

**Trade Policy Orientation and Productivity Growth in the manufacturing
sector: A Comparative study of three states**

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Abstract

India started liberalizing its economy in general and its industrial sector in particular over two decades ago. One of the objectives of liberalization was to make Indian industries more efficient, highly competitive and improve their competitiveness in global market. Toward this end the government of India pursued three sets of reforms broadly: one, disbanding the complex network of industrial licensing and industrial controls and permit system. Two, liberalizing the foreign trade and currency transaction. Third, initiating steps to encourage the FDI inflows (Sidharthan 2003). These measures were taken in 1991 and the process of liberalization is still continuing. This paper is a modest attempt to find out the impact of liberalization on the industrial sector of three states and verify empirically which school of thought is valid one. The result shows that in terms of growth liberalization doesn't pay a heed to it and when we analyze the productivity we find a differential result showing that there is some improvements in post liberalization period in Tamil Nadu and Andhra Pradesh and just a reverse trend in case of Orissa. So this testifies the fact that neither Neo-classical school nor Revisionist School is valid for Indian states.

JEL Classification: F13, F14, C13, C22, O4

Keywords: Trade liberalization, labor productivity, capital productivity and factor intensity ratio, TFP

1. Introduction

India started liberalizing its economy in general and its industrial sector in particular over two decades ago. One of the objectives of liberalization was to make Indian industries more efficient, highly competitive and improve their competitiveness in global market. Toward this end the government of India pursued three sets of reforms broadly: one, disbanding the complex network of industrial licensing and industrial controls and permit system. Two, liberalizing the foreign trade and currency transaction. Third, initiating steps to encourage the FDI inflows (Sidharthan 2003). These measures were taken in 1991 and the process of liberalization is still continuing. Many restrictions like licensing, permits are withdrawn, foreign trade was eased out and list of negative products have been considerably trimmed. It was expected that once the Indian industries were exposed to global competition they will be compelled to produce more in an efficient manner. So based on our expectation we framed one hypothesis that liberalization is contributing to growth and productivity of industrial sector. These measures were taken in 1991 and the process of liberalization is still continuing. It was expected that once the Indian industries were exposed to global competition they will be compelled to produce more in an efficient manner.

II. Theory

The term 'Productivity' is extolled in literature of 'Economic Growth.' Because it influences and gets influenced by costs, profits, output, employment and investments. Therefore, it occupies a crucial role in economic growth. The role of trade policy in determining the growth of output and productivity in the industrial sector has been widely discussed in the literature of 'Trade theory and Economic growth'. It has been also empirically tested which resulted a controversy between two schools of thought. First, studies done by Little, Scitovsky and Scott (1970), Bhagwati (1978), Kreuger (1978) have generated a view which is called a main stream view favored by most of the neoclassical economists that the economies with relatively neutral foreign trade regime in which the effective exchange rate for exports relative to imports is close to unity or at any rate not too highly skewed towards import substitution show a better performance with respect to growth and productivity than the economies which have restricted trade regimes in terms of tariff and other quantitative restrictions. This view says that in effort to promote import

substitution beyond a point creates a closed economic structure, which in turn leads to high cost and poor productivity performance. The study done by Nishimizu and Robinson (1984) also supports this view. Another argument linking trade policy with productivity and efficiency is based on the foreign exchange constraints. A stylized fact characterizing developing countries is that intermediate and capital goods imports are not very much substitutable with domestically produced goods. In a sense, these imported goods embody technologies that domestic producers can make use of through imports. Thus, any policy that hinders imports or make them more expensive will lead to low productivity performance.

On the other hand a different school of thought led by Rodrick (1989), Stewart and Ghani (1989), Pack and Helleiner (1989) questioned the theoretical as well as the empirical basis of the hypothesis, which links outward orientation to productivity growth. This revisionist school of thought put importance to certain factors like 'learning curve' and better prospect for 'research and development' in the face of assured domestic market rather than a highly uncertain foreign market. These theories side by side try to put a parallel argument linking the inward orientation with productivity performance and growth.

The present study is designed to verify that hypothesis i.e. whether liberalization does have any impact on growth, efficiency and productivity of industrial sector and have a comparison among three states i.e. Orissa and Andhra Pradesh and Tamil Nadu to test the relevance of two schools of thought. The second part shows the methodology and the third part presents the empirical analysis of growth and productivity of both states. The final section concludes with some policy implications.

III. Methodology

This study has taken a time period of twenty five years starting from 1980-81 to 2004-05 and the entire period is divided into two sub-periods like pre liberalization period (1980-81 to 1989-90) and the post liberalization period (1991-92 to 2004-05). In this study, we consider the period up to 2004-05, the maximum feasible at the time when we embarked upon it. To measure the growth performance of variables, the trend growth rates have been calculated by taking the semi-logarithmic equation as

$$\text{Log } Y = a + bt$$

Where Y- concerned variable, a - constant, b - growth rate and t- time.

