Pricing: a Management Technology for Goat Meat Market in Bangladesh Using Simultaneous Equation Model

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Abstract

This study was conducted to find out the management technology of goat meat market for improving local contribution to this market in Bangladesh. In this study a complex multi-equation system model is established to represent the management technology for goat meat market. Due to biological and economic factors interrelated with goat meat market Simultaneous Equation Model (SEM) was used by estimating Two Stage Least Square (TSLS) method. Time series data for the year 1980-2000 were used in the study. The model was analyzed using the E-views software. Results show that 1% increase in goat meat price increased the population of female adult goat, total number of goat, the supply of goat meat and income from goat by 0.003, 0.024, 0.002 and 0.309%, respectively. On the other hand, 1% increase in goat meat price reduced the demand of goat meat by 0.511%. Female adult goat, total number of goat, the supply of goat meat, income and demand are inelastic responded significantly to the price of goat meat. Due to inelasticity in demand for goat meat, producers can earn more money and it is also possible to the government for earning more money both from the national and international market. To manage the goat meat market more efficiently, pricing of goat meat as management technology can be used. For goat meat production the government should control and fix the rates such as slaughter rate of male goats and female goats, kidding rate of female goats, mortality rates of goat kids, goat meat export rate, skin export rate and live goats export rate. The price support policy should be applied/introduced not only to the price of goat meat but also for trade policy in the case of small and large scale goat farming. Therefore, 'pricing' of goat meat is the most important 'management technology' to improve and develop the goat meat market in Bangladesh.

1. Introduction

Goat production forms an important component of the integrated crop-livestock and smallholder agriculture and goat meat price is highest among meats in Bangladesh. Goats are reared by very poor people as an income generating source in the rural areas at a very cheap price which differ from original producers to ultimate consumers. It happens mainly due to involvement of middlemen in marketing channel. Sometimes, specially in rainy season and deceased period, goat price at farm gate goes so down that it does not cover up the production cost of the goat farmers. On the other hand, whole price mechanism is under the control of the middlemen during Eid festival (Eid-ul-Azha) and these middlemen earn huge amount of profit, consequently both the producers and consumers can not get the benefit of goat price during this time. At present on an average, the market price for goat meat, chicken and beef is Taka 450, 250 and 300 kg^{-1}, respectively. In this situation, if market is controlled by middlemen, consumers will be suffered by them or monopoly sellers for purchasing high priced goat meat. Farmers' cooperatives, good marketing channels and central meat processing station paving the way for production of meat as per consumers' demand at a reasonable price is a contributing factor in the sustenance of the market. Furthermore, terms and conditions of trade in international market are determined by product's demand elasticity within two countries (Rahman, 1995). Before planning for export there is a need to determine the elasticity of goat meat. Every step of goat meat production depends on the management of the goat meat market. Consequently, government should handle the goat meat market for producer's supply and consumer's demand. Therefore, there is a need of technology to manage

goat meat market efficiently. That is why interrelationships of the variables-goat population, demand, supply, price, and its substitute and income are important to be identified and determined-need econometric analysis so that measures can be taken in improving goat meat market management. Amin et al. (2002) mentioned of major and minor problems and its solutions for goat and goat meat marketing system. Government role will be just to monitor the process and policy implications. Lagemeir (1967), Kulshreshtha and Willson (1972), Coleman and Meike (1988) and Sarmin (1998) used both of Ordinary Least Square (OLS) and Two Stage Least Square (TSLS) in Simultaneous Equation Model (SEM). If simultaneity among variables is ignored and OLS procedure is applied to estimate the parameters of a system it will be biased and inconsistent. Furthermore, tests of hypotheses on parameters will be invalid (Ramu, 1995). That is why present study used TSLS. Sarmin (1998) used econometric analysis for beef market in Malaysia. In Bangladesh, a few number of economic research studies done on profitability of goat rearing under scavenging conditions (Sayeed et al., 2003), under stall feeding and semi-intensive system (Yasmin, 2003). Yasmin (2003, 2004, 2005, 2006) used econometric analysis for goat. Yasmin (2003, 2004) used SIMM technology for goat production and export analysis. Yasmin (2005) estimated factors affecting goat meat market. Few more studies were also done by Yasmin (2004) but no study has been done on goat meat market management technology which is very essential in Bangladesh at present. On this background, the objective of this study is to identify management technology for developing and improving the goat meat market in Bangladesh by econometric analysis using SEM.

