International Journal of Innovations & Research Analysis (IJIRA)
ISSN : 2583-0295, Impact Factor: 5.449, Volume 02, No. 03(I), July- September, 2022, pp 74-78

MULTIVARIATE ANALYSIS PERTAINING TO COST FUNCTION FOR THE INDUSTRIAL SECTOR OF ALL INDIA

M. K. Dave*
S. G. Raval**

ABSTRACT

This paper discusses the estimation of cost function for all industries throughout India at current as well as constant prices. The data from ASI and CIM have been used for the period 1981-82 to 2017-18. The cost function model seems to be fitted at current as well as at constant prices. Estimated cost can be utilized for further cost forecast for a certain period.

Keywords: *Cost Function, Industrial Sector, Constant Prices, Regression.*

Introduction

The most commonly used concept of costs is the money concept costs of production. It means the minimum amount of money that is required to be spent to produce a given level of output. (Ravindra dhulati, 2010).

The cost function depends on many forces and the functional relation of cost to various forces will help us to provide the informational foundation for different cost forecasts. The list of these forces may vary from firm to firm in an industry or also from one type of industry to another. Industries have a major role to play in economic development of developed and under developed countries. (R. Cauvery)

Minzhe Du and Yunxiao Liu (2021) employed a restricted cost function model to measure the effects of environmental regulations on productivity growth on power plants in China for the period 2005-2010. They found that there was almost U-shaped effect of environmental regulations on productivity growth. The elasticities of substitution between energy and labor suggested that energy and labor were substitutable. The results also showed that technological progress is the driving force in productivity growth. Keyoung Kim and Youngsang cho (2016) utilized the Tabit model to estimate the cost of power outage for the industrial sector in South korea. They used the data of 430 companies by survey questionnaire. Their analysis revealed that the estimated outage cost is 1.24-1.30 times greater than a simple VoLL. They also found that preannouncement of outage can result in reduction of the economic loss to the industrial sector.

In this paper section-2 deals with the data base. The cost function model is presented in section-3.1 and time series analysis approach for profit is given in section-3.2. Table: 1 and Table: 2 describes regression analysis of the model at current and constant prices. Table: 3 gives moving averages at current as well as constant prices. Graphical presentation of estimated cost, deflated estimated cost and moving averages are represented by diagrams 1, 2 and 3. Section- 5 introduces concluding remarks.

Data Base

For our study we have used the data from Annual Survey of Industries (ASI) and Census of Indian Manufacturers (CIM). The data are considered for all India pertaining to all industries for the period 1981-82 to 2017-18. We have also considered data for Wholesale price index - Annual average for the period 1981-82 to 2017-18 by taking 1981-82 as base year from RBI bulletin, applying forward & backward splicing method to obtain the relevant series at constant prices.

* Research Scholar, Statistics Department Gujarat University, Ahmedabad, India.
** Head of Statistics Department, Som Lalit Commerce College, Ahmedabad, Gujarat, India.

Research Methodology

- **Model**

Let us consider the cost function for industrial sector of all India given by the following equation

$C(t) = \alpha[F(t)]^{\beta_1}[M(t)]^{\beta_2} \cdot U_t$ ....(1)

Where C(t) = Total cost for year t

F(t) = Fuel input for year t

M(t) = Material input for year t

t = Time (year)

U_t = Disturbance term for year t

$\alpha, \beta_1, and\ \beta_2$ are parameters of the model.

The log-log model of the above model is given in equation (2) is as under

$L_nC(t) = \beta_0 + \beta_1 L_n[F(t)] + \beta_2 L_n[M(t)] + Z_t$ ………...(2)

Where $\beta_0 = L_n(\alpha)$

$Z_t = L_n(U_t)$

Under normality assumptions regression analysis can be considered as usual with a purpose of estimating the parameters and hence to estimate the model.