First, the study investigates the growth performance of the industrial sector of two states by estimating the trend growth rates of growth indicating variables like gross value added (GVA), capital stock, labor force, investment level in both periods¹. It is likely that all the variables will have a positive growth performance after liberalization. Secondly, the study undertakes the productivity and efficiency aspect. The trend growth rates of labor productivity, capital productivity, factor intensity (K/L), capital output ratio, and profit share. It is anticipated that labor productivity and capital intensity will experience a positive growth while the capital productivity will have just reverse trend because as liberalization is likely to increase both capital stock and value added along with labor force. Thirdly, the study looks into a more comprehensive measure of productivity i.e. total factor productivity (TFP). It is a neo-classical concept and takes into account all factors of production. It is a ratio of output to weighted sum of inputs or it is the residual between growth rate of output and weighted sum of growth rates of inputs. It is a measure of technical progress and efficiency. So finally the study uses the translog index method of TFP estimation to show the impact of liberalization on industrial productivity of three states and both periods. This index assumes geometric progression in variables and it is compound growth formulation in the following form;

$$TFPG = \frac{\Delta A_t}{A_t} = \Delta \ln Y_t - \{\bar{w}_t \Delta \ln L_t + \bar{r}_t \Delta \ln K_t\} \dots\dots\dots(1)$$

Where $\bar{w}_t = 1 - \bar{r}_t$

Y_t = value added in time period 't'.

And $\Delta \ln Y_t = \frac{\Delta Y_t}{Y_t} = \ln Y_{t+1} - \ln Y_t$

$\Delta \ln L_t = \frac{\Delta L_t}{L_t} = \ln L_{t+1} - \ln L_t$

$\Delta \ln K_t = \frac{\Delta K_t}{K_t} = \ln K_{t+1} - \ln K_t$

¹ Details about the construction of different variables are given in appendix A and the unit root test for stationarity for different variables is given in appendix B.

$$\bar{w}_t = \frac{w_{t+1} + w_t}{2} \quad \text{and} \quad \bar{r}_t = \frac{r_{t+1} + r_t}{2}$$

Where w_t and r_t are being shares of factor inputs in gross value added.

The Translog index of TFP is obtained by using the following identity (taking A_0 as unity)

$$A_{t+1} = A_t \left(\frac{1 + \Delta A_t}{A_t} \right)$$

Since the study deals with the impact of liberalization, a regression has been carried out by taking some of the liberalization measuring variables along with liberalization dummy. A logarithmic transformation of the C-D production function yields an equation that is linear in the logarithms of output and inputs and in time. It is written as:

$$\ln Y = a + \alpha \ln L + \beta \ln K + \lambda t + \varepsilon_{it} \text{-----} (2)$$

IV. Empirical analysis of Industrial Performance

Industrialization plays a dynamic role in the process of economic development of the developing economies. It holds the key to provide a lasting solution to the problem of low economic growth. Because industrialization is the only line of attack for achieving rapid growth and opulence for the economy. Thus, accelerating the rate of growth in the economy it creates more employment opportunities and thus paves the way for poverty alleviation. Many economists have documented both theoretically as well as empirically the contribution of industrial progress to the course of overall economic development of the underdeveloped economies. The early writers like Rosenstein-Rodan (1943), Singer (1952) and Nurkse (1953) have emphasized the significance of industrialization in the growth process of their respective theories of economic development. Similarly Chenery (1989) and Adelman (1988) have demonstrated economies with higher rate of growth in industrial sector have also able to achieve higher economic growth. Moreover, the development experience of many countries in the west has made it clear. When it comes to the case of India the importance of industrialization as a means of achieving rapid growth and prosperity has long been recognized in the thinking on

development strategy for India, even before the formal process of economic planning was launched in the economy. As far back as 1944 the Bombay plan, an influential document reflecting the views of nationalist Indian industrialist had stressed the importance of pushing through the extensive industrial programme in a short period. Therefore, five year plans just after independence reflected an extensive industrialization strategy. More specifically, we gave much more importance to industrialization in second plan following the Mahalanobis model.

The growth rate of industrial sector can be analyzed in terms of changes in the growth rates of growth indicating variables like value added, capital stock and employment. Accordingly, the estimates of the mean growth rate of these variables for the pre, post reform and full period are given.

Table-1 (Growth Rates of Select Indicators)

States	Value Added			Labor Force			Capital Stock		
	I	II	III	I	II	III	I	II	III
A.P.	7.98	4.42	7.61	1.02	-0.54	0.57	12.45	3.69	9.08
Orissa	20.77	7.21	14.21	1.73	-3.70	-0.27	15.63	3.11	8.83
T.N.	6.37	8.90	6.23	0.75	1.74	1.9	12.72	6.24	9.2

Note: (1) I- pre reform period, II- post reform period, III- full period

(2) The figures are compound growth rates showing the anti logarithm of the relevant regression coefficients minus one when the equation estimated are of the form “ $\log y = a+bt$ ” and ‘t’ refers to time. All the growth rates are statistically significantly different from zero at five percent level for a two tailed test.