2. Materials and Methods

2.1. Theoretical framework

Theoretical framework of this study is based on the market model which can be summarized in three general structural equations as shown below:

$$Dt=f(Pit, Pjt, Zt)$$
$$Qt=f(Pt, Nt, Zt)$$
$$Dt=Qt \quad \text{..... (1)}$$

Demand for a product at the period (Dt) is explained as being dependent on its price (Pit), prices of one or more of its substitutes (Pjt) and the disturbance factors (Zt). Accordingly, supply (Qt) would depend on its prices (Pit), production (Pt) and the disturbance factors. The market is said to be under equilibrium when the demand is equal to the supply under common price. In an econometric description of the model, the variables are classified as endogenous variables or targets (D and S) and exogenous variables (P, N and Z). In the matrix form, the above equation system is represented by the following:

$$B_1Y=B_2\times=U \quad \text{..... (2)}$$

Where Y is a G×n matrix of current endogenous variables, X is an M×n matrix of exogenous variables and U is a G×n matrix of current disturbance terms. B_1 represents the G×G matrices of coefficients of the endogenous variables and B_2 is a G×M matrix of coefficients of the exogenous variables (Sarmin, 1988).

2.2. System modeling specification

2.2.1. Production cycle

Goat meat production involves a complex biological process which is determined by the management, type of animal, feed and environmental influences. The production cycle of goat consists of kids and adult goat. Figure 1 shows production cycle for goat. For completion of the production cycle goat takes five months for pregnancy period and kidding interval varies 1-2 months. Two kids adult^{-1} female year^{-1} is the actual figure for village goat (Husain, 1999). In Bangladesh, goat attains slaughter weight normally at about one year six months. Slaughter goats also come from culled breeding goats which are old she/he goat having breeding problems or low performance. The female breeding goat is very important in determining the number of kid, number of goat to be kept for breeding purpose and number to be slaughtered for meat.

2.2.2. Goat meat price

The goat meat sector traces the life cycle from goat-kid production to slaughter for goat meat production and the most central impact is female goat under goat inventory model. The kid production will be increased if the breeding stocks increase. It depends actually on the 'rate' of how many breeding stocks come for replacement purpose. Goat population/goat meat production can be increased by increasing the reproduction rate, kidding rate and reducing kid mortality rate. Actually, the goat meat supply is highly influenced by the number of slaughtered goat and goat meat is the result of the number of slaughtered goats. So the 'slaughter rate' and 'meat extraction rate' show a greater impact on fresh goat meat production. Higher goat meat price increases the number of goats as well as goat meat supply by increasing meat extraction rate and income. On the other hand, demand depends on goat meat price, substitute price and per capita income. Goat meat supply and demand both are related with goat population, goat meat price and income from goat. The price of goat meat (GP) in all flow under the model (Figure 2) indicates the goat meat price is the common important factor determining the flow of goats to the goat meat production and for income generation. Actually Figure 2 shows both biological and economical factors interrelated in the goat

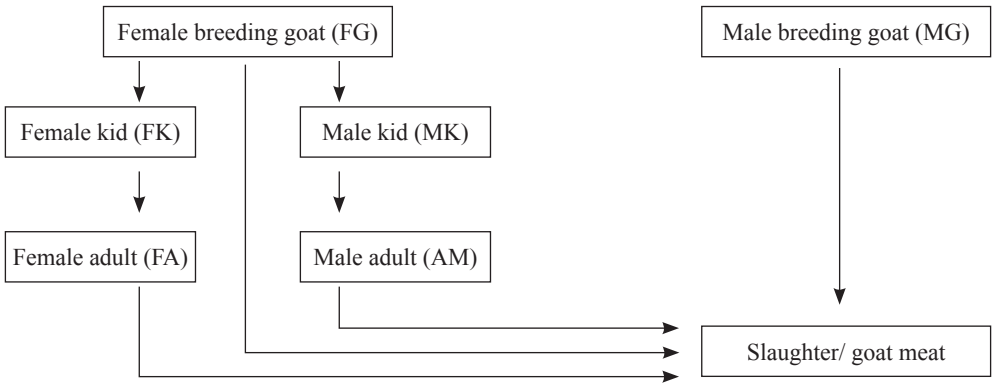

Figure 1: Production cycle for goat population in Bangladesh

meat marketing system.

