A comparative Statistical Study of Production functions of the Sugarcane and Sugar with reference to Bardoli, Kamrej and Sayan Sugar Factories

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Abstract

India is the agriculture based country where many industries are also working. One of the main crops is Sugarcane and Sugar industry has developed on this basis, many factors affect to the production of Sugarcane and Sugar. In this situation it becomes essential to know whether the production of Sugarcane and Sugar remain constant or not? Keeping this point in view investigator decided to obtain the Cobb-Douglas (CD) production functions by the Ordinary Least Square method for Sugarcane and Sugar of Bardoli, Kamrej and Sayan Sugar factories and to compare the same. Investigator examined the value of T-statistic, P-value, F-statistic and R-squared. Moreover, investigator tried to study about the progress of the production by comparing the obtained production functions with the law of constant, increasing and decreasing returns to scale of economics. Investigator applied econometric EViews 8 software for the analysis of the data. Interesting findings came into light through this investigation.

KEYWORDS: Sugarcane, Sugar factory, Cobb - Douglas, production function, EViews 8

INTRODUCTION

India is the agriculture based country. Majority of people depend on agriculture and live in villages. Though in the present time, various states of India have been developed in the direction of the production of different products in the different fields. In the state of Gujarat, too various small and large scale industries have been developed scientifically like textile, oil, chemicals, paper, wood, Sugar, etc. For the past many years the Sugarcane has a higher percentage than other crop in most of the villages of Gujarat. Among such villages Sugarcane is one of the most attractive crops in the district of Navsari and Surat. As a result of Sugar industry has developed a lot on co-operative bases. During the last 20 years such factors affected to the production of Sugarcane and situation created for the gradual increase in the production of Sugar which is the industrial part of Sugar factories.

In this situation it becomes very essential to know whether production of Sugarcane remains constant or not in the farms located in the area of Sugar factories. Moreover it also becomes necessary to know that such increase is progressive or not? With reference to above mentioned situation and background, investigator decided to obtain the Cobb-Douglas (CD) production functions of Sugarcane and Sugar and study it comparatively. Investigator decided to calculate the production functions concentrating on Bardoli, Kamrej and Sayan Sugar factories.

OBJECTIVES OF THE STUDY

Following were the main objectives of the present study:

(1) To estimate the production functions of Sugarcane for three variables and Sugar for two variables by Ordinary Least Square method and compare it.

(2) To study about the progress of the production of Sugarcane and Sugar by comparing the obtained production functions with the law of constant, increasing and decreasing returns to scale of economics.

(3) To obtain the Output elasticity of the means of the production of Sugarcane and Sugar.

(4) To examine the values of P-value, T-statistic, F- statistic, R-squared.

RESEARCH METHODOLOGY

Looking to the nature and type of the present investigation it can be said that the investigator has used case study method.

POPULATION AND SAMPLE

Total quantity of the subject is known as population. But because of the limitations of time, energy and money, all the time it is not possible for the investigator to cover all the subjects of the population under the study. Thus it is not practical to collect the data from all the subjects covered under the study. Because of this question of selecting the sample from the population raised before the investigator. The same question raised before the investigator. Total 24 Sugar factories were working in the state of Gujarat. Out of them total 19 Sugar factories were located in the south Gujarat region. All these Sugar factories become population for the present investigation but as mentioned earlier it was not possible for the investigator to study all these Sugar factories. Thus, Investigator decided to select three Sugar factories of Surat district - Bardoli, Kamrej and Sayan, by using purposive sampling method. Moreover investigator studied all these factories concentrating on 19 years 1994 to 2012.

RESEARCH TOOL

Various research tools are available for the collection of necessary data. But looking to the nature of the on hand investigation, investigator collected the necessary data from annual reports of the Bardoli, Kamrej and Sayan Sugar factories. It means investigator collected necessary data for the present investigation from the available documents.

PROCEDURE OF DATA COLLECTION

Procedure of data collection may effect on the results of the investigation. Every Sugar factory is having two main sections - Agriculture and Industrial department. From the agriculture department of the concern Sugar factories data collected regarding the production of Sugarcane, plantation area of land, working days and investment etc. for

the last 19 years. It is observed that such important data being kept by the agriculture and industrial departments of the Sugar factories. Investigator personally visited to Sugar factories selected for the present study. Investigator collected necessary data personally and from their published annual reports.

