Asian Resonance

Industrial Growth, Economic Reforms and Output Differentials in the Manufacturing Sector of Rajasthan

Abstract

The present study deals with industrial production of the manufacturing sector. For this purpose time-series secondary data for the year 1980 to 2005 have been used to estimate Cobb-Douglas production function by Ordinary Least Square method. Industrial growth has been found to be affected by the economic reforms. In industrial production the quality as well as quantity of the input used played a significant role to affect the output. In this context, the present paper focuses its attention on the decomposition of efficiency effects to show the qualitative as well as quantitative contribution of the inputs in pre-reforms and post-reforms periods.

Keywords: Industrial growth, Product quality, Manufacturing, Government policy

JEL classification: L1, L5, L6, L7

Sulochna Meena,
Lecturer,
Deptt. of Economics,
Govt.P.G.College,
Tonk, Rajasthan

J.N.Sharma
Lecturer
Deptt. of Economics,
Govt. P.G.College,
Tonk, Rajasthan

Introduction

Industrial growth plays a significant role in an economy. The study of industrial growth enables one to study the role of industrial growth in the development of an economy. The industrial output has directly co-related with its growth and different industrial inputs in affecting the different level of production. It has been cleared that the performance of manufacturing sector has not been found sound in India and considered as the poor performed sector. Our industrial growth touched the figure of 8 in the 11th five year plan. The present study analyses the role of inputs at the different levels of scale, what are the different inputs and their combinations being used for the production in pre-reform and post –reforms periods which is the basic problem that is being faced by the producers and firms. At the time of planning, industrial sector should be given special attention because they contribute most to the objectives of an economy. The industrial growth must be raised to two digits so that the additional job opportunities may be created for the unemployed persons in future. The output of the manufacturing industries has been affected by the quality as well as quantity of inputs. Thus, the present study has been designed to show that how and up to what level the quantity as well as quality of inputs have affected the industrial production.

Having raised the above issues, the main objectives of the present study are:

(1) To estimate the Cobb-Douglas production function of the Manufacturing Sector for developed and less developed districts as well as for the pre-reforms and post-reforms periods.

(2) To estimate the production differentials and decompose them into efficiency and scale effects Keeping in view the above objectives the districts of Rajasthan on the bases of selective indicators related with the manufacturing, electricity and mining sectors rank has been provide to them. Ranking method has been used to assign rank to all the districts of Rajasthan then the districts have been divided into two groups as developed districts group and less developed districts group. The test of structural changes has been found to be significant to calculate the output differentials.

Review of Literature

There are many studies related with the production function and its estimation. The studies, related with the present study vary in objectives and methodological ground. Barua and Lech (1987) have estimated variable elasticity of substitution function for eleven industries using cross sectional (inter-state) data for 1969. Bhavani (1991a) has estimated three

input Trans-log production function for some metal-based small scale industries. The three inputs considered are labour, capital and materials. The Ordinary Least Squares technique has been labour, capital and materials. The Ordinary Least Squares technique has been followed for the estimation. While Agarwal and Goldar (1992) have estimated technical efficiency for engineering firms using Cobb- Douglas functions taking labour, capital and energy as three inputs. They have used both deterministic and stochastic frontier functions. Srivastava (1996) has estimated production function for Indian manufacturing and various two-digit industries using panel data for public limited companies for the period 1980-1989. A three input (Cobb-Douglas and Trans-log) model has been used taking capital, labour and material as the three inputs. Kumar and Gupta (2008) have evaluated the performance of the manufacturing sector over the time and made cross country comparison. For this purpose they used data for the year 1980-2004. Anita (2010) has found that productivity growth has declined after reforms for firms in all technology groups. She divided the industries into four groups: high-tech, medium-tech, medium low-tech and low-tech.

All the above described studies have used the analysis of the estimation of the manufacturing production function, but lacked the estimation of product differentials and their decomposition into the efficiency and scale components.

Data, Variables And Model Estimation:

The secondary time-series data for the period 1980 to 2005 have been used from Annual Survey of Industries and collected from the reports of ASI. This data set for the output and input related variables have been considered for the period 1980-2005. All the nominal data have been converted into their real values.