The goat price (GP) is the important factor determining the flow of goats from one group to another in the goat meat market. Therefore, it is assumed under competitive market that the increase and decrease of 'price of goat meat' will affect the 'decision of reproduction and slaughter of goat/goat meat supply'. That is why Figure 2 shows the price of goat meat in all flow in the system.

2.2.3. Goat meat marketing system

Figure 2 shows the goat meat market specified for this study consisting of the goat population/inventory, goat meat supply, income and demand from goat meat models.

Goat population/inventory model

The inventory model is categorized into four groups with respect to age and sex. They are female adult (FA), male adult (AM), female kid (FK) and male kid (MK). Among them female goat plays a very important role in the growth of total goat population.

*Female adult (FA) goat sub-model***:** It is a function of female kid and goat meat price. The model can be specified as follows:

FA=f (FK, GP) ..... (3)

*Total goat (TG) sub-model***:** Total goat is a function of the female adult, male adult, female kid, male kid and goat meat price. The model can be specified as follows:

TG=f (FA, AM, FK, MK, GP) ..... (4)

Goat meat supply (GMS) model

Though male goats are the main source of goat meat other categories of goat population also go for slaughter at lower rate than male goats. Actually the supply of goat meat is a function of the goat meat price, total goat, female adult, male adult, female kid and male kid. The model can be specified as follows:

GMS=f (GP, TG, FA, AM, FK, MK) ..... (5)

Income (IN) model

The income from goat meat is a function of the price of goat meat. The model can be specified as follows:

IN=f (GP) ..... (6)

Goat meat demand (GMD) model

The demand for goat meat is a function of the price of goat meat price, beef price, chicken price and income. The model can be specified as follows:

GMD=f (GP, BP, CP, IN) ..... (7)

Goat meat market equilibrium model

The market for goat meat is in equilibrium when the total goat meat supply is equal to the goat meat demand, which is specified by:

GMSt=GMDt ..... (8)

2.3. Analytical framework

2.3.1. System

A system is a group of equations. System can be estimated with a number of econometric methods. A model is a group of equations with as many equations as endogenous variables (David, 1995).

2.3.2. Simultaneous equation model

A unique feature of simultaneous equation model (SEM) is that the endogenous variable in one equation may appear as an explanatory variable in another equation of the system. In contrast to single equation models, in SEM more than one dependent endogenous variable is involved, necessitating on many equations as the number of endogenous variables. As a consequence such an endogenous explanatory variable becomes stochastic and is usually correlated with the disturbance term of the equation in which it appears as an explanatory variable. In this situation OLS model may not be applied because the estimates thus obtained are not consistent, i.e. they do not cover to there true population values. The OLS method is inappropriate for the estimation of an equation in a system of simultaneous equation. If there is no simultaneous

