics. He noted that heterogeneous goods have a series of integrated characteristics, and the goods are sold as the gathering of inherent characteristics. And that households purchase these goods, use them as a kind of "investment", and turn them into utilities. Therefore, he asserted that level of utilities depends on the quantity of different characteristics, hence it is difficult to analyze such goods market with the traditional economic model, because it cannot be considered by a single total price. It is against that backdrop that, Lancaster thought to adopt a series of prices (hedonic price) to express corresponding product characteristics. Therefore, the product price is made up of hedonic prices, with each product characteristic having its own implied price, and all hedonic prices form a price structure (Bassey *et al.,* 2013). Rosen analyzed theoretically the long term and short-term equilibrium of the heterogeneous product market. Rosen's work established the

modelling foundation for the hedonic price theory, based on which, econometrics method can be used to estimate the hedonic price function, get implicit prices of product characteristics, and then analyze the demand of product characteristics.

Various studies (Kadigi *et al.,* 2013; Ramesh *et al.,* 2012; Alemayehu, 2011 and Kassie *et al.,* 2011) have been undertaken to determine factors that influence market prices of livestock especially cattle. Kadigi *et al.* (2013) used several variables as the basis of attributes used in hedonic pricing models. Characteristics used include sex, breed, lot size, frame size, muscling score, body condition, weight, time of sale, market location, among other factors. A hedonic price function relates the price of a product to the various attributes embodied in the commodity (Ramesh *et al.,* 2012). The underlying hypothesis is that products have utility-bearing attributes and the values of those attributes contribute to the price of the product. The observed price of a good is therefore a composite of the implicit values of the product's attributes. Theoretically, the prices traders receive are reflections of the utility anticipated by the buyers and this utility is derived from the attributes of the product as livestock's can be considered as quality (attribute) differentiated goods.

Parish *et al.* (2017) employed a hedonic pricing model to establish indices of genetic worth of a dairy bull in Alberta, Canada. Their study indicated that most important factors used by dairy farmers in valuing dairy bulls are milk volume, protein and fat content, general conformation, body capacity, and popularity of the bull. Kassie *et al.* (2011), similarly applied heteroscedasticity consistent hedonic price modelling to examine factors that influence cattle prices in the rural markets of central Ethiopia. The results of the study showed that season, market location, age, sex and body size are very important determinants of cattle price. Similarly, Fafchamps and Gavian (2009) employed monthly price data of over 20 years in Niger to examine the determinants of sheep and goat prices, reported that season of selling, rainfall pattern, district location and seasonal holidays influence prices of livestock.

This study focuses on the main phenotypic attributes that buyers inspect when buying sheep and goats in addition to external factors such as seasonality. The external features farmers look at and attach value to, are age, colour, body size, sex, and the place where the sheep and goats were brought from. Although in some parts of Bauchi State, economic analysis of livestock marketing has been conducted, yet, studies on sheep and goats' attributes (physical observable character) or factors which are most important in explaining variations in selling prices which can then be matched to preferences of the buyers for live sheep and goats were limited. However, studies on hedonic price analysis of sheep and goats will reveal preference for sheep and goats and other factors (physical observable characters) that influence the selling price. This could be a major input for sheep and goats' breeders, policy makers and buyers and traders as to improve production and quality of the product according to the market demand and gives indications about the market (bargaining) price to the buyers/traders. The outcomes of the study may also serve as reference for researchers to embark upon similar or related researches in other parts of the country with hope to develop a standard of marketing strategy for sheep and goats in the near future. This necessitates an empirical study on market price analysis to determine the factors that influence price of sheep and goats in Bauchi State, Nigeria.