The present study deals with the traditional production function strategy considering the output and inputs of the manufacturing sector of Rajasthan.The variables used and adjusted in the present study are; ***labour***- Total numbers of persons engaged have been taken as a measure of labour input. It is used as an explanatory variable and hypothesized to be positively correlated with the manufacturing output. ***Capital***- Capital is used as independent input variable in production function of manufacturing sector. The net fixed capital stock at constant prices has been considered as the measure of capital input. The construction of the net fixed capital stock series have been done by the Perpetual Inventory Method. The capital has also been supposed of having the positive effects on the manufacturing output considered in the study. ***Value Added***- The value added represents that part of value of product which is created in the factory and is computed by deducting the value of input comprising cost of material, fuels, amount paid for the work done by other concerns, other expenses which include cost of transport, fee of directors and managing agents, interest charges etc and depreciation of fixed assets. As the dependent variable, value added is generally used as the proxy for the manufacturing output.

The study has been followed by the econometric modeling to estimate the Cobb-Douglas production function in log-linear form by the ordinary least square method.

The traditional production function form has been specified and the expression can be put as below.

$$Q = F(L, K) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

Where, Q-value added, L-labour and K-capital

After logarithmic transformation, the equation to be estimated becomes,

$$\ln Q=\beta_0+\beta_1 \ln L+\beta_2 \ln K \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(2)$$

The above function has been estimated for the pre-reforms and post-reforms for the both types of districts group by the ordinary least squares method. To see how production differentials between pre-reforms and post-reforms period can be decomposed into efficiency and scale components, let us consider the production function for the two time period symbolizing as 0 for the pre-reform and as 1 for the post-reforms periods by superscripts. Now the production function for the post-reforms periods can be expressed as:

$$\ln Q^1=\beta_0^1+\beta_1^1 \ln L^1+\beta_2^1 \ln K^1+ \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

and for the pre-reforms period as;

$$\ln Q^0=\beta_0^0+\beta_1^0 \ln L^0+\beta_2^0 \ln K^0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

On subtracting equation (4) from equation (3) we can obtain the percentage change in manufacturing output between post-reforms and pre-reforms periods. The results can be expressed as follows

$$\ln Q^1-\ln Q^0=\beta_0^1+\beta_1^1 \ln L^1+\beta_2^1 \ln K^1-\beta_0^0-\beta_1^0 \ln L^0-\beta_2^0 \ln K^0 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots(5)$$

By making the necessary arrangements in equation (5), we get,

$$\ln Q^1-\ln Q^0=\beta_0^1+\beta_1^1 \ln L^1+\beta_2^1 \ln K^1-\beta_0^0-\beta_1^0 \ln L^0-\beta_2^0 \ln K^0+\beta_1^o \ln L^0-\beta_1^0 \ln L^0+\beta_2^0 \ln K^0-\beta_2^o \ln K^{o=}[(\ln L^1-\ln L^0)\beta_1^0]+[(\ln K^1-\ln K^0)_2^0 \beta]+[(\beta_0^1-\beta_0^0)+(\beta_1^1-\beta_1^0) \ln L^1+(\beta_2^1-\beta_2^0) \ln K^1 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(6)$$

By measuring all the variables at their sample means, the average percentage output difference is seen to be the sum of three terms enclosed by the brackets. The first right hand term is the production differences due to the labour differences (measured by the estimated scale parameters $\beta^0{}_1$. This is simply the scale effect. By the similar arguments the second term in brackets picks up capital differences due to difference in capital investment in manufacturing segment. The final third term captures production differences due to differences in efficiency relating with labour and capital. It has been found that the total product differences are due to the quantitative effects

of labour and capital, known as scale effects and the qualitative effects of labour and capital known as the efficiency effects.

The various scale and efficiency components have been expressed as below.

(lnL1 —lnL^0) β_1^* — Scale Differences in Output due to labour.

(lnK1 —lnK^0) β_2^* — Scale Differences in Output due to capital.