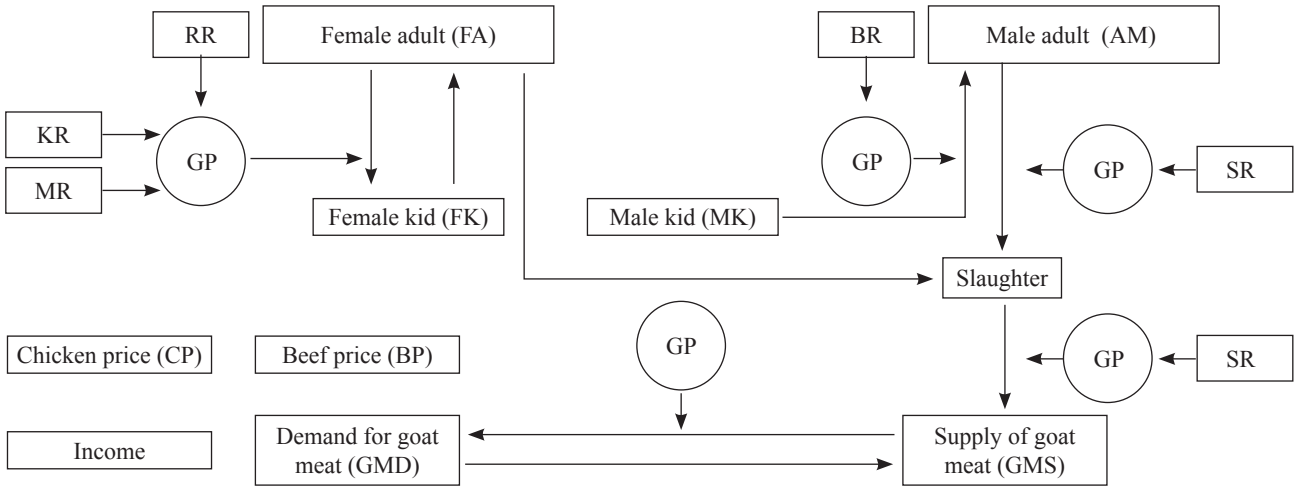

Figure 2: Goat meat marketing system in Bangladesh

TG=Total goat (thousand heads); FA=Female adult (thousand heads); AM=Male adult; (thousand heads); FK=Female kid (thousand heads); MK=Male kid (thousand heads); GMD=Goat meat demand (ton); GP=Goat meat price (Taka ton^{-1}); BP=Beef price (Taka ton^{-1}); CP=Chicken price (Taka ton^{-1}); In=Income (Taka head^{-1}); GMS=Goat meat supply (ton); RR=Reproduction rate; KR=Kidding rate; SR=Slaughter rate; BR=Breeding rate; MR=Mortality rate; ER=Extraction rate

equation, or simultaneity problem, the OLS estimators produce consistent and efficient estimators. On the other hand, if there is simultaneity, TSLS estimators are consistent. Equations are obtained by solving each of the endogenous variables in terms of the predetermined variables, the unknown parameters and the disturbance terms. A reduced form of equation will generally contain the error terms from all the equations (Gujrati, 1995).

2.3.2.1. Reduced form of equations

The reduced form of equations for market model will depend on a constant, all the structural parameters and the error term (Ramu, 1995). When an investigator obtains the estimates of the reduced form of equations and then attempt to go back and solve for the structural parameters they find one of the following three situations:

- It is not possible to go from the reduced form back to the structure
- It is possible to go back in a unique way
- There is more than one way to go back

The first type, in which it is not possible to go from the reduced form to the structure, is known as the unidentified equation or under identification. The second case, the unique situation is called exact identification. The final case in which more than one structural estimate is obtainable is called over identification. This problem of being able to go back and reconstruct estimates of structural parameters from estimates of the reduced form coefficients is known as the identification problem (Ramu, 1995).

2.3.2.2. Identification problem

By the identification problem we mean whether numerical estimates of the parameters of a structural equation can be obtained from the reduced form coefficient. If this can be done we say that the particular equation is identified. If this cannot be done then we say that the equation under consideration is unidentified/ under identified. An identified equation may be either exactly/ fully/just identified/over identified (Gujrati, 1995).

Reduced form of equations for over identification

Demand function: $Qt=\alpha_0+\alpha_1 Pt+\alpha_2 X_1+\alpha_3 X_2+u_t$
Supply function: $Qt=\beta_0+\beta_1 Pt+\beta_2 Y_1+u_t$

Equating demand to supply, the following equilibrium price and quantity:

$Pt=\Pi_0+\Pi_1 X_1+\Pi_2 X_2+\Pi_3 Y_1+v_t$
$Qt=\Pi_4+\Pi_5 X_1+\Pi_6 X_2+\Pi_7 Y_1+w_t$