MATERIALS AND METHODS

THE STUDY AREA

Bauchi State is one of the States in the northern part of Nigeria located in the Sudan savannah and the Sahel savannah zones between latitudes 9° 3' and 12° 3' north and longitudes 8° 50' and 11° east of the Greenwich meridian. The Sudan savannah type of vegetation covers the southern

part of the State. While The Sahel type of savannah, also known as semi-desert vegetation, becomes manifest from the middle of the State as one moves from the State's south to its north. The State occupies a land mass of about 49,119km^2 representing about 5.3% of Nigeria's total land mass (BSADP, 2015). Rainfall ranges between 1300 mm per annum in the south and 700 mm per annum in the extreme north. Therefore, there is progressive dryness toward north, culminating in the desert condition in the far north. Temperature ranges from a minimum of 9.11^{0}C in December/January to a maximum of 40.55^{0}C between April and May (BSADP, 2015). According to National Bureau of Statistics (NBS, 2017) Bauchi State has a total estimated population of 4,826,112. This large peasant population of the State engages in crop and livestock production. The major crops grown include sorghum, millet, maize, rice, groundnuts, soya beans, cowpea, sesame etc. While the major livestock reared include cattle, sheep, goats and poultry. Most of the livestock are reared under extensive management system. The predominant small ruminants are goats (breeds include Sokoto red, Sahel and West African Dwarf goat) and sheep (breeds include Uda, Yankasa, Balami and West African Dwarf sheep) while few other breeds are also found. Rearing of small ruminants, crop production and marketing form the major economic activities in the study area.

SAMPLING TECHNIQUES AND SAMPLE SIZE

The sampling technique was multi-stage. In the first stage, Bauchi State was clustered into three Agricultural zones comprising: central (Darazo, Ganjuwa, Ningi, and Warji), northern (Dambam, Gamawa, Giade, Itas-gadau, Jama,are, Katagum, Misau, Shira and Zaki) and western (Alkaleri, Bauchi, Bogoro, Dass, Kirfi, Tafawa Balewa and Toro). In the second stage, eight (8) urban livestock markets and six (6) local livestock markets was purposively selected (14 livestock markets). This was based on fact that, there are well established livestock markets in the selected LGAs and there was sufficient supply and concentration of sheep and goats' traders. In the third stage, 321 sheep and 220 goats' traders from each market were selected using simple random sampling techniques. Data were collected with aid of structured questionnaire from 321 sheep traders and 220 goats' traders from 14 markets over a 12-month period. In addition, a check list was used for observation, inspection and asking the traders verbal questions regarding price as well as sheep and goats characteristics that determine selling price such as age, sex, coat colour, size, breed and body condition. Age was measured approximated by the type and number of teeth following Fikru and Gebeyew (2015) estimation guideline. Information on sex, coat colour and breed was observed through inspection of the sheep and goats. Live weight of sheep and goats was measured in Kilogram using measuring weigh scale (1000kg). The study classifies sheep and goats based on their sizes into small, medium and large, each category weighing approximately 1-30kg, 31–50kg and 51-70kg, respectively. This classification was adopted and modified from Mohammed *et al.* (2013) that classified cattle based on their sizes into small, medium and large, each category weighing approximately 220-350kg, 350–480kg and 480-600kg, respectively in Gombe metropolis.

Data for body condition scoring in sheep and goats was an estimate of the muscle and fat cover of animal by palpation of different regions of the body. The method adopted for this study was originally described by Nsoso *et al.* (2003). The method consists of a scale of six scores, from 1 to 6, based on the fat coverage in the lumbar region. This method was subsequently modified by Khan *et al.* (2006) where sheep and goats body condition were determined by visual assessment to identify any physical deformity. It is done by feel with hand thoracic, hind leg, hump parts and tail of the animal to assess the fat content which indicates the state of health and nutrition of the animal as well as quantity of meat and fat deposited.

A hedonic price regression model was fitted to determine the factors influencing sheep and goat prices. The model was adopted to achieve the objective which is to determine the factors (live weight, sex, coat color, age of animal, breed, body condition and season) that influence price of sheep and goats.

