*BRAC University Journal, Vol. IV, No. 1, 2007, pp. 9-11*

# IMPACT OF PRICE AND OTHER FACTORS ON TEA IN BANGLADESH: SOURCES OF VARIATION AND DISPARITY OVER DIVISION

Mohammad Lutfur Rahman
*Department of Mathematics and Natural Science*
*BRAC University, 66 Mohakhali C/A*
*Dhaka-1212, Bangladesh*

ABSTRACT

Tea is a beverage made by steeping leaving in boiling water. Tea is the most popular and cheapest beverage next to water in the world. It is consumed by a range of age groups in all levels of society. An attempt has been made in this research to analyze the price elasticities of most exportable crops in Bangladesh: sources of variation and disparity over the division. In investigating the impact of price and other factors on the supply of tea, the Cobweb supply model in a modified form has been considered. The supply price elasticities have also been estimated. The Ordinary Least Squares (OLS) method has been used to estimate the model. The study is based on time series data over 12 years (BBS: 1985/86-1996/97).

**Key words:** Price elasticities, Cobweb supply model, OLS method, and Time series data.

## I. INTRODUCTION

Bangladesh, a predominantly agrarian economy, is characterized by small-scale, fragmented farming, employing primitive technology and is one of the poorest and most populous nations of the world. The country has to support some 115 million people with a density of 800 persons per sq. km. The majority of the population lack food security as reflected in extreme poverty and widespread hunger. Though agriculture serves as the mainstay of the population contributing about half of the Gross Domestic Product (GDP) and employing two-third of the total labor force, the high population growth rate offsets the increased agricultural production thereby exacerbating the food deficit and poverty. The land-man ratio is one of the lowest in the world. Hossain (1989) rightly remarked that, "there are few countries in the Third World where technological progress is of higher importance in maintaining the food-population balance than in Bangladesh. This study attempts to estimate supply response parameters and supply price elasticities for most exportable agricultural items in Bangladesh. The study also analyzes the sources of variation in agricultural supply. The Cobweb supply model has been estimated by considering the Ordinary Least Squares method. In the present study, total agricultural output is taken as the dependent variable and price, cultivated area, irrigated area and fertilizer are considered as independent variables

## II. THE DATA

The present study considers the annual time-series agricultural data for the years 1985-86 to 1996-97 for whole Bangladesh. The data have been collected from various publications of Bangladesh Bureau of Statistics (BBS: 1985/86 to 1996/97).

Data on cultivated area and irrigated area are given in acres and each year. These total acreages are converted into total hectares. The sum of all fertilizers (in metric tons) for each region and year is taken as a measure of fertilizer variable. The production data are available for twelve years. Harvest prices of these agricultural items are expressed in taka per metric ton.

## III. MODEL SPECIFICATION

**The specified model:**

Following the theoretical development and depending on the availability of data in the present study the Cobweb Supply model has been specified as:

$$Q_{i\,t} = \beta_o + \beta_1 P_{i\,t} + \beta_2 P_{j\,t-1} + \beta_3 X_{1i\,t} + \beta_4 X_{2\,it} + \beta_5 X_{3\,it} + U_{it} \quad \textbf{(1)}$$

Where, t is a time subscript, i and j are subscripts denoting the agricultural items (i≠j).

$\beta_o$ =Intercept term, $\beta_j$=Slope parameter with respect to input j, $Q_{it}$ =Total aggregated output of ith item in t-th year in thousand metric ton expressed in harvest price, Pi =Price of the i-th item, Pj= Price of the competing item, $X_1$=Total Cultivated area in thousand hectares, $X_2$=Total irrigated area in thousand hectares, $X_3$= total Chemical Fertilizer in thousand metric tons. Thus the Cobweb supply model (1) considers total cultivated area, total irrigated area and total chemical fertilizer as explanatory variables. Due to the lack of data, variables related to technical change and weather could not be incorporated in the model.

**Price elasticities of supply:**

Price elasticities of supply for tea considered in the present study can be computed from equation (1) by using the formula:

$$\eta_{si} = \frac{P_i}{Q_i}\left(\frac{\delta Q_i}{\delta P_i}\right) \qquad \textbf{…. (2)}$$

Where, $\eta_{si}$ =Price elasticity of supply for agricultural item i.

$P_I$ =Average price of item i

$Q_I$ = Average quantity supplied for item i and from equation (1)

$$\frac{\delta Q_i}{\delta P_i} = \beta_1$$

## IV. ESTIMATION &RELATED TESTS

The Maximum Likelihood Estimation (MLE) method seems to be the most appropriate one for estimating model (1) because of the presence of lagged price (of competing crops) in the model. But MLE and all other simultaneous equations estimation methods (2SLS, 3SLS, etc.) provide unbiased, efficient and consistent estimates if and only if the sample size is large. However, the simple and most widely used econometric estimation technique-ordinary least squares (OLS), provides the best estimates in case of small samples (Mariana 1978). Since the sample size is small in the present study, OLS method has been used for estimating the Cobweb Supply model as specified in equation (1).