ANALYSIS AND INTERPRETATIONS OF DATA

It is important to analyse the obtained statistical data properly.

"Cobb-Douglas production function", which was obtained by Cobb and Douglas, is largely used in economics. The production function was estimated by them through the study of production of various industrial factories in the world. Therefore, it is used as the production of law of population.

Here the production of Sugarcane (W – in tons) in the field of agriculture of the Sugar factories of Bardoli, Kamrej and Sayan considered as a function of three independent variables, land (X - acres), labor (Y- in days) and capital (Z – in Rs.). It is expressed as long form of Cobb- Douglas production function as under:

$$W = A\,.\; X^{\alpha}.Y^{\beta}.Z^{\gamma}$$

Where, W = total production, X = land, Y = labor, Z = capital, A = constant $\alpha, \beta, \gamma =$ positive parameters.

However, α, β, γ were then the returns to scale factor if $\alpha + \beta + \gamma > 1$, which implies production exhibits increasing returns to scale, if $\alpha + \beta + \gamma = 1$, which implies production exhibits constant returns to scale, if $\alpha + \beta + \gamma < 1$, which implies production exhibits decreasing returns to scale.

Similarly the production of Sugar (Z – in Qtl.) in the field of industry of the Sugar factory of Bardoli, Kamrej and Sayan considered as a function of two independent variables, labor (X- in hours), and capital (Y – in Rs.). It will be expressed as long form of Cobb- Douglas production function as under:

$$Z = A\,.\; X^{\alpha}.\; Y^{\beta}$$

Where, Z = total production, A = constant, X = labor, Y = capital,
α, β = Positive parameters.

ESTIMATION OF PRODUCTION FUNCTIONS

The Cobb-Douglas Production Function was transformed into linear form by taking the log on both sides. The logarithmic form of Cobb-Douglas production functions as follows:

$$\log(W) = \log A + \alpha * log(X) + \beta * \log(Y) + \gamma * \log(Z) + \varepsilon$$

To estimate the Cobb-Douglas production function by the method of Ordinary Least Square, several econometrics models have been examined using econometric software EViews 8. The results of theoretically and empirically examination of several models strongly suggest the Cobb-Douglas form. The logarithmic form of Cobb-Douglas

model was estimated by Ordinary Least Square method in EViews 8 software and the EViews 8 results of this function were as follows:

(1)Estimated Cobb-Douglas production function for production of the Sugarcane of the Bardoli Sugar factory for three variable Land, Labor and Capital by the method of Ordinary Least Square is mentioned in table 1.1.

EViews 8 Result **Table -1.1**

Dependent Variable: LOG(W)
Method: Least Squared
Date: 03/15/14 Time: 21:32
Sample: 1994 2012
Included observations: 19
LOG (W) = C(1)+ C(2) * LOG(X) + C(3) * LOG(Y) + C(4) * LOG(Z)

	Coefficient	Std. Error	t-Statistic	Prob.
A	2.691793	1.653845	1.627597	0.1244**
α	0.859753	0.171489	5.013450	0.0002*
β	0.103927	0.222977	0.466090	0.6478**
γ	0.082882	0.047204	1.755832	0.0995**

R-squared	0.769607	Mean dependent var	14.38251
Adjusted R-squared	0.723529	S.D. dependent var	0.159650
S.E. of regression	0.083945	Akaike info criterion	-1.932652
Sum squared resid	0.105701	Schwarz criterion	-1.733823
Log likelihood	22.36020	Hannan-Quinn criter.	-1.899002
F-statistic	16.70207	Durbin-Watson stat	1.498696
Prob(F-statistic)	0.000048		

(* indicates significant values, ** indicates not significant values at 5% level)

(2)Estimated Cobb-Douglas production function for production of the Sugarcane of the Kamrej Sugar factory for three variable Land, Labor and Capital by the Ordinary Least Square method is mentioned in table 1.2.

EViews 8 Result **Table -1.2**

Dependent Variable: LOG(W)
Method: Least Squared
Date: 03/16/14 Time: 13:37
Sample: 1994 2012
Included observations: 19
LOG (W) = C(1)+ C(2) * LOG(X) + C(3) * LOG(Y) + C(4) * LOG(Z)

	Coefficient	Std. Error	t-Statistic	Prob.