(3) The pre reform period is 1980-81 to 1990-91 and the post reform period is from 1991-92 to 2004-05 as the entire study covers the period of 25 years from 1980-81 to 2004-05.

In terms of growth rate of Value added, the performance of all three states is much better in pre-reform period than the post-reform period. The growth rate is being 7.98 percent per annum in pre reform period which comes down to 4.42 percent per annum for Andhra Pradesh. While it is the worst in case of Orissa which experiences a sharp decline in growth rate of value added. The growth in pre reform period is 20.77 per annum that let down so sharply to 7.21 percent per annum. Same thing happened in case of Tamil Nadu. Its growth rate is 8.90 in pre-reform period but comes down to 6.37 per annum. Therefore, although all three performed

poorly in post reform period in terms of growth rate of GVA, but it is worst in case of Orissa as compared to other two states. However, one revealing fact is that all states maintained a good magnitude of growth throughout the entire study period. The annual growth rate of labour force of both states is higher in pre-liberalisation period than that of post liberalisation period. It is being 1.73 and 1.02 percent per annum for both Orissa and Andhra Pradesh in pre reform period while it turned out to be depressing in post reform period i.e. -3.70 and -0.54 percent for Orissa and Andhra Pradesh respectively. But Tamil Nadu comes out as an exception. The results are just opposite of the results obtained for other two states. Its growth rate is 0.75 in pre growth rate but it rises to 1.74 per annum in post reform period. Thus, it indicates the pessimistic impact of NEP or Structural Adjustment Programmes of 1991 on the labour absorbing capacity and employment generation of the manufacturing sector of both A.P. and Orissa but helps Tamil Nadu. Again, a deep observation reveals that there is a declining trend for both states in this respect, but it is more intense in case of Orissa. The same trend is experienced in case of capital stock in case of all states. The growth is higher during pre-reform period than the post-reform period. It is being 12.45 in case of Andhra Pradesh and 15.63 percent per annum in case of Orissa and 12.72 in case of Tamil Nadu. The decline is so intense in post-reform period that the figures are more than four times less of the figures of pre reform-period for Orissa and A.P. and two times less in case of Tamil Nadu. The figures are being 3.69 for Andhra Pradesh and 3.11 for Orissa and 6.24 for Tamil Nadu respectively. This also reveals the same fact that reform did not help the three state economies to adopt new technology that is more capital intensive in nature.

The growth rate of value added suffered a major slow down and there is a parallel slow down in the growth rate of capital stock and employment (labour force) in the manufacturing sector during the post reform period. The rationale behind the dramatic decline in value added and other variables may be one that after the liberalisation of the economy, the flow of foreign capital and entrepreneurship shadowed the market. Therefore, due to lack of demand for domestic goods and rising cost of production, inefficient management etc, forced those firms to shut down. Because the value added for one manufacturing set up can be improved either by fetching higher price in the market or by getting better on production front by reducing the cost of production. Thus, it seems that the manufacturing sector of both states could not gain on both fronts. The large-scale

competition injected by new policy set up did not let the corporate sector to charge higher prices and fast changes in technology did not allow the gradually becoming quality conscious firms to reduce their cost of production substantially. The large-scale retrenchment and retirement schemes introduced in structural adjustment programmes decelerate the growth in labour force though Tamil Nadu being an exception. The overall picture that emerges from the above analysis gives the testimony of the fact that the growth pattern of manufacturing sector of both states is not satisfactory in the post reform period.

Performance of Factor Ratios

The structure and dynamics of manufacturing sector can be analysed with the trends in the factor ratios as presented in the table-2. The Capital- Value added ratio, defined as the incremental capital output ratio (ICOR) shows the per unit capital requirement of output. As Balkrishanan (2003) mentions that, “a decline in ICOR following trade liberalisation was an explicit prediction of the study of Anne Krueger (1998) who has for long championed outward orientation as the strategy for developing economies”. Here exactly the same thing happens as per the prediction of Krueger in this study for two states except Orissa. In case of A.P. and Tamil Nadu, it registers a decline in post reform period (4.14 in pre reform period, 0.70 in post reform period for A.P., and 6.97 in pre-reform and 2.29 in post reform period). However, it has some sort of relations with capital-labour ratio indirectly through capital productivity. In our study, capital productivity is increased and it is partly because of declining capital-labour ratio as K/L overstates the labour productivity and understates capital productivity. Therefore, it cannot be concluded the efficiency of capacity utilisation of industrial sector altogether unless other factors show a positive trend.

Table-2 (Estimate of Factor Ratios)

States	Capital-Value Added Ratio			Labor-Value added Ratio			Average Emolument		
	I	II	III	I	II	III	I	II	III
A.P.	4.14	0.70	1.35	4.74	6.44	5.60	3.26	1.37	1.74
Orissa	0.68	2.10	1.75	5.69	6.32	5.71	2.81	2.32	1.93
T.N.	6.97	2.29	3.67	12.38	7.33	10.11	7.71	11.79	9.33

Note: (1) I- pre reform period, II- post reform period, III- full period

(2) The figures are compound growth rates showing the anti logarithm of the relevant regression coefficients minus one when the equation estimated are of the form “ $\log y = a+bt$ ” and ‘t’ refers to time. All the growth rates are statistically significantly different from zero at five percent level for a two tailed test.