($\beta_1^1 - \beta_1^0$) lnL* — Efficiency difference due to labour.

($\beta_2^1 - \beta_2^0$) lnK* —Efficiency difference due to capital

In the above expression the values of L, K used are the average value in log form for different time period. Similarly on calculating the scale differences at post-reform means the values of βs of the pre-reforms period have been used and vice-versa.

Analysis of Results

Under the two phased analysis of results, the first phase attempts to analyze the estimates of the production function. The Table-1presents the estimates of the production function for the manufacturing industries. The developed and less developed districts of Rajasthan are presented in the table and then divided into pre-reforms and post-reforms periods. As in the pre-reforms period labour has been found to be played positively significant role in increasing output in less developed districts while in the developed districts capital has been found positively significant at 1% level. The role of labour and capital has shown the negative insignificance in the developed and less developed districts respectively in the pre-reforms period.

Table-1:
Estimates of Production Function

Parameter	Less Developed Districts Group		Developed Districts Group	
	Pre-Reform	Post-Reform	Pre-Reform	Post-Reform
intercept	-27.30* (7.08)	3.26 (0.97)	-4.73 (1.28)	9.27* (2.15)
Labour	4.92* (7.33)	0.17 (0.38)	-0.16 (0.67)	0.47 (0.83)
Capital	- 0.02 (0.14)	0.29 (1.55)	1.42* (4.51)	-0.30 (0.74)
R^2	0.911*	0.251	0.673*	0.069
Adj.R^2	0.894*	0.084	0.607*	0
F	51.487	1.505	s10.278	0.373
D-W	1.927	_	2.241	1.547
Chow F	11.073		9.382	

Note : Values in parentheses are the absolute t – ratios. :

*- Significant at 1% level.

It means that in the pre-reforms period more capital is used in the developed districts while less developed districts have been ignored, as for the use of capital is concerned. In the post-reforms period no significant role of labour and capital has been found in both districts group. In less developed districts the manufacturing output has been found effected in the hypothesized direction. The manufacturing output increased in the developed districts but not due to role of capital. In post-reform period the manufacturing factor did not entertain properly so the performance of manufacturing sector has been found to be poor.

The value of co-efficient of determination in case of pre-reform period shows that about 91% and 67% variation in the production is explained by the model fitted for the less developed and developed districts respectively, which is highly significant at 1% level. But in the post-reform period it is clear that the role of these inputs becomes ignored in increasing the output. There are many other factors which played crucial role for the manufacturing output. The role of FDI, banking, telecommunication, infrastructure facilities etc. exist after liberalization of the economy. The traditional inputs did not play any significant role to increase the output performance of the manufacturing sector.

The Chow test has been performed to know the structural changes exist in the manufacturing sector, as the result shows that the null hypothesis has been found to be rejected at the 1% level of significance. The production differentials have been found between each district group for the pre-reforms and post-reforms period.

Table-2 presents the estimates of the output differentials and their decomposition into efficiency and scale effects. The Cobb-Douglas specification of the output differentials has been followed in the framework of the traditional production function. Each of the efficiency and scale effects has been calculated both at pre-reforms as well as post-reforms means for the developed and less developed districts group separately.

In case of developed districts group the inbuilt efficiency difference has been found to be 14% irrespective of any production inputs. The efficiency difference due to labour shows, that in post-reforms period the productivity of labour has been found to be more by 6.25% in comparison with the situation of the pre-reforms period. Evidently due to the incorporation of the new production techniques the qualitative role of labour has shown an improvement in the situation. The same picture is also being shown by the efficiency difference estimated at post-reforms means where the efficiency role of labour has been more by 6.34% in post-reforms period compared with the pre-reforms period.

The efficiency of capital has been found less in post-reforms period by 19.23% compared with the pre-reforms period. This trend has been found due to the lower levels of capital productivity in the post-reforms period. It might be the main cause of this phenomenon that Government completely ignored the manufacturing sector especially in the developed districts.