Where,

$\Pi_0=\beta_0-\alpha_0/\alpha_1-\beta_1$, $\Pi_1=-\alpha_2/\alpha_1-\beta_1$, $\Pi_2=-\alpha_3/\alpha_1-\beta_1$, $\Pi_3=\beta_1/\alpha_1-\beta_1$, $\Pi_4=\alpha_1\beta_0-\alpha_0\beta_1/\alpha_1-\beta_1$, $\Pi_5=-\alpha_2\beta_1/\alpha_1-\beta_1$, $\Pi_6=-\alpha_3\beta_1/\alpha_1-\beta_1$, $\Pi_7=-\alpha_1\beta_2/\alpha_1-\beta_1$, $w_t=\alpha_1 u_{2t}-\beta_1 u_{1t}/\alpha_1-\beta_1$, $v_t=u_{2t}-u_{1t}/\alpha_1-\beta_1$

The demand and supply model contains seven structural co-efficient but there are eight equations to estimate them-the eight reduced form of co-efficient, i.e. the number of equations is greater the number of unknown (Gujrati, 1995). In cases of over identification, OLS is not appropriate and should be discarded in favor of other methods. One such method is TSLS (Gujrati, 1995).

2.3.3. Estimation procedure

Simultaneity problem arises because some of regressors are endogenous and are therefore likely to be corrected with the

disturbance or error term. Therefore, a test of simultaneity is essentially a test of whether (an endogenous) regressor is correlated with the error term. In the presence of simultaneity, the methods of TSLS and instrumental variables will give estimators that are consistent and efficient (Robert, 1991).

2.3.3.1. Two stage least square (TSLS) method

For solving econometric models involve a large number of equations. TSLS offers an economical method. For this reason the method has been used extensively in practice. TSLS provides only one estimate parameter^{-1}. It is an estimator equation where some of the right-hand variables are correlated with the disturbance, so OLS would be biased. This problem always arises if there are endogenous variables on the right side of the equation. TSLS takes a variable that is uncorrelated with the disturbance (an instrument) and uses it to find the component of an endogenous variable that is attributable to the instrument. That process is the first stage regression. There is one first-stage regression for each endogenous variable on the right side of equations. Then the procedure runs a regression on a regression original equation with first-stage fitted values replacing the endogenous variables. The co-efficients of this regression are the TSLS estimates (David, 1995).

2.3.3.2. Instruments

The right hand variables can be a mixture of endogenous and exogenous variables. Any exogenous variables in the equation are also instruments. This process is the first regression. To make it possible to calculate two stage estimates, specification must satisfy the order condition for identification, which says that there must be at least as many instruments as there are co-efficient to estimate equation. The constant is always a suitable instrument (David, 1995).

2.4. Empirical framework

2.4.1. Data collection and design

Data on goat meat production from 1980 to 2000 were collected from Bangladesh Bureau of Statistics (BBS, 1982, 1985, 1990, 1995, 2000). Secondary price data for the year 1980-2000 were collected from a database for Agricultural Marketing Research and Planning, Department of Agricultural Marketing, Dhaka (DAM, 2001).

2.4.2. Data adjustment

Female goat, male goat, female kid and male kid data were categorized using 35, 20, 23 and 22%, rate respectively (Honhold, 2001). Taka mound^{-1} for price data is converted into Taka ton^{-1}. Base 1985 used as deflator for the real price data. The following variables are converted into log variables:

LGMD=LOG (GMD); LGMS=LOG (GMS); LTG=LOG (TG); LIN=LOG (IN); LFA=LOG (FA); LAM=LOG (AM); LFK=LOG (FK); LMK=LOG (MK); LGP=LOG (GP); LBP=LOG (BP); LCP=LOG (CP).

2.4.3. Goat meat marketing system

The goat population/inventory, goat meat supply, income and demand models and their interrelationships in Bangladesh goat meat marketing system are explained by the following SEM:

Goat population/inventory model

Female adult goat sub-model

LFA=f (LFK, LGP) ..... (9)

Total goat sub-model

LTG=f (LFA, LAM, LFK, LMK, LGP) ..... (10)

Goat meat supply model

LGMS=f (LTG, LFA, LAM, LFK, LMK, LGP) ..... (11)

Income model

LIN=f (LGP) ..... (12)

Goat meat demand model

LGMD=f (LGP, LBP, LCP, LIN) ..... (13)

Equilibrium model for goat meat market

LGMSt=LGMDt ..... (14)

2.5. Hypothesis testing

There are four main categories of dependent variables in the study. The dependent variables are the population of goat, supply of goat meat, income and demand for goat meat. The hypotheses to be tested are as follows:

- The size of goat is hypothesized as having no positive relationships with the prices of goat meat
- Supply of goat meat is hypothesized as having no positive relationships with the prices of goat meat
- Income from goat meat is hypothesized as having no positive relationships with the prices of goat meat
- Demand for goat meat is hypothesized as having no negative relationships with the prices of goat meat.