(3) The pre reform period is 1980-81 to 1990-91 and the post reform period is from 1991-92 to 2004-05 as the entire study covers the period of 25 years from 1980-81 to 2004-05.

The labour-value added ratio represents the per unit requirement of labour of output. In our case it registers an increase in post reform period for both states except Tamil Nadu (4.74 in pre-reform, 6.44 in post reform period for A.P., and 5.69 in pre reform period and 6.32 in post reform period for Orissa). But for Tamil Nadu it is 12.38 in pre-reform period while it declines to 7.33 in post- reform period. However, in the post reform, period labour force declined but there is a sharp decline in value added simultaneously in post reform period for A.P. and Orissa, which renders an increase in labour-value added ratio in post reform period for both states. This analysis in general illustrates the inefficiency of industrial sector in A.P. and Orissa and just reverses in Tamil Nadu. The analysis of wage rate (Emolument-labour ratio) also supports the previous results as it declines in post reform period thereby reflecting a declining labour productivity and increasing labour output ratio for both A.P. and Orissa and just reverse picture in case of Tamil Nadu. Overall picture it shows that while Tamil Nadu benefits from trade liberalisation the other two states do not.

Productivity Performance

Industrial growth is dependent upon the expansion of productive factors and efficiency with which these factors are utilized. It may however, be emphasized here that the role of efficiency and productivity have been established as much more significant in the process of achieving higher rate of growth than factor accumulation. As it is already mentioned that the neo-classical growth theory, more specifically the publication of Solow's paper on the theory of economic growth in 1956, it has been recognized that the long-term growth is possible only through technical progress or improvements in productivity. This is because of the reason that if growth is caused by factor accumulation only, then it will stop or slow down after a point since the factor accumulation i.e. growth in labor and capital, is subject to the diminishing marginal productivity. The growth in value added (output) due to factor accumulation finally stops and the growth process becomes unsustainable in the end. Thus, the productivity plays a more crucial

role for the sustainability of industrial growth in an economy.

Partial Factor Productivity Analysis

Now we turn to the analysis of the more conventional measure of productivity i.e. labour productivity and capital productivity. Since the trends in partial productivities are dominantly affected by the trends in factor intensity (K/L), the analysis is extended to cover the trend in capital-labour ratio (K/L). It is important to note that in a situation where the (K/L) is increasing over time, the analysis of partial productivity changes would overstate the increase in labour productivity and understate the increase the in capital productivity. Similarly, in the opposite case where the capital-labour declines over time; the analysis shows a decline in labour productivity and increase in capital productivity.

Table-3 (Trends in Partial Productivity)

States	Capital Productivity			Labor Productivity			Capital-Labor Ratio		
	I	II	III	I	II	III	I	II	III
A.P.	2.39	5.48	5.53	12.98	9.97	13.12	11.32	4.25	7.39
Orissa	-1.72	-2.05	-0.68	11.33	6.34	7.25	13.66	7.08	9.13
T.N.	2.11	3.39	2.58	7.03	3.21	4.38	10.79	5.44	7.15

Note: (1) I- pre reform period, II- post reform period, III- full period

(2) The figures are compound growth rates showing the anti logarithm of the relevant regression coefficients minus one when the equation estimated are of the form “ $\log y = a+bt$ ” and ‘t’ refers to time. All the growth rates are statistically significantly different from zero at five percent level for a two tailed test.

(3) The pre reform period is 1980-81 to 1990-91 and the post reform period is from 1991-92 to 2004-05 as the entire study covers the period of 25 years from 1980-81 to 2004-05.

The evidence shown above indicates a sharp fall in labour productivity in post reform period. It is 12.98, 11.33, and 7.03 percent per annum for Andhra Pradesh, Orissa and Tamil Nadu in Pre-reform period. Nevertheless, it declines very sharply in post reform period. Again, the fall in it is very huge in case of Orissa. The analysis of capital productivity (CP) shows just reverse of what labour productivity shows. The capital productivity is higher in post reform period than pre-reform period. The reason for this will be clearer in the subsequent analysis of capital intensity. Andhra Pradesh and Tamil Nadu maintain a higher growth rate of capital productivity in post reform period i.e. 5.48 and 3.39 percent per annum for both A.P. and Tamil-