**Tests for homogeneity of regions:**

In the construction of the Cobweb Supply function it has been assumed in this research that the two districts (considered in this research) lay on the same Supply function. The districts can be viewed to have the same production technologies. But the econometric technique used allows the district to vary in the intercepts or levels of technology and input used.

Hence a test for homogeneity of the parameters that have been generated from the two data sets is a test of the hypothesis:

$H_0$: $\beta_{11} = \beta_{12}$ , $\beta_{21} = \beta_{22}$ , $\beta_{31} = \beta_{32}$, $\beta_{41} = \beta_{42}$

Which we can test by using the **F-test (Maddala, 1971)**[3], where

$$F = \frac{RRSS - URSS/(k-1)}{URSS/(n_1 + n_2 - 2k - 2)} \qquad \textbf{……(3)}$$

With (k-1) and ($n_1$+ $n_2$ –2k-2) degrees of freedom. Where RRSS= restricted residual sum of squares, URSS= unrestricted residual sum of squares. Test result suggested the acceptance of the homogeneity assumption regarding the regions/districts (i.e.; they lie on the same supply function

## V. DIAGNOSTIC TESTS AND REMEDIAL MEASURES

The diagnostic tests performed and the remedial measures taken are the usual ones for multicollinearity, autocorrelation and heteroscedasticity. The presence of moderate multicollinearity has been detected by the method of **Variance Inflation Factor**. **Durbin-Watson d-test** and **Run test** have been used to detect the presence of autocorrelation. **Cochrane-Orcutt Iterative** procedure is considered as a remedial measure. The **Goldfeld Quandt test** has been used to detect the presence of heteroscedasticity and the test result suggested the absence of it

## VI. RESULTS AND DISCUSSIONS

In the present study, while estimating the Cobweb Supply model for tea, the price or price index of competing crops has been taken as price deflator. Robi crops price index are considered in the present study. The Cobweb Supply model (1) provided best estimates for tea when Robi crops

price index (RP) was considered as price deflator. Robi crops price index has been computed by using Laspeyre's price index of base year method. Robi crops are the crops, which are sown in winter and harvested in the spring or early summer

**Estimates of Cobweb Supply Models for tea:**

The autocorrelation and multicollinearity corrected OLS estimates of the Cobweb Supply model as represented by model (1) for tea is shown in Table 1. The t-ratio of parameter estimates of standard errors is shown in brackets. The level of significance is at 5% in all cases. The adjusted $R^2$ values suggested that the Cobweb Supply model gives very good fit for tea where the explanatory variables can explain 92% variations in output supplied. Though the adjusted $R^2$ value for cotton is 0.85 (less as compared to those for other agricultural items) the model fit may not be considered that poor.

| Item | Constant | Price | Cultivated area | Adjusted $R^2$ |
|---|---|---|---|---|
| Tea | -20777.36 (-5.62) | 2.35 (1.93) | 0.18 (6.50) | 0.85 |

Cobweb supply model for tea has been considered for whole Bangladesh (especially in Sylhet and Chittagong division). As for the independent variables, only price and cultivated area are considered. This is because of the fact that tea production does not depend on irrigation and fertilizer used (and as such relevant data were not also available). The coefficient of price parameter is statistically significant at the 5% level and the explanatory power of the estimated supply function is very satisfactory. That means price policies offer very great scope for increasing supply of tea

**Supply Price elasticities:**

The estimated price elasticities for tea considered in the present study is elastic. Elasticity estimates are obtained by using the formula given in equation (2) which is (1.10). It is evident from analysis that tea is elastic, suggesting that quantity supplied for tea changes at a much higher rate than its price change.

## VII. CONCLUSION

The study was aimed at analyzing the supply response of most exportable crops in Bangladesh. For observing the impact of price and other related factors on the supply of tea, the cobweb supply model in a modified form has been considered. Supply is found to be highly responsive to price for tea which are the cash crops in Bangladesh.

Cultivated area being a fixed factor, the possibility of increasing output and hence supply through increased use of cultivated area is substantially low. However, there is an ample opportunity for supply expansion through yield increasing method. The study also suggests that irrigation facility is not designed properly at the moment to help increase supply. So there is a need to design irrigation facility.

The findings of this study can be used in a wide range of applied works for further research in this area. The study results are likely to contribute in public policy formulation for Bangladesh.

## VIII. REFERENCES

[1] BBS (1990-1998): Statistical year book of Bangladesh" Bureaus of Statistics, Dhaka

[2] Drapper, N.R; and Smith; [1981], applied regression analysis, New York: john Wiley and sons**.**

[3] G.S. Maddala and T.D. Mount, A Comparative Study of Alternative Estimators for Variance Components Model' Journal of the American Statistical Association June 1973, Pp-324-328

[4] Gujrati, D.N [1970], Using Dummy Variables in Testing For Equality between Sets of Coefficient in Linear Regression: A Generalization "The American Statistician, Vol.24no.5 Pp.18-22, 50-52

[5] Koutsoyiannis, A.1977. Theory of Econometrics, the Macmillan Press Ltd

[6] Maddala, G.S 1988. Introduction to Econometrics, Mc Graw-Hill Ltd