A	1.932945	1.749240	1.105020	0.2866**
α	0.825938	0.169286	4.878952	0.0002*
β	0.044425	0.310247	0.143194	0.8880**
γ	0.144974	0.077323	1.874911	0.0804**

R-squared	0.862238	Mean dependent var	13.04736
Adjusted R-squared	0.834686	S.D. dependent var	0.315041
S.E. of regression	0.128092	Akaike info criterion	-1.087469
Sum squared resid	0.246114	Schwarz criterion	-0.888639
Log likelihood	14.33095	Hannan-Quinn criter.	-1.053819
F-statistic	31.29450	Durbin-Watson stat	1.262189
Prob(F-statistic)	0.000001		

(* indicates significant values, ** indicates insignificant values at 5% level)

(3)Estimated Cobb-Douglas production function for production of the Sugarcane of the Sayan Sugar factory for three variable Land, Labor and Capital by the Ordinary Least Square method is mentioned in Table 1.3

EViews 8 Result **Table – 1.3**

Dependent Variable: LOG(W)
Method: Least Squared
Date: 03/16/14 Time: 11:38
Sample: 1994 2012
Included observations: 19
LOG (W) = C(1)+ C(2) * LOG(X) + C(3) * LOG(Y) + C(4) * LOG(Z)

	Coefficient	Std. Error	t-Statistic	Prob.
A	3.125180	1.238331	2.523704	0.0234*
α	0.598009	0.197300	3.030962	0.0084*
β	0.635127	0.181903	3.491558	0.0033*
γ	0.054233	0.060311	0.899225	0.3827**

R-squared	0.851813	Mean dependent var	13.81877
Adjusted R-squared	0.822175	S.D. dependent var	0.215538
S.E. of regression	0.090891	Akaike info criterion	-1.773649
Sum squared resid	0.123917	Schwarz criterion	-1.574820
Log likelihood	20.84966	Hannan-Quinn criter.	-1.739999
F-statistic	28.74107	Durbin-Watson stat	1.874043
Prob(F-statistic)	0.000002		

(* indicates significant values, ** indicates insignificant values at 5% level)

The logarithmic form of Cobb-Douglas production functions for the production of Sugar as follows:

$$\log (Z) = \log(A) + \alpha * \log(X) + \beta * \log (Y) + \varepsilon$$

The logarithmic form of Cobb-Douglas function was estimated in EViews 8 software and the estimation results of this function were as follows:

(4)Estimated Cobb-Douglas production function for production of the Sugar of the Bardoli Sugar factory for two variable Labor and Capital by the Ordinary Least Square method is mentioned in Table 1.4

EViews 8 Result **Table – 1.4**

Dependent Variable: LOG(Z)
Method: Least Squares
Date: 04/04/14 Time: 14:36
Sample: 1994 2012
Included observations: 19
LOG (Z) = C(1)+ C(2) * LOG(X) + C(3) * LOG(Y)

	Coefficient	Std. Error	t-Statistic	Prob.
A	8.832795	1.141106	7.740555	0.0000*
α	0.375033	0.104232	3.598046	0.0024*
β	0.125093	0.052326	2.390632	0.0295*

R-squared	0.636823	Mean dependent var	14.42535
Adjusted R-squared	0.591426	S.D. dependent var	0.134327
S.E. of regression	0.085862	Akaike info criterion	-1.928223
Sum squared resid	0.117955	Schwarz criterion	-1.779101
Log likelihood	21.31812	Hannan-Quinn criter.	-1.902986
F-statistic	14.02783	Durbin-Watson stat	0.560493
Prob(F-statistic)	0.000303		

(* indicates significant values at 5% level)

(5)Estimated Cobb-Douglas production function for production of the Sugar of the Kamrej Sugar factory for two variable Labor and Capital by the Ordinary Least Square method is mentioned in Table 1.5

EViews 8 Result
Table 1.5
Dependent Variable: LOG(Z)
Method: Least Squares
Date: 04/04/14 Time: 14:43
Sample: 1994 2012
Included observations: 19
LOG (Z) = C(1)+ C(2) * LOG(X) + C(3) * LOG(Y)

	Coefficient	Std. Error	t-Statistic	Prob.
A	1.015556	1.677943	0.605239	

				0.5535**
α	0.496736	0.194068	2.559594	0.0210*
β	0.402712	0.082090	4.905737	0.0002*