$P = f(X)$ or $P = f(X1 \ldots Xn)$ …(1)

where;

P= Price of Sheep or Goat

X ranges from $X_1, \ldots, X_n$ = Factors

Considering f(X) as a linear function

The hedonic price regression model for sheep is expressed as:

$$P_S = a + b_1D_1 + b_2D_2 + b_3D_3 + b_4D_4 + b_5D_5 + b_6D_6 + b_7D_7 + e \quad ...(2)$$

Where;

P_S = Price of Sheep (₦)

a = Constant

D_1 = Age (1=Immature <1 year, 2= Young 1-3 year, 3= Matured 4-6 year and 4=Aged >6 years)

D_2 = Live weight (kg) (1= <10kg, 2= 10-20kg, 3= 21-30kg, 4= >30kg)

D_3= Sex (1=Ram, 2= Ewe and 3= Castrated)

D_4 = Body condition (1= Lean, 2= Moderate, 3 =Fat and 4= Very fat)

D_5= Breed (1= Yankasa, 2=Uda, 3= Balami and 4= West Africa Dwarf and 5= Otherwise)

D_6 = Coat colour (1= White, 2=Black, 3=Brown and 4 = Otherwise)

D_7 = Season (1= Early dry, 2= Late dry, 3= Early rainy and 4= Late rainy)

The reference group in the hedonic price regression model of sheep is as follows;

D_1 = Age (2= Young 1-3 year)

D_2 = Live weight (kg) (2= 10-20kg)

D_3= Sex (1=Ram)

D_4 = Body condition (2= Moderate)

D_5= Breed (1=Yankasa)

D_6 = Coat colour (1= White)

D_7 = Season (2= Late dry)

The hedonic price regression model of goat is expressed as:

$$P_G = a + b_1D_1 + b_2D_2 + b_3D_3 + b_4D_4 + b_5D_5 + b_6D_6 + b_7D_7 + e \quad ...(3)$$

where;

P_G = Price of goats (₦)

a = Constant

D_1 = Age (1=Immature <1 year, 2= Young 1-3 year, Matured 3-5 year and Aged >6 years)

D_2 = Live weight (kg) (1= <5kg, 2= 5-15kg, 3= 16-25kg, 4= >25kg)

D_3= Sex (1=Bucks, 2= Does and 3= Castrated)

D_4 = Body condition (1= Lean, 2= Moderate, 3 =Fat and 4= Very fat)

D_5= Breed (1= Red Sokoto, 2= Sahel, 3= West Africa Dwarf and 4=Otherwise)

D_6 = Coat colour (1= Red, 2=Black, 3=Brown and 4 = Otherwise)

D_7 = Season (1= Early dry, 2= Late dry, 3= Early rainy and 4= Late rainy)

The reference group in the hedonic price regression model of goats is as follows;

D_1 = Age (2= Young 1-3 year)

D_2 = Live weight (kg) (2= 5-15kg)

D_3= Sex (2=Does)

D_4 = Body condition (2= Moderate)

D_5= Breed (1=Red sokoto)

D_6 = Coat color (1= Red)

D_7 = Season (2= Late dry)

RESULTS AND DISCUSSION

ESTIMATED HEDONIC REGRESSION OF FACTORS THAT INFLUENCE PRICES OF SHEEP

The result of the estimated hedonic price regression model explains 74.1% of the variation in prices of sheep. This shows that about 74.1% of the variation in the prices of sheep was influenced by the combined effects of the independent variables (age of animal, live weight, sex, body condition, breed, coat colour and season) included in the hedonic model. The remaining proportion can be attributed to error term. F-statistics (12.66) was significant at $P<0.05$, this statistic suggest goodness of fit of the model. Durbin Watson p-value of 1.02 was also reported. Which indicates there is a positive first order auto correlation as presented in Table 1.

The location of the 14 weekly markets also has an observed effect on the prices of sheep. Market location were entered as dummy variable. The reference market was Azare market because of sufficient supply and concentration of sheep traders. The estimated coefficient for market locations shows prices are lower in markets located in distant areas than those located in close distance areas. The result of the model also shows that sheep fetch higher prices in Bogoro, Toro, Marrarraba-liman Katagum and Laraski livestock markets when compared to Azare market. This is likely due to the relatively high potential for sheep population in the northern and central zone of Bauchi State and hence high supply. Another reason is that, Azare market is the major market where traders buy sheep (supply) and resale in other markets in Bauchi State. These results imply that buyers and sellers would benefit if they carefully choose market location.

