An Empirical Analysis of Total Factor Productivity Growth of Manufacturing Sector in Karnataka

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Abstract

The performance of organised manufacturing sector in Karnataka has changed after the economic reform of 1991. Using data from the annual survey of industries for the period 1980-81 through 2010-11, this paper compares the pre-reform with two phases of post-reform(1990-2000) and (2001-2011) performance of manufacturing sector in Karnataka, in terms of total factor productivity growth. Translog Divisia Index production function with two variable model is used to estimate total factor productivity (TFP) to determine, if the state has experienced improvement in manufacturing productivity during the post-reform years. Results show that at the state level, total factor productivity growth rate in manufacturing is lower during the first phase of (1990-2000) post-reform period. Though there is increase in the TFP growth in the second phase of reform period, the findings of the overall growth rate indicate that government of Karnataka should promote the productivity of manufacturing sector, since its development will have a significant impact on the growth of Indian economy.

Key Words: Manufacturing, Total Factor Productivity, Translog Production Function

1. INTRODUCTION

As Paul Krugman (1994, p. 13) has famously put it: "Productivity isn't everything, but in the long run it is almost everything". Productivity is obviously a fundamental element in economic progress and productivity growth is renowned as a key feature of economic dynamism. It is considered to be important to increase the output, enhance the competitiveness of the industry in the domestic market as well as in the foreign markets, thereby stimulate the export competitiveness of a country. Productivity estimation is useful to assess the performance of the various industries over a period of time. The prosperity of new developed nations has been attributed mainly to the sustained growth of their total factor productivity.

Karnataka, a pioneer in industrial development, has a strong and vibrant industrial base built up over the years with a wide network of large and medium industries in the public and private sectors and a large small-scale industrial sector. Karnataka ranks among the top five industrially developed states in India. In line with India's progress the state of Karnataka has played an important role in various spheres. The per capita income of Karnataka has more than doubled in the last 50 years. At present there is cause of optimism due to the favourable industrial climate of Karnataka and its human resources.

2. PROBLEM DEFINITION

Over a period of time though Karnataka remains one of the industrially developed state in India, the worrisome factor is that the state's share in Indian industry is declining in terms of factories which indicates that the state is losing its grip in factories. During 1990-2000 the state contribution in terms of factories declined to 5.48 per cent, fixed capital 4.96 per cent, employment came down to 4.61 per cent, while value added increased to 5.49 per cent and value of output increased to 5.52 per cent. It was during the period from 2000-2011 except for factories the contribution of other four variables shows an upward trend. That is the contribution in terms of fixed capital increased to 6.70 per cent, employees raised to 6.62 per cent, value added 6.80 per cent and the value of output the contribution increased to 6.28 per cent.

Table1. Karnataka's Share in Indian Manufacturing Sector (In Per cent)

Item	1980-1990	1990-2000	2000-2011	1980-2011
No. of Factories	5.79	5.48	5.41	5.23
Fixed Capital	5.01	4.96	6.70	6.16
No. of Employees	4.93	4.61	6.62	5.58
Gross Value Added	4.83	5.49	6.80	6.30
Value of Output	4.63	5.52	6.28	5.97

Source: ASI Issues

In this paper, Total Factor Productivity growth of Karnataka manufacturing is described. The objective was to analyse the relative growth of TFP of Karnataka manufacturing in different periods.

3. DESCRIPTION OF VARIABLES

3.1 Output:

As a measure of output there is a choice between gross output and gross value added. Generally value added is preferred because it is believed that there would be variations in the gross output with changes in the stages of productive process of an industry. This paper used gross value added as the appropriate measure of output. The nominal values of value added can be deflated by two methods, single deflation method and double deflation method. For gross value added single deflation is appropriate (Goldar. B 2004).In the single deflation method both the components of value added – the value of output and the value of input – are deflated by single price index i.e, that of output. To deflate gross value added the wholesale price index at 1993-94 price was used which is issued by the Office of the Economic Advisor, Ministry of Industry.

3.2 Capital:

Capital stock estimation is a controversial issue both in theory and in practice. There is no unique method of estimating capital series. This paper followed the standard practice of the perpetual inventory method for the generation of capital stock. Real capital stock was computed by deflating the capital series by the wholesale price index of machinery and machine tools (at 1993-94 prices). The capital stock at any year is calculated as:

$$K_t = K_0 + \sum_{t=1}^{T} I_t$$

Where I_t is investment in year t and K_0 is capital stock for benchmark year, i.e. 1980-81. Investment figures were obtained using the formula:

$I_t = (B_t - B_{t-1} + D_t) / R_t$

Where B is book value of fixed capital, D is depreciation and R indicates Wholesale prices index of Machinery (base 1993-94 = 100) is used.

3.3 Labour

There are three choices of labour input i) man hours worked, ii) number of workers and iii) number of employees which includes both workers and persons other than workers such as supervisors, technicians, managers, clerks etc. Total number of persons engaged is taken as the measure of labour input. As both workers, working proprietors and supervisory/managerial staff can affect productivity, so number of persons engaged is preferred to number of workers.