Nadu than pre-reform period i.e. 2.39 and 2.11 percent per annum respectively. However, in case of Orissa it is negative but it is lower in post-reform period. Thus, there is an improvement in post reform period. The analysis of capital-labour ratio supports the above analysis of labour productivity and Capital productivity. It is easily observed that there is sharp fall in capital-labour ratio for three states. Therefore, it shows the trend as expected that a falling in capital-labour ratio (capital intensity) will lead to a fall in labour productivity and a better improvement in capital productivity. The analysis is just opposite of the studies of Ahluwalia (1991) in which she had shown a sharp increase in capital intensity accompanied by falling capital Productivity (rising capital-output ratio) and moderately rising labour productivity. She had highlighted the phenomenon of strong capital deepening and capital inefficiency in Indian manufacturing sector during the period of 1959-60 to 1985-86. However, here the analysis shows a falling capital deepening and capital efficiency. Thus, the implication of the analysis is that there is better utilisation of capital and capacity during post liberalisation period. Nevertheless, if we look into it in another way it shows that the manufacturing sector of both states here became more labour intensive after the reform that is just reverse of the expectation. However there is a differential impact of reform on the partial factor productivities in these states though the direction of change is same.

The fact described about the relation between the factors productivities and factor intensity is clearly visible in these figures (chart-1, 2 and 3). In case of Andhra Pradesh, we can observe that there is a steep rise in capital intensity; the labour productivity accompanied it while the capital productivity goes just reverse of it. Similarly, in Orissa the same story repeats. It can be observed that wherever there is upward trend in K/L ratio, the labour productivity also follows it, but the capital productivity may not follow it. Same thing happened in case of Tamil Nadu. However, we have shown the trend of absolute values of these three variables.

Chart-1

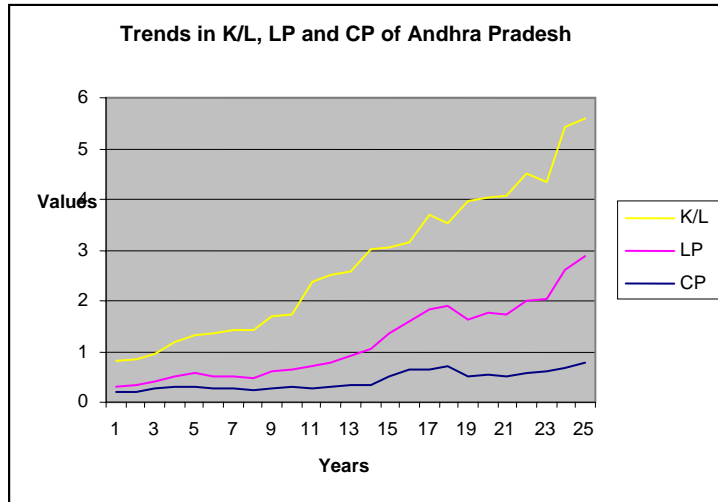


Chart-2

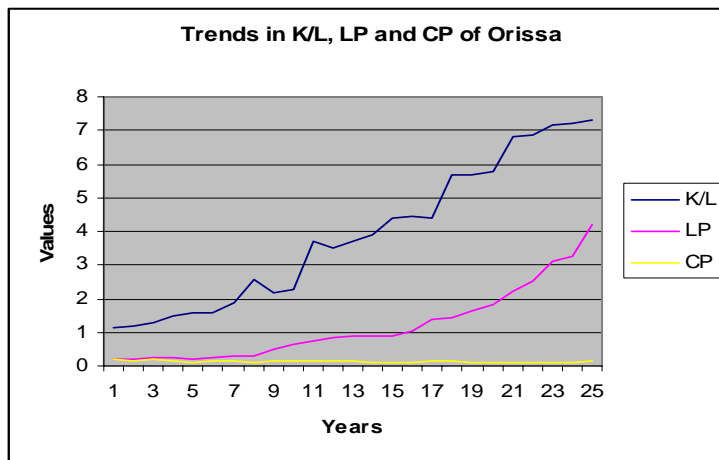
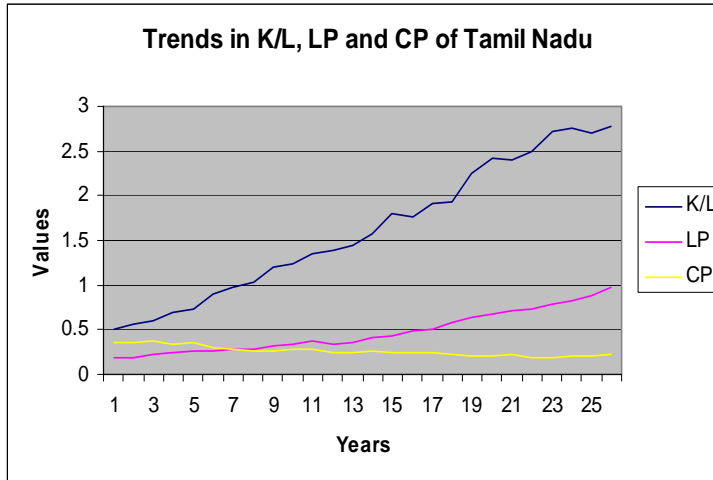


Chart-3



Total Factor Productivity Analysis

Total factor productivity growth (TFPG) is recognized as a key feature of economic dynamism today. Because it encompasses the effects, not only of technological progress but also the better utilisation of capacities, learning-by-doing, and improved skills of labour etc. It is therefore, a composite measure of technological progress and changes in efficiency. In this section, we have analysed the long-term growth trends in TFPG of manufacturing sector of three states obtained from a Translog index method. The compound growth rate of TFPG is derived for entire period and for both pre and post reform period.