Method of Moving Averages

We also consider another approach of time series analysis for the series representing total cost of the industrial sector. We have taken 3 yearly and 5 yearly moving averages for cost series for all industries for all India over the period 1981-82 to 2017-18. Here we have tried to compare both the approaches- regression as well as moving averages.

Statistical Analysis

Table 1: Regression Analysis for all Industries of All India (Current Prices)

Model: $L_nC(t) = \beta_0 + \beta_1 L_n[F(t)] + \beta_2 L_n[M(t)] + Z_t$

Regression Statistics	
Multiple R	0.999808039
R Square	0.999616115
Adjusted R Square	0.999593534
Standard Error	0.030495181
Observations	37

ANOVA					
	df	***SS***	***MS***	***F***	***Significance F***
Regression	2	82.33295368	41.1664768	44267.12027	8.5392E-59
Residual	34	0.031618506	0.00092996		
Total	36	82.36457218			

	Coefficients	***Standard Error***	***t Stat***	***P-value***	***Lower 95%***	***Upper 95%***
Intercept	0.101862666	0.074526675	1.36679471	0.180660076	-0.0495938	0.253319092
ln fuel	0.059670186	0.044881295	1.32951124	0.192531299	-0.0315396	0.150879951
ln material	0.956705064	0.036812632	25.9884992	5.16461E-24	0.88189279	1.031517333

Table 2: Regression Analysis for all Industries of All India (Constant Prices)

Model: $L_nC(t) = \beta_0 + \beta_1 L_n[F(t)] + \beta_2 L_n[M(t)] + Z_t$

Regression Statistics	
Multiple R	0.999332257
R Square	0.998664961
Adjusted R Square	0.998586429
Standard Error	0.031441841
Observations	37

ANOVA					
	df	***SS***	***MS***	***F***	***Significance F***
Regression	2	25.14320427	12.5716021	12716.70786	1.35956E-49
Residual	34	0.033612038	0.00098859		
Total	36	25.1768163			

	Coefficients	***Standard Error***	***t Stat***	***P-value***	***Lower 95%***	***Upper 95%***
Intercept	0.097804147	0.118450336	0.82569751	0.414732105	-0.1429159	0.33852419
ln def fuel	0.035582271	0.051428773	0.69187478	0.493714001	-0.06893357	0.140098113
ln def material	0.984446749	0.034640963	28.4185731	2.81622E-25	0.914047841	1.054845656

Table: 3 Moving Averages

Total Cost	3 Yearly Mov. Avg.	5 Yearly Mov. Avg.	Deflated Total Cost	3 Yearly Mov. Avg.	5 Yearly Mov. Avg.
5694900	-	-	56949		-
6709650	6468747.333	-	63962.35	60994.36333	-
7001692	7257926.333	7343503.6	62071.74	64388.37333	64773.764
8062437	8104322.667	8261411.6	67131.03	67652.49	68884.25
9248839	9198572	9307227.2	73754.7	72795.72	72731.122
10284440	10490669	10758654.8	77501.43	78150.94667	78798.732
11938728	12160666	12720477.2	83196.71	84369.31	86943.506
14258830	14689702.33	15050429.4	92409.79	94487.13333	95070.066
17871549	17676326.33	17654101.2	107854.9	104884.0633	101997.88
20898600	20690982.67	20925211.4	114387.5	111460.9667	110102.118
23302799	24165226	24490549	112140.5	116748.6333	117516.46
28294279	27894198.67	28732133.6	123717.9	121779.9667	123957.44
32085518	33153089.67	34702237.2	129481.5	131086.4	134764.48
39079472	40638036	41179974.2	140059.8	145988	147673.62
50749118	48506691.33	48283098.2	168422.7	161722.9	161710.82
55691484	56750167	54066872.4	176686.2	179670.9333	170867.96
63809899	60168590.67	60438271	193903.9	181952.4333	182259.68
61,004,389	65250251	65259477.8	175267.2	188729.8333	187378.28
70936465	68932002	69705730.8	197018.4	188767.1	191031.66
74855152	74571455.33	75267460.8	194015.7	195329.0667	196582.8
77922749	81465483.33	83859048.8	194953.1	203542.8	209231.64
91618549	91167875.67	96930582.4	221659.6	218374.7	228548.86
103962329	110625003.7	112832720.6	238511.4	251258.5	253389.92
136294133	131540768.3	136215522.4	293604.5	283445.6333	289685.44
154365843	161832244.7	162350869	318221	329418.7333	327493.44
194836758	190499294.3	194788130.8	376430.7	368450.4333	370797.7
222295282	227760226	228246371	410699.6	414054.3333	412075.26
266148638	264009751.3	274394874.6	455032.7	455241.5333	464216.56
303585334	318280777.7	331400834.6	499992.3	511317.5	521375
385108361	389520084.3	387315095.4	578927.5	580380.9	569915.9
479866558	455613835	443888158.2	662222.9	631518.1667	613606.96
501,866,586	510249032	497553282.6	653404.1	663038.3333	652201.5
549,013,952	540930498	532313091.8	673488	673285.7	677042.86
571,910,956	559944105	554289055	692965	689862.4333	690457.76
558,907,407	573521579	586052085	703134.3	708465.5667	718487.84
589,746,374	603111839	-	729297.4	741995.4	-
660,681,736	-	-	793554.5	-	-