3.4 Factor Shares

The translog divisia index method of total factor productivity growth requires the estimation of each factor inputs to the value added. For single deflation method the share of emoluments to the value added is taken as labour share. Assuming constant returns to scale the capital share is calculated as one minus the labour share.

4. METHODOLOGY

Productivity is defined as the relationship (usually a ratio or an index) between output produced by a production unit and quantities of inputs utilised by the unit to produce that output (OECD 2001). When single input is used to measure productivity, it is called as 'factor productivity' and when all factors are combined together for the purpose, it is known as 'total factor productivity'.

By definition,

$$\text{TFP} = \frac{Q}{X}$$

Where 'Q' is output and 'X' is the weighted sum of the inputs.

The present paper used Translog Production Function adopted in Goldar's (2004) study. Goldar (2004) adopted two input framework and three input framework models. Translog production function of two input framework has been used in this paper.

For the two-input framework, the translog index of TFP is given by the following equation:

$$\Delta \ln TFP(t) = \Delta \ln Y(t) - \left[\frac{SL(t)+SL(t-1)}{2} \times \Delta \ln L(t)\right] - \left[\frac{SK(t)+SK(t-1)}{2} \times \Delta \ln K(t)\right]$$

In this equation, Y is output (value added), L labour and K capital. SL is the income share of labour (in value added) and SK denotes the income share of capital. SL and SK add up to unity. ΔlnTFP is the rate of technological change or the rate of growth of total factor productivity.

Using the above equation, the growth rates of TFP have been computed for each year. These have then been used to obtain an index of TFP in the following way. Let A denote the index of TFP. The index for the base year, A(0), is taken as 100. Then, the index for subsequent years is computed using the following equation:

$$\frac{A(t)}{A(t-1)} = \exp$$

After obtaining the TFP index for different years, estimates as TFP growth rate have been made for three sub-periods, 1980-81 to 1989-90, 1990-91 to 1999-00, 2000-01 to 2010-11 and for the entire period 1980-81 to 2010-11. The estimation of TFP growth

rate for the entire period and for three sub periods has been calculated by semi-log trend equation to the TFP index.

5. RESULTS AND DISCUSSIONS

The analysis of total factor productivity growth of Karnataka manufacturing sector shows that during the pre-liberalisation period the manufacturing sector registered a growth rate of 4.0 per cent which is approximately 2 per cent higher than the all-India growth rate. Against this in the first phase or the period of the economic reforms witnessed a negative growth rate (-2.4 per cent) of total factor productivity. Babu, .M. Suresh, et al (2013) found that greater access to power, transport and communication facilities substantially influence total factor productivity at the regional level. The insufficient infrastructural facilities hampered the total factor productivity growth of Karnataka manufacturing sector during this period. At the national level two important factors (a) decline in the growth rate of agriculture and (b) deterioration in capacity utilisation seem to have retarded the growth rate of total factor productivity during this period (Goldar and Kumari, 2003). It is generally perceived that technological progress is the main driving force behind productivity growth, especially in manufacturing industries. The performance of the organised manufacturing sector in terms of technological progress (TP) had been fairly satisfactory during the 1980s, with an average annual rate of 1 per cent at the national level and 1.8 per cent at the Karnataka level. While in the 1990s it was -2.1 per cent for the state and -1.4 per cent for the country (Mukherjee.D and Rajarshi Majumder 2007).

As the dissemination of new technologies and products progressed from early adopters to others and capacity was also adjusted appropriately, TFPG accelerated sharply during the second phase of reform period. Infrastructural development in Karnataka during this period in terms of economic infrastructure such as transportation and power and social infrastructure such as health and education enhanced the total factor productivity growth of the manufacturing sector (Astha Agarwalla 2011).

Table 2 Growth Rate of TFP of Karnataka Manufacturing

PERIOD	KARNATAKA	INDIA
1980-81 TO 1989-90	4.0	2.1
1990-91 TO 1999-00	-2.6	0.4
2000-01 TO 2010-11	2.8	3.5
1980-81 TO 2010-11	1.7	1.1

Source: Computed

On an average the growth rate of total factor productivity of Karnataka manufacturing sector for the entire period is 1.7 per cent which is more or less similar to the growth rate (1.1 per cent) of Indian manufacturing sector.

6. CONCLUSIONS AND POLICY IMPLICATION

This paper provides evidence on change in productivity in manufacturing sector in Karnataka state using data from the Annual Survey of Industries over an extended sample period from 1980-81 through 2010-11. The Translog Production Function is used to compute total factor productivity. The results show that:

- The manufacturing sector of Karnataka experienced a slowdown in Total Factor Productivity growth or even a productivity decline during the first phase of reform period (1990-2000).
- There is an increase, in the growth rate of TFP of Karnataka manufacturing sector during the second phase of reform period (2000-01 to 2010-11).
- The overall growth rate shows that there is a need to emphasis on the Total Factor Productivity for more exports.

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