Table-2:
Output Differentials and their Decomposition into Efficiency and Scale Components

Parameters	Calculated at Pre-Reforms mean $X^*=\bar{X}^0, \beta^*=\beta^1$		Calculated at Post-Reforms mean $X^*=\bar{X}^1, \beta^*=\beta^0$	
	Developed Districts Group	Less Developed Districts Group	Developed Districts Group	Less Developed Districts Group
Efficiency Differences				
Intercept ($\beta_0^1 - \beta_0^0$)	14	30.56	14	30.56
Labour ($\beta_1^1 - \beta_1^0$) $\ln\bar{L}^*$	6.25	-32.16	6.34	-35.44
Capital ($\beta_2^1 - \beta_2^0$)$\ln\bar{K}^*$	-19.23	2.27	-20.07	2.63
Total	1.03	0.67	0.27	-2.25
Scale Differences				
Labour ($\ln\bar{L}^1 - \ln\bar{L}^0$)$\beta_1^*$	0.06	0.12	-0.02	3.39
Capital ($\ln\bar{K}^1 - \ln\bar{K}^0$)$\beta_2^*$	-0.15	0.33	0.69	-0.02
Total	-0.09	0.45	0.67	3.37

The same seen can also be observed in case of the results calculated at post-reforms means where the efficiency difference due to capital is higher by 20.07% in the pre-reforms period. It is also clear that the overall efficiency differences in developed districts group show that the manufacturing output has been found more in the post economic reforms period by 1.03% than the pre-reforms period.

The case of less developed districts group produces the reverse picture about producer and the reverse picture about the efficiency role of labour and capital. In case of labour input it is clear that the efficiency productivity of labour in pre-reforms period was higher than that in the post-reforms period and thus the efficiency difference due to labour has been reported to be higher in pre-reforms period by 32.16% than the post reform period. The magnitude of the efficiency difference due to labour has been estimated as 35.44% if calculated at post-reforms means. Regarding efficiency difference due to capital, the capital has been found productive in the post-reforms period by 2.27% (calculated at pre-reforms means).

The scale differences into output levels have also been assigned to both labour and capital inputs. In case of developed districts group the quantitative productivity impact of labour has been found to be higher by 0.06% in comparison with pre-reforms period showing that an average there has been reported an increase in the use of labour in the post-reforms period. If calculated at post-reform mean the quantitative productive role of labour has been found to be 0.02% less in the post reforms period. The role of capital shows that the units of capital have been employed less in post economic reforms period than in the pre economic reforms period due to this the output differential amounts 0.15% less in the post reforms period (calculated at the post-reforms productivity of capital).

The scale difference in less developed districts group shows that the manufacturing output has been found higher by 0 .12% due to labour calculated at the post reforms productivity level. If the pre-reforms productivity is used to estimate the scale difference due to labour it can be seen that the output differential is more in post-reforms period by 3.39% that the pre-reforms period. It is also evident that the output differentials due to scale differences have been found to be 0.33% higher in post-reforms period if calculated at the post-reforms productivity level of capital.

Finding and Policy Implications

The production function estimates in the specified Cobb-Douglas frame work of the output-input relationship reveals that in less developed area of Rajasthan in the sphere of manufacturing sector the levels of labour productivity has been found decreased in the post-reforms era, while that of capital has been increased in the post-reforms periods. Similarly, in the case of developed districts group the productivity of labour in pre-reforms period have been found to be increased while that of capital has been found decreased in the post-reforms period. The specified Cobb-Douglas production functional form reveals a very powerless goodness of fit as reported by insignificant values of co-efficient of determination.

However, it has been suggested that Rajasthan state should develop special industrial zones so that performance of manufacturing sector can be increase to the desired level. Special plan as well as sectoral plan should be developed for the backward districts. It has been found that the many other inputs has been affecting the industrial output so that the better trade policies need to be framed to attract the quality investment in critical areas. It is clear that the major contribution of economic growth now comes from the private sector so such type of policies should be framed that supports these dynamism. For upliftment of the region the involvement of the industrial association and concerned ministers are required thus, for this the better consultation and coordination of industrial association and ministers should be involve in industrial policy framing.

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