From the table-4, given below we will observe a differential impact of reform on TFPG. Orissa, experiences better performance in pre-liberalisation than the post-liberalisation period i.e. 1.02 percent per annum declines to 0.67 percent per annum in post reform period. However, in case of A.P., though the growth rate is negative right the way through the entire period, but there is a marked improvement in post reform period than pre reform period. The growth rate of TFPG is -1.53 in pre reform period, which comes to -0.53 percent per annum in post reform period. Again Tamil Nadu is having a different result just reverse of the two states and the national level study done earlier by different authors. It experiences an improvement in post liberalisation period. Its TFPG is 0.26 in pre-liberalised era while it turns to 1.06 in post reform period. Thus, this analysis witnesses a differential impact of reform on manufacturing sector in terms of productivity or TFP.

Table 4 (Translog Index of TFPG)

Year	TFPG of Andhra Pradesh	TFPG of Orissa	TFPG of Tamil Nadu
1980-81	100	100	100
1981-82	107.114	96.872	101.907
1982-83	129.194	116.016	99.263
1983-84	150.491	112.530	89.649
1984-85	149.968	88.071	90.368
1985-86	122.859	114.986	81.666
1986-87	119.709	132.865	86.328
1987-88	100.418	121.761	98.138
1988-89	111.621	143.248	93.672
1989-90	106.697	145.124	103.298
1990-91	95.805	149.380	105.61
1991-92	92.514	155.016	102.499
1992-93	96.986	154.208	106.829
1993-94	95.119	157.362	97.979
1994-95	117.984	135.123	99.252
1995-96	131.292	146.372	112.13
1996-97	142.912	142.128	107.122
1997-98	86.601	144.523	103.367
1998-99	93.369	99.484	96.882
1999-00	86.745	113.757	103.067
2000-01	93.767	105.063	101.354
2001-02	96.088	95.928	113.151
2002-03	101.732	112.646	106.044
2003-04	109.674	121.152	109.309
2004-05	111.822	124.185	101.907
TGR			
1980-81 to 2004-05	-0.87	1.01	0.69
1980-81 to	-1.53	1.32	0.26

1990-91			
1991-92 to 2004-05	-0.53	0.67	1.06

Note: TGR implies trend growth rate.

However to assess the fact that whether liberalisation policy of 1991 is responsible for this differential performance by three states in terms of TFPG on one hand and the result derived by previous analysis is reliable on the other hand. To answer this question we have estimated an unrestricted Cobb-Douglas production function for the manufacturing sector of three states. We have estimated the two models for each state, one without dummy and another with dummy variable to assert the impact of liberalisation.

Table-5: C-D production Function Estimation

Andhra Pradesh			Orissa		Tamil Nadu	
Variables	Model-I	Model-II	Model-I	Model -II	Model-I	Model-II
Intercept	-4.85** (-1.75)	-5.77*** (-1.61)	-9.66* (-3.42)	-10.74* (-3.10)	-6.29* (3.10)	-9.06* (-3.93)
Log L _t	1.01* (3.94)	1.06* (3.74)	1.00** (2.33)	1.13** (2.28)	0.78* (4.10)	0.97* (4.87)
Log K _t	0.19 (1.20)	0.22 (1.25)	0.64** (2.38)	0.60** (2.09)	0.59* (5.80)	0.60* (6.31)
Time	0.04* (3.17)	0.04* (3.13)	0.08* (3.31)	0.08* (3.02)	0.01 (0.69)	0.004 (0.63)
Dum.Lib	—	0.05 (0.42)	—	-0.08 (-0.05)	—	0.09** (2.09)
R ²	0.84	0.92	0.81	0.87	0.92	0.91
D.F.	25	24	25	24	25	24
D.W.	1.72	1.68	1.84	1.84	1.82	1.89

- Note: 1) * implies significant at 1 % level
2) ** implies significant at 5% level
3) *** implies significant at 10% level.
4) Figures in bracket are t-values.

The results are provided in the table -5. In this table, the coefficient of determinant (R²) is quite close to one in both models, hence gives the best fit. The R² value is quite high and close to one in both models. So it gives the best fit. The Durbin-Watson 'd' statistics is also tending towards

two showing absence of autocorrelation. The coefficient of capital is insignificant but the coefficient of labour (elasticity of labour with respect to output) is highly significant showing contribution of skilled labour to the output for Andhra Pradesh. When the dummy variable is used to represent post reform period it turned out positive and insignificant. But we can some inkling from the sign of the coefficient. Thus, the positive sign shows an improvement in productivity during post reform period. In case of Orissa, the intercept term is negative and highly significant indicating that except labour, capital and technological progress there are some other factors that negatively contribute to output. The coefficient of capital and labour are positive and significant showing positive contribution of both factors into output. The coefficient of 't' is also positive showing a positive technological progress throughout the entire period. However, when a dummy variable is used to represent post reform period in the model-II, it came negative and insignificant, but did not alter the significance of other variables.