2.5.1. Evaluation procedure

The stander errors (SE) of the estimated structural co-efficient are not presented because these co-efficient are generally non-linear functions of the reduced form of co-efficients and there is no simple method of estimating their SE from the SE of the reduced form of co-efficient. For large sample size, however, SE of structural co-efficients can be obtained approximately. The t-test was used to test the significance of an individual co-efficient (Gujrati, 1995; Jan, 1971).

2.6. E-views software

The data were analyzed using the computer E-views software**.** E-views provide a number of methods for estimating systems of equation by OLS, TSLS, non-linear least squares (David, 1995). To run TSLS one has to choose equation from the

main menu. The equation specification box will open. List the dependent variables and independent variables exactly as for OLS. Click on TSLS in the estimation part of the dialog box and the dialog box will change to include a window where should list the instruments (David, 1995).

3. Results and Discussion

Discussions on the results obtained are based on the statistical and economic values of the estimated equations of the respective model in the system. Table 1 shows the estimated co-efficient of the simultaneous equation model. Results indicate that price is the most important technology for management in measuring goat meat market and to improve and develop it in future.

3.1. Results of simultaneous equation model

3.1.1. Goat population/inventory model

3.1.1.1. Female adult goat sub-model

Equation 15 shows the estimated co-efficient of the female adult goat sub-model. It can be explained at a 99% level by the explanatory variables, goat meat price and female kid, used as indicated by the value of the goodness of fit R^2 of 0.99. The responses of the dependent variable, female adult, are positive for the explanatory variables, female kid and goat meat price. Every1% increase in the goat meat price causes the inventory size of female adult goat to increase by 0.003%. Another important factor is the female kid. Every 1% increase in female kid causes the inventory size of female adult to increase by 1%. Significant at 1% is female kid and at the 10% level is goat meat price. The result indicates that the price of goat meat is the most important factor in determining the inventory size of female adult goat.

3.1.1.2. Total goat population sub-model

Equation 16 shows estimated co-efficient of total goat equation. It can be explained at 99% level by the explanatory variables, goat meat price and female adult goat, male adult goat, female kid and male kid used as indicated by the value of the goodness of fit R^2 of 0.99. The responses of the dependent variable (total goat) is positive for the explanatory variables-goat price, male adult goat, female kid, male kid and female adult goat. Estimated co-efficient of explanatory variable significant at 5% level is female adult goat and female kid at 1% level is male kid, at 20% level is goat price and only male adult goat is insignificant. The results indicate that the female adult goat, male kid, female kid is the most important factor in determining the total goat. Every 1% of increase in the female adult goat, male adult goat, female kid and male kid cause 0.375, 0.022, 0.239 and 0.344% increase in the total goat population. Another important factor is the goat meat price. Every 1% increase in goat meat price causes 0.024% increase in total goat population.

3.1.2. Supply of goat meat model

Equation 17 shows estimated co-efficient of goat meat supply equation. It can be explained at 83% level by the explanatory variables-goat meat price and female adult goat used as indicated by the value of the goodness of fit R^2 of 0.83. The responses of the dependent variables are positive for explanatory variables-goat price and female adult. Estimated co-efficient of explanatory variable significant at 10% level is female adult goat and 5% level is goat meat price. The results indicate that female adult goat is the most important factor in determining the goat meat production. Every 1% increase in female adult goat and goat meat price causes 0.842 and 0.002% increase in goat meat production, respectively. The responses of the dependent variable to these factors are inelastic.