The result further revealed there was significant difference ($P<0.05$) in the price of Ram, when compared with the price of ewe and castrated sheep. Ram attracted the higher price than ewe. The reason was probably because male sheep were preferred than female because of Carcass quality. The result obtained here is also consistent with the findings of Mahmud *et al.* (2014), confirms that other things being equal, price per animal was significantly higher for males as compared to female sheep. The lower price offered for female sheep is mainly because producers only sell female animals at the end of their productive life, which makes them older than Ram and castrates offered for sale. In other hand, castrated sheep attract higher price than Ram and ewe. This is probably because castration is a widely used practice for adding value to the animals. In the overall model, there was a significant difference ($P<0.05$) in the prices of young sheep (reference group) when compared with the price of immature. While the price of matured and aged sheep is higher than the price of young sheep. This can be attributed to carcass difference. Tsedeke *et al.* (2011), also confirms that prices are highest for matured sheep relative to the immature and young sheep. However, Terfa *et al.* (2013), also confirms that age influenced sheep price significantly and negatively, implying that sheep command a higher price up to a very old age and the price will fall down as age goes up.

Live weight of sheep significantly influences market prices of sheep at $P<0.05$. Live weight range between 10-20Kg was used as reference group. Sheep with live weight of 21-30Kg and above significantly influenced prices of sheep at $P<0.05$ and attracted higher prices compared to the reference group (10-20Kg). This is a clear indication of the interests of sheep producers/buyers in the study areas probably because of the reproductive functions they are expected to perform to ensure herd growth and continuity.

The price of *Yankasa* breed of sheep were compared with price of *Uda*, and *West African Dwarf*, the result shows that the price of *Yankasa* breed were found to be statistically significant at $P<0.05$ with negative coefficient, which implies that, prices of *Yankasa* were higher than that of *Uda* and *West African Dwarf*. However, price of *Balami* and other cross breed of sheep were significantly ($P<0.05$) higher when compared with price of *Yankasa*. This probably may arise because of the meat quality and taste of *Yankasa* and *Balam* breed as confirmed by butchers. Another reason is that *Yankasa* was the most commonly breed of sheep reared in the study area, in addition, *Uda and West African Dwarf* placed in the markets by traders' lack sufficient feeding. However, coat colour of sheep were not statistically significant at $P<0.05$. In most cases, coat colour is not given special attention in the study area for sheep. Although some colours are preferred for some ritual ceremonies.

Body condition was another factor that influence market prices of sheep in the study area. The price of moderate sheep was found to be significant at $P<0.05$ and attracted higher price when compared with price lean. Furthermore, the price of fat and very fat sheep was found to be significant at $P<0.05$ with positive coefficient. This implies that fat and very fat sheep attracted higher prices

when compared with moderate (reference group) and lean sheep. The variation in the price of sheep with different body condition score in the study area may be as a result of assessment carried out by buyers in terms of quantity of fat deposit found in very fat animal when compared with moderate and lean.

In the empirical model, the early dry season corresponds to December – February; late dry season (March – May); early rainy season (June – August) and the late rainy season (September – November). The late dry season was used as the reference group for comparison of the influence of season on prices of sheep. The results show there was a significant difference ($P<0.05$) in the price of sheep across season. All the coefficients were negative, meaning that prices of sheep were higher around March to May (late dry season) when compared to price of sheep around December to February (early dry season). This is probably due to shortage of feed and high cost of feed at late dry season linked with poor financial position of rural producers. Similarly, prices of sheep were lower around June to August (early rainy season) and around September to November (late rainy season) when compared to price of sheep around March to May (late dry season). It is the period of rainfall, marketing activities during this time is usually low and therefore prices tend to be low due to low demand.