R-squared	0.765539	Mean dependent var	13.07534
Adjusted R-squared	0.736232	S.D. dependent var	0.315949
S.E. of regression	0.162266	Akaike info criterion	-0.655216
Sum squared resid	0.421286	Schwarz criterion	-0.506094
Log likelihood	9.224554	Hannan-Quinn criter.	-0.629979
F-statistic	26.12086	Durbin-Watson stat	0.661926
Prob(F-statistic)	0.000009		

(* indicates significant values, ** indicates insignificant values at 5% level)

(6)Estimated Cobb-Douglas production function for production of the Sugar of the Sayan Sugar factory for two variable Labor and Capital by the Ordinary Least Square method is mentioned in table 1.6

EViews 8 Result **Table 1.6**

Dependent Variable: LOG(Z)
Method: Least Squares
Date: 04/08/14 Time: 09:25
Sample: 1994 2012
Included observations: 19
LOG (Z) = C(1) + C(2) * LOG(X) + C(3) * LOG(Y)

	Coefficient	Std. Error	t-Statistic	Prob.
A	11.06804	0.790888	13.99444	0.0000*
α	0.358758	0.051153	7.013488	0.0000*
β	-2.30E-05	0.038883	-0.000592	0.9995**

R-squared	0.774483	Mean dependent var	13.86772
Adjusted R-squared	0.746293	S.D. dependent var	0.123560
S.E. of regression	0.062236	Akaike info criterion	-2.571815
Sum squared resid	0.061974	Schwarz criterion	-2.422693
Log likelihood	27.43224	Hannan-Quinn criter.	-2.546577
F-statistic	27.47400	Durbin-Watson stat	1.161762
Prob(F-statistic)	0.000007		

(* indicates significant values, ** indicates insignificant values at 5% level)

INTERPRETATION

The analysis of the data presented in the table 1.1 to 1.6 reveals that,

(1) From using the value of parameters (coefficients) and estimated the constant value of Cobb-Douglas Production function of Sugarcane of Sugar factory for three variables of EViews 8 result table (1.1, 1.2 & 1.3), obtained standard form the estimated production functions for Bardoli, Kamrej and Sayan Sugar factories respectively were :

$$\log(w) = 491.805 + 0.859753 * \log(x) + 0.103927 * \log(y) + 0.082882 * \log(z) + \varepsilon,$$

(1.653845) (0.171489) (0.222977) (0.047204)

$$\log(w) = 85.693 + 0.825938 * \log(x) + 0.044425 * \log(y) + 0.144974 * \log(z) + \varepsilon \text{ and}$$

(1.749240) (0.169286) (0.310247) (0.077323)

$$\log(w) = 1334.074 + 0.598009 * \log(x) + 0.635127 * \log(y) + 0.054233 * \log(z) + \varepsilon$$

(1.238331) (0.197300) (0.181903) (0.060311)

(2) Obtained the returns to scale value from the EViews 8 result Table (1.1, 1.2, &1.3) for the production of Sugarcane of Bardoli, Kamrej and Sayan Sugar factories respectively were:

$\alpha + \beta + \gamma = 1.046562 > 1$, $\alpha + \beta + \gamma = 1.015337 > 1$ and $\alpha + \beta + \gamma = 1.287369 > 1$

Which represent the increasing returns to scale. Means that the production of Sugarcane of Bardoli, Kamrej and Sayan Sugar factories was progressive.

(3) The Output elasticity of production means land, labor and capital of Bardoli, Kamrej and Sayan Sugar factories from the EViews 8 result table (1.1, 1.2, & 1.3) obtain below:

Variable	Bardoli Sugar factory	Kamrej Sugar factory	Sayan Sugar factory
Land	0.859753	0.825938	0.598009
Labor	0.103927	0.044425	0.635127
Capital	0.082882	0.144974	0.054233

(4) The total output elasticity of the means of production of the Sugarcane of Sayan Sugar factory was 1.287369, which was higher than the Bardoli and Kamrej Sugar factories. It means that the production of Sugarcane of Sayan Sugar factory was much progressive than Bardoli and Kamrej Sugar factories.