3.1.3. Income model

Equation 18 shows estimated co-efficient of income equation. It can be explained at 63% level by the explanatory variable goat meat price used as indicated by the value of the goodness of fit R^2 of 0.625. The response of the dependent variable (income) is positive for the explanatory variable, goat meat price. Estimated co-efficient of the explanatory variables is significant at 1% level. Result indicates that the price of goat meat is the most important factor in determining the income

Table 1: The simultaneous equation model for goat meat marketing system in Bangladesh

Goat inventory (population) GI model

Goat Meat Supply (GMS) model

LGMS = 2.447+0.002 LGP+0.842 LFA ..... (17) R^2=0.833
(3.144) (2.004)*** (1.827)***

Income (IN) model

LIN = 1.664+0.309 LGP ..... (18) R^2=0.625
(6.297) (5.622)*

Goat Meat Demand (GMD) model

LGMD = -0.063-0.511 LGP+0.681 LIN+1.131 LCP ..... (19) R^2=0.883
(-.098) (-2.613)* (1.843)*** (2.182)***

Note: t-test values are in parentheses

*Significant at 1% level; **Significant at 5% level; ***Significant at 10% level; ****Significance at 20% level

from goat meat production. Every 1% increase in the goat meat price causes 0.309% increase in the income.

3.1.4. Demand of goat meat model

Equation 19 shows estimated co-efficient of goat meat demand equation. It can be explained at 88% level by explanatory variables-goat meat price, chicken price and income, used as indicated by the value of the goodness of fit R^2 of 0.88. The responses of the dependent variables are positive for the explanatory variables-income and chicken price and the negative response are observed for the goat price. The estimated co-efficient of the explanatory variables-income, chicken price and goat price, are significant at 10, 10 and 5% level. The results indicate that the price of goat meat is the most important factor in determining the demand for goat meat. Every 1% increase in goat meat price causes 0.511% decrease in goat meat demand. Other important factors are the income and chicken price. Every 1% increase in income causes goat meat demand to increase by 0.681% (inelastic) and every 1% increase in chicken meat price increases goat meat demand by 1.131% (elastic).

3.2. Discussion on the results of Simultaneous equation model

3.2.1. Goat population/inventory model

The goat meat market is one of the most important meat markets and goat meat pricing a management technology influences to enhance the growth in the population of goat for goat meat production. Every 1% increase in female kid causes the inventory size of female adult to increase by 1% means female kids are reared up and when these female kids are adult go for reproduction. Healthy males are kept for breeding purpose. Every 1% of increase in the female adult goat, female kid and male kid cause 0.375, 0.239 and 0.344% increase in the total goat population significantly and in the case of male adult, 0.022% increase in the total goat population but not significantly. It means the number of female adult goats increase with the increasing number of female kids and increase the number of total goat population significantly. But male adult goats increase with the increasing number of male kids which actually go for slaughter/meat production that is why male adult do not increase the number of total goat population significantly but increase the meat production. Yasmin (2004) using SIMM technology (Yasmin, 2001) suggested goat meat could be produced more in future by reducing mortality rate and enhancing reproductive rates. Female adult goat is expected to increase from 17.6 million heads in 2002 to 45.6 million heads in 2015, female kid is expected to increase from 10 million heads in 2002 to 24.3 million heads in 2015, male adult goat is expected to increase from 10 million heads in 2002 to 26.7 million heads in 2015. How many goats go for breeding purpose or go for reproduction purpose depends on goat meat price. Every 1% increase in goat meat price causes 0.02% increase in total goat population. When price of goat meat goes up, producers decide to rear up female adult goat for reproduction. Maximum aged/culled female goats and adult male goats go for slaughter that is why, total goat population increases but in small number. Pricing technology is very helpful to producers in managing goat population properly according to the slaughter or breeding, reproduction or culling decisions.

3.2.2. Goat meat production

Every 1% increase in female adult goat and goat meat price cause 0.84 and 0.002% increase in goat meat production significantly which implies increasing number of female goat increase the number of kids and kids again increase the female adult goat number and produce more goat meat by slaughtering male goats. Male adult goat mainly reared up for meat production and also aged unfertile female goats go for culling. Slaughtering is very responsive towards the change in the price of goat meat. Actually, how many go for culling, how many reared up with improved feed and special care to produce good quality goat meat depends on goat price. So producers can manage decision of production of goat meat properly by using pricing technology.