Therefore, the reform did not pay any significant impact. However if the sign of the coefficient is considered, it gives the fact that there is decline in TFPG in post reform period. In case of Tamil Nadu same kind of results are obtained for labour, capital and time variable acting as proxy of technological progress as in case of Orissa. All three variables are positively contributing to output. When dummy comes to show the impact of liberalisation in model-II it comes out significant and positive showing that it gains from reform. One fact can be mentioned that there cannot be a direct comparison of results obtained both growth-accounting method and production function estimation.

V. Conclusion and Policy Implications

This study presents the empirical analysis of growth and productivity trends in the organised sector of the manufacturing of three states over a two and a half decade from 1980-81 to 2004-05. The analysis makes a cause for grave concern particularly for Orissa. Whether we look at the total factor productivity (TFP) i.e. the overall efficiency with which labour and capital are combined to generate value added or the partial factor productivities like labour productivity and capital productivity and other growth indicating industrial indices, the story told by all is more or less same for Orissa. It looks very poor in the post reform period. The growth rate of value added falls so sharply in the post reform period that it comes as three times less than that of pre reform

period. The similar trend is noticed for other variables. Only the capital productivity shows a positive trend. Therefore, it is stuck to the 'Revisionist School of thought'. However, in case of Andhra Pradesh the situation is somewhat different. It looks poor in the analysis growth profile during post reform period, but it experiences an improvement in terms of TFPG in the post reform period though the magnitude is negative throughout the entire study period. However, Tamil Nadu shows a better performance in line with the theoretical prediction of neoclassical school of thought as far as the technological progress in manufacturing is concerned. Nevertheless, the study concludes that neither the 'Neo-Classical School' of thought nor the 'Revisionist School' of thought are valid. Because both theories are irrelevant unless we consider their respective premises, i.e. the Neo-classical school of thought is valid if the region is having a strong industrial base earlier. Then it can take the advantage of reform and performs better. However, if the region is industrially backward then reforms could not bestow desirable results. Thus, the study concludes that both theories are valid but they should appear one after another in the sense that one economy should become fit for liberalisation before adhering to it. An economy could not become industrialised following liberalisation rather it should become industrialised following its own set of efforts i.e. learning by doing, setting up different industries based on the local resources. It might be agro based or forest based or mines based or else. Development of higher infrastructural facilities in the form of power, roads, and telecommunication facilities has to be a top priority for the policy makers to raise the efficiency of factor use and capacity use. Both states economies should develop indigenous technological capabilities of their own and technical education to workers etc. is important steps to be taken care of. For this, it is suggested that firms should be encouraged to invest more in research and development. Further policy measures are needed to encourage the firms to provide the technical training programmes to not only workers but also the managers so that they could learn computer aided designs and decision-making processes. Then it can become efficient on both cost and production fronts following reforms. However, it is very bold to have a conclusion like this as we do not have data measuring the openness of state economy exactly.

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APPENDIX A

Descriptions of Data and variables

The study relies upon the concept and measurement of factors, inputs and output as defined in Annual Survey of Industry (ASI). Thus, it serves as the principal source of data on all industrial characteristics used for this study. Annual Survey of Industry (ASI) provides data on both value of output and value added at current prices. But, our study makes use of value added as the basis of total factor productivity estimation, assumes output to be the function of labor and capital only. Out of the two measures of value added provided by ASI, namely net value added and gross value added, we have used the latter which is obtained by adding net value added and the depreciation data given in the ASI. The number of employees as published by ASI has been included as a measure of labor inputs and this presents workers and non workers. It is obvious that there is no entirely satisfactory or universally accepted theory or way of measuring capital stock. “The capital stock is the one that will really drive a purist mad” (Solow 1957). However, here we analyze how to prepare a series of capital stock for the present study. The solution is always of second best nature.

The capital stock estimation is such a problem that makes a purist mad (Solow 1957). There is no confirming theoretical background yet for constructing it. However, we are following the popular method used by other studies. The first and foremost question is about gross vs. net capital stock. If it is possible to estimate a true economic depreciation, it would be desirable to use the estimate of net capital stock for economic analysis. However, the existing estimates of depreciation are either tax based accounting concepts or based on certain rules of thumb. Roychoudhry (1977) estimated net capital stock for the industrial sector by following the

‘perpetual inventory accumulation method’ (PIAM) using the ASI data including the depreciation figures. Nevertheless, as it is already known that depreciation underestimates the capital stock, his estimates suffered from this bias. However, Pinnel-Siles avoids this problem by adding the book value depreciation figures to net investment, and then the capital stock series is estimated. This study also follows the same procedure. The detail procedure is given as follows:

(a) The initial (base) year’s capital stock has been obtained by doubling the fixed capital figures as provided in the ASI. This is denoted by K_0 .