(5) From using the value of parameters (coefficients) and estimated the constant value of Cobb-Douglas Production function of Sugar of Sugar factories of EViews 8 result table (1.4, 1.5, & 1.6), obtained standard form the estimated production functions for Bardoli , Kamrej and Sayan Sugar factories respectively were:

$$\log(z) = 680448091.0 + 0.375033 * \log(x) + 0.125093 * \log(y) + \varepsilon,$$

(1.141106) (0.104232) (0.052326)

$$\log(z) = 10.3647 + 0.496736 * \log(x) + 0.402712 * \log(y) + \varepsilon \text{ and}$$
$$(1.677943) \quad (0.194068) \quad (0.082090)$$

$$\log(z) = 116960711086.0 + 0.358758 * \log(x) + (-2.30) * \log(y) + \varepsilon$$
$$(0.790888) \quad (0.051153) \quad (0.038883)$$

(6) The Output elasticity of the production means labor and capital of Bardoli, Kamrej and Sayan Sugar factories from the EViews 8 result table (1.1, 1.2, & 1.3) was obtained as follows:

Variable	Bardoli Sugar factory	Kamrej Sugar factory	Sayan Sugar factory
Labor	0.375033	0.496736	0.358758
Capital	0.125093	0.402712	-2.30

(7) Obtained the returns to scale value from the EViews 8 result Table (1.4, 1.5, & 1.6) for the production of Sugar of Bardoli, Kamrej and Sayan Sugar factories respectively were:

$\alpha + \beta = 0.500186 < 1$, $\alpha + \beta = 0.899448 < 1$ and $\alpha + \beta = -1.941242 < 1$

Which represent the decreasing returns to scale for Bardoli and Kamrej and Sayan Sugar factories. It means that the production of Sugar of Bardoli and Kamrej and Sayan Sugar factories were not progressive.

(8) The total output elasticity of the means of production of the Sugar of Kamrej Sugar factory was 0.899448, which was higher than the Bardoli and Sayan Sugar factories. It means that the production of Sugar of Kamrej Sugar factory was progressive at the level of output elasticity than Kamrej and Sayan Sugar factories.

(9) The output elasticity of land for the production of Sugarcane of Bardoli, Kamrej and Sayan Sugar factories were 0.859753, 0.825938 and 0.598009 respectively. Its t-Statistic were 5.0113450, 4.878952 and 3.030962 respectively with a two-tailed p-value of 0.0002, 0.0002 and 0.0084 respectively. It was weakly significant for Bardoli and Kamrej Sugar factories. The explanatory variable log(x) explained a significant amount of the variation in log (w). While it was insignificant for Sayan Sugar factory. The explanatory variable log(x) explained an in significant amount of the variation in log (w).

While the output elasticity of labor and capital for the production of Sugarcane of Bardoli, Kamrej and Sayan Sugar factories were (0.103927, 0.0444250 , 0.635127) and (0.082882, 0.144974, 0.054233) respectively. Its t-statistic were (0.466090, 0.143194, 3.491558) and (1.755832, 1.874911, 0.899225) respectively with a two-tailed p-value of (0.6478, 0.8880, 0.0033) and (0.0995, 0.0804, 0.3827) respectively. It was not significant for Bardoli and Kamrej Sugar factories.Therefore, the explanatory variable log (y) and log (z) explained an insignificant amount of the variation in log (w) for Bardoli and Kamrej Sugar factories. While weakly significant for labor of Sayan Sugar factory.

The explanatory variable log(y) for Sayan Sugar factory explained a significant amount of the variation log (w).

(10) If the means land, labor and capital of the production of Sugarcane of Bardoli,Kamrej and Sayan Sugar factories increases by 1%, the total production (w) increased by (85%, 10%, 0.08%) , (0.83%, 4%, 14%) and (60% , 64% ,5%) respectively.

(11) If the means labor and capital of the production of Sugar of Bardoli, Kamrej and Sayan Sugar factories increases by 1%, the total production (z) increased by (38%, 13%) , (50%, 40%) and (36% , -2 %) respectively.

(12) The output elasticity of labor for the production of Sugar of Bardoli, Kamrej Sugar factories were 0.375033, 0.496736, and 0.358758 respectively. Its t- Statistic were 3.598046, 2.559594 and 7.013488 respectively with a two-tailed p-value of 0.0024, 0.0210 and 0.0000 respectively. It was weakly significant. The explanatory variable log(x) explained a significant amount of the variation in log (z).