Table 1: Estimated hedonic regression of factors that influence price of sheep

Variable	Coefficient	SE	t-statistic
Market location			
Azare (Reference group)	0	0	0
Gamawa	292.119	1043.613	0.28^{NS}
Dambam	744.7455	1015.047	0.73^{NS}
Hardawa	-510.7142	1135.698	-0.45^{NS}
Sakuwa	306.9694	1152.278	0.27^{NS}
Darazo	2586.576	1133.279	2.28^{**}
Katangar warji	1543.554	1141.130	0.48^{NS}
Soro	55.49353	1143.269	0.05^{NS}
Gadan maiwa	989.9098	1175.361	0.84^{NS}
Alkaleri	-793.3391	168.536	-4.71^{***}
Bogoro	2326.3397	1146.361	2.02^{**}
Toro	3374.2348	1056.547	$3.20^{***.}$
Mararraba L/ katagum	1454.925	701.568	$2.07^{*.}$
Laraski	201.4143	126.609	1.59^{*}
Sex			
Ram (Reference group)	0	0	0
Ewe	-778.653	562.344	-1.38^{*}
Castrated	840.923	557.137	1.51^{*}
Age of sheep			
Immature (<1 year)	-925.3075	642.3107	-1.44^{*}
Young (1-3 year) (Reference group)	0	0	0
Matured(4-6 year)	1202.41	649.7913	1.44^{*}
Aged (>6 years)	1404.3715	642.0086	2.19^{*}
Live weight			
<10kg	-972.4376	640.1296	-1.52^{*}
10-20kg (Reference group)	0	0	0

21-30kg	1032.862	644.4651	1.60*
>30kg	1520.3454	647.4619	2.35**
Breed			
Yankasa (Reference group)	0	0	0
Uda	-138.4526	729.0277	-0.19NS
Balami	1435.632	728.1231	1.97*
West African dwarf of sheep	-2397.0349	716.35	-3.35***
Other wise	397.0349	731.3145	0.51NS
Coat colour			
White (Reference group)	0	0	0
Black	-646.4775	652.3576	-0.99 NS
Brown	-61.50292	644.1884	-0.10 NS
Otherwise	-417.393	640.0613	-0.65NS

Source: Field survey, 2017

Note: ***Significant at p≤0.001, **Significant at p≤0.01, *Significant at p≤0.05 and NS= Not Significant, DW= Durbin Watson.

Table 1: Estimated hedonic regression of factors that influence price of sheep cont'd

Variable	Coefficient	SE	t-statistic
Body condition			
Lean	-1385.282	728.8026	-1.90*
Moderate (Reference group)	0	0	0
Fat	1042.386	722.6943	1.44*
Very fat	1171.043	739.3885	1.58*
Season			
Early dry	-1899.569	733.1033	-2.59**
Late dry (Reference group)	0	0	0
Early rain	-1386.7376	723.1841	-1.92*
Late rain	-1353.2787	722.6815	-1.49*
Constant	37990.17	1297.949	29.27***
R^2	**0.741**		
F-statistic	**12.66***		
DW	**1.02***		

Source: Field survey, 2017

Note: ***Significant at P≤0.001, **Significant at P≤0.01, *Significant at P≤0.05 and NS= Not Significant, DW= Durbin Watson.

ESTIMATED HEDONIC PRICE REGRESSION OF FACTORS THAT INFLUENCE PRICE OF GOATS

The result of the estimated hedonic price regression model explains 88.4% of the variation in prices of goats. This shows that about 88.4% of the variation in the prices of goats was influenced by the combined effects of the independent variables (age of animal, live weight, sex, body condition, breed, coat colour and season) included in the hedonic model. The remaining proportion can be attributed to error term. F-statistics (11.8) was significant at P<0.05, this statistic suggest goodness of fit of the model. Durbin Watson p-value of 1.06 was also reported. Which indicates there is a positive first order auto correlation as presented in Table 2.