From Table 1 we observed that for cost function model at current prices R= 0.99 which shows that there is strong association between total cost and fuel input and material input. We also observed that value of R^2 is 0.99 which is highly significant and shows that 99% variation is explained by the model. Adjusted R^2= 0.99 which also exhibits similar behavior. All regression coefficients are statistically significant at 5% level of significance.

F-value is also highly significant which shows that regression model may be considered to be good fit for the data.

From Table 2 it is observed that at constant prices also the values of R and R^2 are 0.99 and 0.99 respectively for cost function model. R^2=0.99 indicates that 99% variation is explained by the model. All regression coefficients are statistically significant at 5% level of significance. At constant prices F-value is very high which shows that regression model may be considered to be good fit for the data.

Table 3 exhibits 3 and 5 yearly moving averages for cost series at current as well as constant (deflated) prices.

Graphical presentation of Estimated total cost, total cost and deflated total cost is represented in diagrams 1,2 and 3 to visualize the growth pattern of the industrial sector of India as whole.

Diagram 1

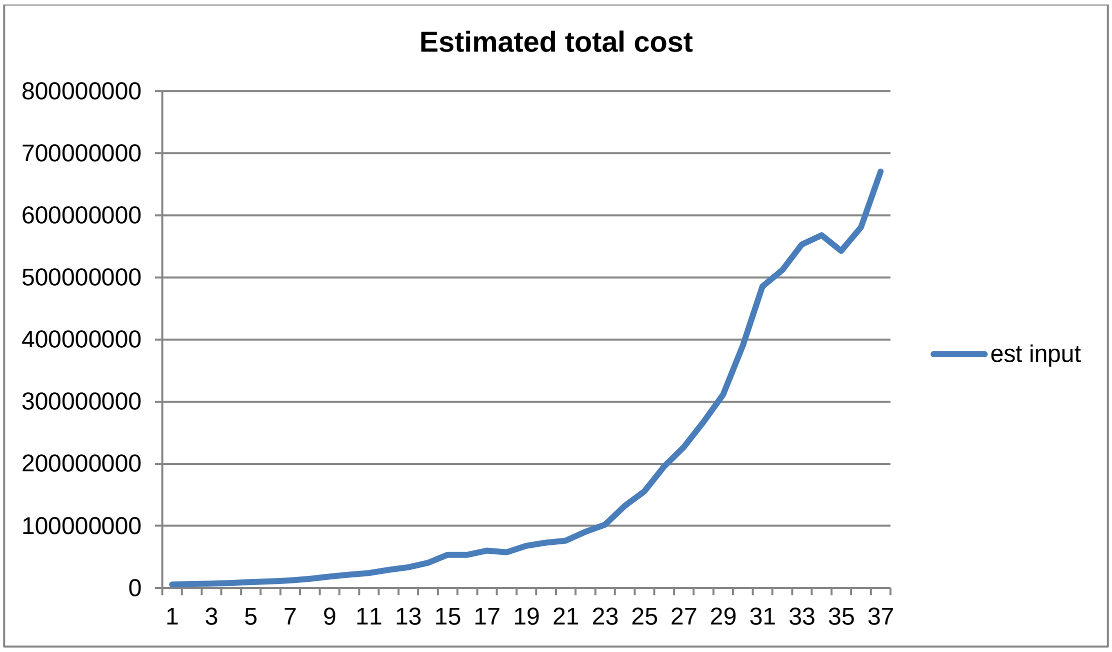


Diagram 2

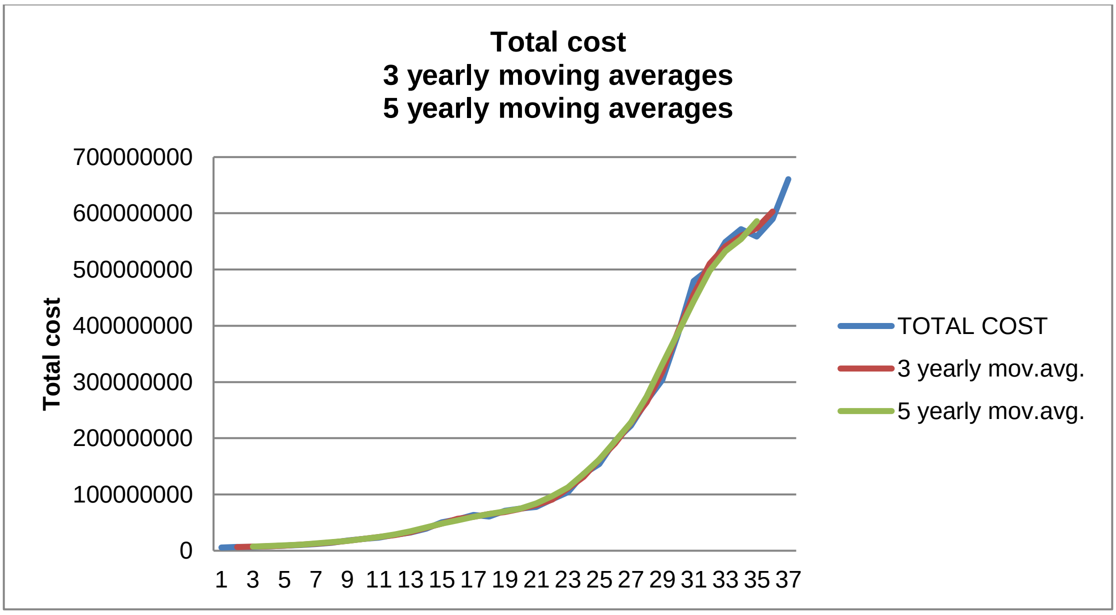
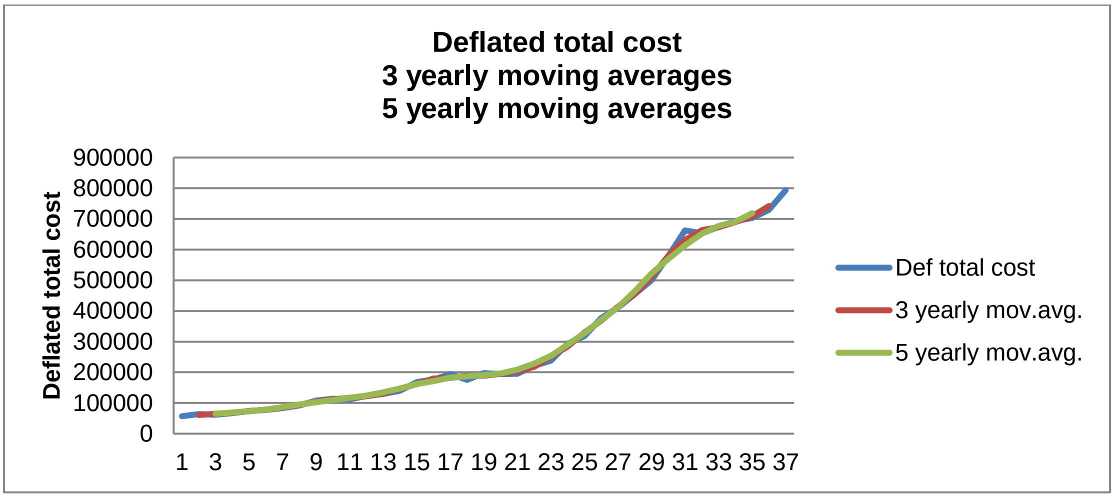