The output elasticity of capital for the production of Sugar of Bardoli, Kamrej and Sayan Sugar factories were 0.125093, 0.402712 and -2.30 respectively. Its t- Statistic were 2.390632, 4.905737 and -0.000592 respectively with a two-tailed p-value of 0.0295, 0.0002 and 0.9995 respectively. It was weakly significant for Bardoli and Kamrej Sugar factories. The explanatory variable log(y) explained a significant amount of the variation in log (z). While insignificant for Sayan Sugar factory. The explanatory variable log(y) explained an insignificant amount of the variation in log (z).

(13) If the means labor and capital of the production of Sugarcane for the Bardoli, Kamrej and Sayan Sugar factories increases by 1%, the total output z will increase by (210% , -28%), (149% , -32%) and (0.0951% , 43%) respectively.

(14) F-statistic value for the production of Sugarcane of the Bardoli, Kamrej and Sayan Sugar factories were 16.70207, 31.29450, and 28.74 respectively and corresponding probability this is called p –values were 0.000048, 0.000001, and 0.000002 respectively, which were less than 0.05 So, means of production land, labor and capital are jointly can influence dependent variable which is total production (w).

While the F-statistic value for the production of Sugar of the Bardoli, Kamrej and Sayan Sugar factories was 14.02783, 26.12086 and 27.47400 corresponding p-values was 0.000303, 0.000009 and 0.000007 which was less than 0.05. It means that means of production labor and capital were jointly influence dependent variable which was total production (z).

(15) R-squared value for the production of Sugarcane of Bardoli, Kamrej and Sayan Sugar factories 0.769607, 0.862238 and 0.851813 respectively. The meaning of that 77%, 86% and 85% respectively fluctuation in the total production of Sugarcane (w) can be explained by land (x), labor(y) and capital (z) jointly and the rest fluctuation in the production of Sugarcane (w) can be explained by other independent variables which were not included in this Cobb-Douglas production function.

(16) R-squared percentage value for the production of Sugarcane of Bardoli, Kamrej and Sayan Sugar factories were 76.97%, 86.22% and 85.18% respectively which were more than 60%. It means that the Cobb-Douglas production function was nicely fitted for the production of Sugarcane of Bardoli, Kamrej and Sayan Sugar factories.

(17) R- squared value for the production of Sugar of Bardoli, Kamrej and Sayan Sugar factories were 0.636828, 0.765539 and 0.774483 respectively. The meaning of that 64% , 77% and 77 % respectively fluctuation in the total production of Sugar (z) can be explained by labor (x) and capital (y) jointly and the rest fluctuation in the production of Sugar (z) can be explain by other independent variables which was not included in this Cobb- Douglas production function.

(18) R- squared percentage value for the production of Sugar of Bardoli, Kamrej and Sayan Sugar factories 63.38%, 76.55% and 77.45% respectively which were higher than 60%. It means that the Cobb-Douglas production function was nicely fitted for the production of Sugarcane of Bardoli, Kamrej and Sayan Sugar factories.

EPILOGUE

Every research helps to increase the level of knowledge in its specific field. This research will also contribute in the field of econometric statistics. It will help to field of agriculture and industry in many respects. Investigator would like to conclude with the only feelings that this investigation will help to different parties by different ways.

REFERENCES

(1) Afrait (1972). Efficiency Estimation of production function vol.13.
(2) Ahmed (2003) Productivity and Factor Substitution, theory and analysis – page 81 by S. Kumar, Deep Publication Pvt. Ltd., Delhi.
(3) Alfred Marshall (1890) Principles of Economics: an introductory volume, London.
(4) Annual Reports (1993 -2012) Bardoli, Kamrej and Sayan Sugar factories.
(5) Chaudhary, I. (1989) A comparative study of two sugar units (Financial & Technical Efficient in sugar unit), M.Phil. Thesis, S.G. Uni., Surat.
(6) Clark Edwards (1962) Non-Linear programming and regression procedures, vol. 44.
(7) Cobb-Douglas. P.H. (1928) A theory of production Amer Eco. Rev. Vol. 18.
(8) D. N. Dwivedi (2008) Microeconomics Theory & Applications, published by Dorling Kindersley (India) Pvt. Ltd. Delhi.
(9) Douglas C. Montgomery Elizabeth, A (2013) Introduction to Linear Regression Analysis. A John Wiley & Sons, INC., Publication, 2013.
(10) Kothari, C.R. (1985) Research Methodology Wishwa Prakashan, New Delhi.
(11) Krishna (2009) Statistics in Management Studies, Meerut, India.