The location of the 14 weekly markets also has an observed effect on the prices of goats. Market location were entered as dummy variable. The reference market was Azare market because of sufficient supply and concentration of goats' traders. The estimated coefficient for market locations shows prices are lower in markets located in distant areas than those located in close distance areas. The result of the model also shows that goats fetch higher prices in Bogoro, Toro, Marrarraba-liman Katagum and Laraski livestock markets when compared to Azare market. This is likely due to the relatively high potential for goats' population in the northern and central zone of Bauchi State and hence high supply. Another reason is that, Azare market is the major market where traders buy goats (supply) and resale in other markets in Bauchi State. These results imply that buyers and sellers would benefit if they carefully choose market location.

The result further revealed there was significant difference ($P<0.05$) in the price of Does, when compared with the price of Bucks and castrated goats. The reason was probably because Does were preferred than Bucks because of Carcass quality. The result obtained here is also consistent with the findings of Mahmud *et al.* (2014), confirms that other things being equal, price per animal was significantly higher for Does as compared to Bucks. In other hand, castrated goats attract higher price than Bucks. This is probably because castration is a widely used practice for adding value to the animals. In the overall model, there was a significant difference ($P<0.05$) in the prices of young goats (reference group) when compared with the price of immature (<1years). While the price of matured goats (4-6 years) and aged goat (>6 years) was higher than the price of young goats (1-3 years). This can attribute to carcass difference. Tsedeke *et al.* (2011), also confirms that prices are highest for matured goats relative to the immature and young goats. However, Terfa *et al.* (2013), also confirms that age influenced goat price significantly and negatively, implying that goats command a higher price up to a very old age and the price will fall down as age goes up.

Table 2: Estimated hedonic regression of factors that influence price of goats

Variable	Coefficient	SE	t-statistic
Market location			
Azare (Reference group)	0	0	0
Gamawa	1162.98	1225.616	0.95^{NS}
Dambam	163.0691	1199.693	0.14^{NS}
Hardawa	-474.8455	1315.562	-0.36^{NS}
Sakuwa	30.00516	1342.867	0.02^{NS}
Darazo	2464.075	1310.865	1.88^{*}
Katangar warji	1135.4	1326.375	0.86^{NS}
Soro	62.03606	1336.116	0.05^{NS}
Gadan maiwa	1513.512	1079.587	1.31^{*}
Alkaleri	793.9633	1366.37	0.58^{NS}
Bogoro	1795.3818	1034.672	1.74^{*}
Toro	1654.7397	1149.561	1.44^{**}
Mararraba L/ Katagum	1585.0813	1009.862	-1.57^{*}
Laraski	1630.9361	1117.533	1.46^{*}
Sex			
Bucks (Reference group)	0	0	0
Does	-1215.848	652.4901	-1.86^{*}

Castrated	1114.0505	648.3031	1.72*
Age of sheep			
Immature (<1 year)	-1366.9706	742.3866	-1.84*
Young (1-3 year) (Reference group)	0	0	0
Matured (4-6 year)	1471.279	754.3814	1.95*
Aged (>6 years)	-1155.93797	747.4525	1.55*
Live weight			
<10kg	-1483.5217	643.9503	-2.30**
10-20kg (Reference group)	0	0	0
21-30kg	1463.2181	643.9503	2.27**
>30kg	1184.6814	655.8107	1.81*
Breed			
Red sokoto (Reference group)	0	0	0
Sahel	832.3646	844.9169	0.19NS
West African of Dwarf goat	-1209.4717	830.5463	-1.46*
Other wise	334.3254	849.547	0.39NS
Coat color			
Red (Reference group)	0	0	0
Black	521.7179	760.5353	0.69NS
Brown	-511.0618	751.9642	-0.68NS
Otherwise	-325.2574	741.6716	-0.44NS
Body condition			
Lean	-423.1406	924.8362	-0.46*
Moderate (Reference group)	0	0	0
Fat	1627.239	932.704	1.74*
Very fat	1242.589	933.1107	1.33*

Source: Field survey, 2017

Note: ***Significant at p≤0.001, **Significant at p≤0.01, *Significant at p≤0.05 and NS= Not Significant, DW= Durbin Watson.