(b) For each year, the addition to gross capital stock has been computed by subtracting the fixed capital of preceding year from the fixed capital of current year. Each year’s depreciation has been added to it to arrive at an estimate of net addition to capital stock. After that, it is deflated by wholesale price index of machinery and capital goods.

Now net addition to capital stock in year ‘t’ is given by I_t .

$$I_t = (FC_t - FC_{t-1} + D_t) \frac{100}{WPIC_t}$$

Where FC_t –fixed capital in year t (ASI)

FC_{t-1} –fixed capital in year t-1 (ASI)

D_t – depreciation in year t (ASI)

$WPIC_t$ - wholesale price index of capital and machinery in year t.

Then for year ‘t’ the estimate of capital stock (K_t) is obtained by using the following equation:

$$K_t = K_{t-1} - 0.02K_{t-1} + I_t$$

$$\text{This means that } K_1 = K_0 + I_1 - 0.02 K_0$$

$$K_2 = K_1 + I_2 - 0.02K_1 \text{ and so on.}$$

Since the industrial data collected from the ASI were at current prices, we used the wholesale prices indices for the relevant categories as deflators in obtaining the value of output and value added at constant prices. The detailed categories for which the wholesale price data are available are collected and the values are obtained by deflating. Then the data on value added is obtained by aggregating the data on constant prices to get the data for total manufacturing sector. The

capital series is deflated by wholesale price index of capital and machines. Similarly, the consumer price index has been used to deflate the total emoluments.

APPENDIX B

Analysis of Stationarity Test of the Variables:

In time series analysis, it is always useful to look at the time series plots of the variables before undertaking any econometric estimation. This can also help in understanding the data for trends, volatility etc., which has a bearing on stationarity of the series. It can be seen that even after considerable smoothing of data (taking differential) the variables exhibit significant trends as well as volatility. In differential form, the variables may exhibit linear trend, some rising trend or other falling trend. This is an indication of non-stationarity of variables. Further, their appearance may show volatility in the data. Here, we test the stationarity for the variables such as: Labor Force, Capital Stock and Gross Value Added using three methods namely DF, ADF and PP test for stationarity (see Appendix-5). The results are shown in the table 1 and 2 below.

Table-1: The estimated ‘ τ ’ statistics values from Unit Root test (Level)

variables	Intercept alone			Intercept+ trend		
	DF	ADF	PP	DF	ADF	PP
Tamil Nadu						
GVA	2.5991	1.5808	2.0816	-0.0024	-0.7668	-0.6373
Labour Force	-0.3278	-0.4802	-0.4950	-1.6077	-1.9639	-1.9110
K Stock	2.3865	1.7127	2.1275	-1.3571	-1.5272	-1.5220
Orissa						
GVA	1.7333	0.6756	1.1890	-0.1097	-1.7323	-0.9308
Labour Force	-1.4444	-1.7854	-1.7598	-1.4403	-1.7402	-1.7456
K Stock	-0.8090	-1.0040	-0.8261	-1.3760	-1.7389	-1.6790
Andhra Pradesh						
GVA	0.9587	0.9587	0.8447	-1.59109	-2.59349	-1.78858
Labour Force	-0.0366	-0.0366	-0.1218	-1.66627	-1.66627	-1.92927
K Stock	-2.0995	-1.3442	-1.9801	-2.56146	-1.29429	-2.56544

Note: Critical values for Unit Root test (DF, ADF, and PP) are -3.7204, -2.9850 and -2.6318 for intercept. In addition, -4.3738, -3.6038 and -3.2367 for intercept + trend respectively at 1%, 5% and 10% level of significance.

Table-2: The estimated ‘ τ ’ statistics values from Unit Root test (First difference)

Variables	Intercept			Intercept+Trend		
	DF	ADF	PP	DF	ADF	PP
Tamil Nadu						
GVA	-5.1389*	-4.5456*	-5.1826*	-5.2016*	-4.7851*	-5.3123*
Labour	-3.8875*	-4.8892*	-3.9168**	-3.8212**	-4.8295*	-3.8575**
Capital	-3.0431**	-5.3217*	-2.9722**	-3.7259**	-5.2030*	-3.7490**
Orissa						
GVA	-2.9129***	-4.2889*	-2.9251**	-3.3047***	-4.4441*	-3.3202
Labour	-3.3742**	-4.1740*	-3.4610**	-9.3120*	-4.2715**	-3.3264***
Capital	-3.9061*	-2.7248***	-3.9195*	-3.8691**	-2.7317	-3.8747**
Andhra Pradesh						
GVA	-4.3211**	-4.3211**	-4.3997*	-4.6641*	-4.6641*	-4.7083*
Labour	-4.0466**	-4.0466**	-4.0761**	-3.9365**	-3.9365**	-3.9701**
Capital	-7.9087*	-7.9087*	-7.7178*	-7.8023*	-7.8023*	-7.7904*

Note: All values are statistically significant at 1%, 5% and 10% level of significance