3.2.3. Income from investment

Rearing goat/goat farming is a good investment for income generation. Investor can earn a lot of money from selling more goat population, selling more quality meat and selling skin and exporting skin abroad. Income depends on price of goat. Every 1% increase in goat meat price causes 0.309% increase in income means producers are interested to invest in goat farming due to goat meat market is a profitable income source. Sayeed et al. (2004) mentioned goat rearing is profitable under scavenging system in Bangladesh Yasmin (2005) suggested stall feeding system is more profitable than scavenging because it require small size of land/area for goat population which is opposite the scavenging but requires more attention to rear up goats. Yasmin (2003) showed semi-intensive farming is the best among them. Due to high population and scarcity of land, live goat should be exported to other country to overcome the land scarcity problem. The number of alive goat (Yasmin, 2005), the amount of goat meat (Yasmin, 2003) and amount of skin (Yasmin, 2006) can be increased by increasing goat population growth but in practical how many goats and how much meat and skin will be exported depends on goat price and on different rates of slaughter, extraction, kidding, mortality and reproduction. So pricing technology is useful to producers for managing investment decision regarding goat meat, goat skin and live goat investment in and outside the country. Application of pricing technology is essential to improve marketing efficiency which means improved marketing activities, improved supply chain by increasing

export performance within goat marketing system.

3.2.4. Goat meat demand model

If demand for goat meat is elastic, no problem but problem is here when its demand is inelastic. Because of elasticity, demand for goat meat reduces highly due to rising price but when it is inelastic demand for goat meat reduces slightly. Other important factors are income and chicken price. Every 1% increase in income causes the goat meat demand to increase by 0.681% (inelastic) because price of goat is the highest among other meats. When people get more money they are able to buy more goat meat, i.e. demand for meat increases. Every 1% increase in chicken meat price increases the goat meat demand by 1.131% (elastic) which means people buy goat meat instead of chicken, i.e. goat meat is the most important substitute for chicken. Bangladeshi Muslim has no problem with eating beef but Hindus do not consume it but prefer goat meat.

4. Policy Implication

The results of the study satisfy both the statistical and economic criteria. Goat population, goat meat production, income and demand for goat meat, all endogenous variables are responsive significantly to the price of goat meat. In this situation, producers have opportunity to manage goat meat market according to goat population, goat meat production and income generation decision which depend on price. Consumers are positively responsive to goat meat consume and producers are positively responsive to goat meat investment. Pricing technology is helpful to manage whole goat meat processing, and price policies will be very effective for goat meat market. Government should given emphasis on the policies that ensure the reasonable price to consumer, profitable price to the producer and special emphasis is needed to determine the rate of kidding and mortality of goat to support higher total goat population and establish export oriented live goat, meat and skin industry. To increase the kidding rate of goat, government should emphasize on highbred goat. Incentives like special care, nutritive feed, disease control, etc. should be increased. Availability of biological products and adequate health research finding and technological support is needed to reduce mortality rate. Higher amount of good quality meat production can be encouraged through genetic improvement, high nutrition feed, improvement of breeds and meat fattening, etc. For generating investment government should control the malpractice of the middlemen in the goat meat market, create facilities for investment in the goat meat market through credit/loan distribution and create employment opportunities to alleviate poverty, encourage trade facilities for goat meat, live goat and skin. Research, training, extension works for goat meat market should be strengthened. Government should determine mainly the rate of slaughter for adult male and female goat and export rate of meat, live goat and skin. Goat produces the highest quality leather so foreign earning from leather export can be increased. Price support policy should be introduced for improving goat meat market. Therefore, 'pricing' can be a 'management technology' to improve and develop the 'goat meat market' in Bangladesh. Further research on short and long run goat meat supply response is needed for price policy using Vector Error Correction Method.

5. Conclusion

Price of goat meat is the most common important determinant able to identify significantly of the important variables-goat population, goat meat production, income and demand of goat meat and their linkages in representing the goat meat marketing system using over identifying simultaneous equation models. Results showed that goat meat production increase due to increase in total number of goats and income. Due to the inelasticity of goat meat demand and supply, price can be treated as management technology of goat meat market and also for market efficiency, i.e. to improve and develop the market for higher goat meat production and income generation at present and future in Bangladesh.

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