Diagram 3



Concluding Remarks

We have made an attempt to estimate total cost function for the industrial sector of all India during the period 1981-2017. This is a macro economic approach based upon statistical tools and analysis techniques. The estimated double log model appears to be highly significant at both current as well as constant prices satisfying all requisite conditions for statistical testing approaches. The graphical presentation is also shown to reflect the theoretical study approach. Another approach based upon time series analysis is also carried out by way of taking 3 yearly and 5 yearly moving average for the determination of trend of total input cost function during the successive periods. This trend analysis has a drawback that we missed some observations in the beginning and end due to statistical trend determination exercises. However, this approach of analysis shows the general variation outlook for the statistical series as whole during the successive periods. Graphical presentation for this application both at current as well as constant prices for 3 as well as 5 yearly moving averages is shown to visualise the growth pattern. It is also important to note that both the types of statistical studies viz. estimated theoretical model as well as estimated trend analysis reflect almost similar behavior which can also be visualise from the graphical presentation. The purpose of this study is visualise or forecast for total input cost function for the industrial sector as a whole during the given period of our analysis. The proposed model can be used for forecasting total input cost for further periods but only for certain future periods. The reason is that there may be some unknown forces that can affect the future forecast. However, our study may be helpful for prediction purposes and also it may be useful for future planning for the industrial sector as whole for all India. It may be also worthwhile for government planning exercises for the coming years.

References

1. Berndt, E.R, Hall, B.H., R.E. Hausman, J.A., 1974. Estimation and inference in non-linear structural models. Ann. Econ. Soc.Meas.3, 653-665.
2. Damodar Gujarati and Sangeetha (2007), Basic Econometrics, 4th ed. (Mcgraw Hill Co.).
3. Grenemann, T.W., R.S. Brown and M. Pauly, 1986. Estimating hospital costs: A multiple output analysis, *Journal of Health Economics* 5, no. 2 107-127.
4. Jack Johnston and John DiNardo (1997), Econometrics Method,4th ed. (Mcgrow,Hill Co)
5. J.S. Cramer (1969), Empirical Econometrics, North-Holland Pub.Co.
6. McDonald, J. F., Moffit, R.A., 1980. The uses of Tobit analysi. Rev. ECon. Stat. 62 (2).
7. McFadden, D., 1978. Cost, revenue and profit functions. In: Fuss, M., McFadden, D. (Eds.), Production Economics: A dual Approach to Theory and Application. vol. 1 North-Holland, Amsterdam.
8. R.G.D. ALLEN (1953), Mathematical Analysis for Economists.
9. Walters A. A. (1963), Production and Cost functions, An Econometric Survey, *Econometrica* Vol. 31 (1, 2).

□❍□