Table 2: Estimated hedonic regression of factors that influence price of goats cont'd

Variable	Coefficient	SE	t-statistic
Season			
Early dry	-1211.8504	832.3874	-1.46*
Late dry (Reference group)	0	0	0
Early rain	-1318.4442	836.3747	-1.58*
Late rain	-1358.7319	835.7247	-1.63*
Constant	29522.56	1549.107	19.05***
R^2	**0.884**		
F-statistic	**11.18***		
DW	**1.06***		

Source: Field survey, 2017

Note: ***Significant at P≤0.001, **Significant at P≤0.01, *Significant at P≤0.05 and NS= Not Significant, DW= Durbin Watson.

Live weight of goats significantly influences market prices at P<0.05. Live weight range between 10-20 Kg was used as reference group. Goats with live weight of 21-30 Kg and above significantly influenced prices of goats at P<0.05 and attracted higher prices compared to the reference group (10-20 Kg). This is a clear indication of the interests of goat producers/buyers in the study areas probably because of the reproductive functions they are expected to perform to ensure herd growth and continuity.

The price of *Red Sokoto* breed of goats where compared with price of *Sahel*, and *West African Dwarf* goat, the result shows that, the price of *Red Sokoto* breed were found to be statistically significant at P<0.05 with negative coefficient, which implies that, prices of *Red Sokoto* were higher than that of *Sahel* and *West African Dwarf* goat. However, price of *Sahel* and another cross breed of goat were significantly (P<0.05) higher when compare with price of *Red Sokoto*. This probably may arise because of the meat quality and taste of *Red Sokoto* and *Sahel* breed as confirmed by butchers. Another reason is that *Red Sokoto* was the most commonly breed of sheep reared in the study area, in addition, *West African Dwarf goat* placed in the markets by trader's lack sufficient feeding. However, coat color of goats where not statistically significant at P<0.05. In most cases, coat colour is not given special attention in the study area for goats. Although some colours are preferred for some ritual ceremonies. Body condition of goats was another factor that influence market prices in the study area. The price of moderate goat was found to be significant at P<0.05 and attracted higher price when compared with price of lean goats. Furthermore, the price of fat and very fat goats was found to be significant at P<0.05 with positive coefficient. This implies that fat and very fat goats attracted higher prices when compared with moderate (reference group) and lean goats. The variation in the prices of goats with different body condition score in the study area may be as a result of assessment carried out by buyers in terms of quantity of fat deposit found in very fat animal when compared with moderate and lean.

In the empirical model, the early dry season corresponds to December – February; late dry season (March – May); early rainy season (June – August) and the late rainy season (September – November). The late dry season was used as the reference group for comparison of the influence of season on prices of goats. The results show there was a significant difference ($P<0.05$) in the price of goats across season. All the coefficients were negative, meaning that prices of goats were higher around March to May (late dry season) when compared to price of goats around December to February (early dry season). This is probably due to shortage of feed and high cost of feed at late dry season linked with poor financial position of rural producers. Similarly, prices of goats were lower around June to August (early rainy season) and around September to November (late rainy season) when compared to price of goats around March to May (late dry season). It is the period of rainfall, marketing activities during this time is usually low and therefore prices tend to be low due to low demand.

CONCLUSION

Based on the findings of the study, it was concluded that, market location, sex, body condition of animal and season significantly ($P<0.05$) influenced selling price of sheep and goats in the study area. Age group and body condition of the traded animals are important observable attributes of the animal reflected in the observed price.

Based on the results of this study, the following recommendations were made:

i. The findings of hedonic price analysis suggested that sheep and goats breeding strategies and activities should duly consider the preferences expressed through the prices paid for animals, these could enhance the efficiency of sheep pricing system and consequently improve the livelihoods of sheep/goats' keepers and traders. It is vital to train producers on the importance of market oriented (commercial) livestock production system.

ii. Live weight is considered a very important variable in determining the price of sheep and goats. Separate weighing machine for small and large animals should be installed at the entry point of market. This will help traders to know the exact weight of animal and brings them at par with other market agents in price bargaining. So, the good quality animals will bring more if they are sold by grade and weight.

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