CHAPTER 5

PRODUCTIVITY GROWTH IN KARNATAKA MANUFACTURING SECTOR-AN EMPIRICAL ANALYSIS

5.1 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 have been attributed mainly to the sustained growth of their total factor productivity.

According to Lewis (1954) when the increasing population has little employment opportunities other than the land, a stage may be reached that the land cannot support the growing population further so the existing workers hours of work would be affected badly, under this circumstance he suggested that by increasing productivity faster than the population the above phenomenon would be eliminated.

According to Kuznets (1966), an essential element in the development and structural transformation of the developed economies was the fast growth in industrial productivity.

Productivity is defined as the relationship (usually a ratio or an index) between output produced by a production unit and quantities of input 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'.

The different concepts of productivity measurements are:

1. Partial measure of Productivity
2. Total Factor Productivity and
3. Multifactor Productivity

Conventionally productivity is measured by the average product of a single input usually labour, over a period of time.

The universal acceptance of technical progress is the result of efficiency improvement of not only the single factor labour rather than the combined factors. Therefore, the right measure of the productivity is the consideration of the average product of all the inputs. This has been called as total factor productivity or multifactor productivity. By definition,

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

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

Partial factor measures of productivity are the most commonly used measures. In output based productivity analysis the partial factor productivity is calculated as the ratio of the gross or net output to the amount of the one of the factors of production, keeping all other inputs constant (OECD, 2001). Hannula (2002) classified partial factor productivity on the basis of the following factors of production;

1. Labour Productivity
2. Capital Productivity
3. Material Productivity and
4. Energy Productivity

In value added productivity analysis where the value added is the output in the production function, labour and capital are the two factors of production and the related partial factor productivities are;

1. Labour Productivity
2. Capital Productivity

The relationship between output and a collection of inputs is known as Multifactor Productivity (MFP). Multifactor Productivity can be in the form of capital-labour, or in the form of capital-labour-energy-materials (KLEMS), based on value-added concept of output, or based on gross output. Abramovitz (1956) found that during the period 1869-1878 and 1944-1953, a major portion of output growth in the United States could not be explained by the growth in factor inputs. He called this residual is the productivity growth of the combined inputs. Solow (1957) also presented very similar results to those of Abramovitz. Diewert (2000) defined the Total Factor Productivity (TFP) of a firm, industry or group of industries is the real output produced by the firm or industry over a period of time divided by the real input used by the same set of production units over the same time period.

5.2 Description of Variables

5.2.1 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. After the selection of the value added, the common question is whether one must select the gross value added or net value added. For productivity analysis theoretically more appealing measure of output might be value added with net depreciation. Since it is difficult to measure true capital consumption, estimation of depreciation would be a problem. Moreover in the Indian scenario depreciation accounting methods vary between industries and the depreciation figures reported in the data hardly ever represents the true depreciation. So this study used Gross Value Added as a measure of output for productivity analysis. 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.

5.2.2 Capital: Capital stock estimation is a controversial issue both in theory and in practice. There is no unique method of estimating capital series. This study 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:

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

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

5.2.3 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.

5.2.4 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.

5.3 Methodologies to Estimate Total Factor Productivity Growth

TFP growth is an age old concept dates back to the work of Tinbergen (1942), Abramotivz (1956), Solow (1957) and Giriliches and Jorgenson (1967). These studies focused on the non-frontier approach to calculate TFP growth. Farrell (1957) initiated the frontier approach to TFP growth. However, it was in the late 1970s that this approach was formalized and used for empirical investigation.

5.4 The Non-Frontier Non-Parametric Approach: Index Approach

Empirically total factor productivity estimations based on different weighting schemes. Each measure of total factor productivity differs from one another on the basis of certain assumptions and with respect to the weighting schemes. In the recent past the Translog Divisia index has been used frequently.

5.4.1 Kendrik Index: Kendrik adopted this method of measuring total factor productivity growth to study the American industries. His measure is based on linear production function where he used only labour and capital inputs.

The underlying assumption of the Kendrik index is that there is homogeneous output denoted by 'Y' and two factors of production Labour 'L' and capital 'K'. 'w_0' and 'r_0' are assumed to be the factor rewards of labour and capital in the base year of the study. Then the Kendrik index of TFP for the year't' is written as

$$A_t = \frac{Y_t}{w_0 L_t + r_0 K_t}$$

At constant prices there exist equality between the value of output and the value of input in any year. When the improvement in the productivity results more output from a given quantity of inputs the equality assumption cannot hold good. At this juncture there is a requirement of a scaling factor S_t, which has a value 1 at time 0 and varies over time as productivity of the input factors change. The equation was developed by Kendrik in 1961.

$$S_t = \frac{Y_t}{w_0 L_t + r_0 K_t} \qquad w = \text{wage rate},\ r = \text{rent}$$

Here T=0 denotes base period while T=t denotes the current period.

The basic assumptions are: constant returns to scale, perfect competition, payment to factors according to marginal product and S_t is unity ie, payment to labour and capital equals the total output. Though the Kendrik index is easy to calculate, it suffers from the assumption of linear production and does not allow the diminishing marginal productivity of factors.

5.4.2 Solow Index: Solow's method is the special form of productivity analysis. The special form is derived from Tinbergen's (1942) productivity measurement which incorporates productivity measurement with production function and this production function incorporates neutral technical change. Solow advocated a theoretical link between production function and the index number approach.

$$Q=A(t)\,f(K, L)$$

Where Q is output and is a function of labour L and capital K. A(t) is the multiplicative factor that captures the technological progress (cumulated effects of shifts in the production function).

Solow's index is based on Cobb-Douglas production function with the assumptions of constant returns to scale, autonomous Hick's neutral technical progress and the factor payments being equal. With these assumptions the growth in multiplicative factor A(t) is defined as

$$\frac{\dot{A}}{A} = \frac{\dot{Y}}{Y} - \left((1-\beta)\frac{\dot{L}}{L} + \beta\frac{\dot{K}}{K} \right)$$

Where β, 1 – β are the elasticities of capital and labour in the C-D production function. TFPG is estimated from the above equation. This estimation is called as growth of the residual productivity. Solow's index is derived from using the following identity (taking A (0) is unity)

$$A\,(t+1) = A\,(t)\left(1 + \frac{\Delta A}{A}\right)$$

Assumption of unitary elasticity of substitution is the limitation of this method because it is based on Cobb-Douglas production function.

5.4.3 Translog – Divisia Index: Data over time come in discrete units. Girilliches et.al. (1967) introduced the discrete approximation to the Divisia derived from the Tornquist index in 1967. If a functional form of technology is assumed to estimate an efficiency parameter, it can be done using econometric techniques. This led to the development of estimating the translog relation between the output, inputs and the technology index. Solow et.al (1957) explained the use of Divisia index. On the basis of the strength that the rates of growth of the Divisia indexes of prices and quantities add up to the rate of growth of the value added (factor reversal test) and that such indexes are symmetric in different directions of time (time reversal test).

The merit of this methodology is that this method does not require marginal productivity conditions; it gives a comprehensive representation of technology and could accommodate noncompetitive pricing behavior and factor augmenting technical change. Nevertheless, the methodology has limitations with respect to the assumption about the shape of the production function and the robustness of the parameters estimated. The translog index of technological change is based on translog production function, characterised by constant returns to scale. It allows for variable elasticity of substitution and does not require the assumption of Hicks – neutrality.

The production function is differentiated with respect to time variable t to obtain the following equation.

$$\frac{d \log V}{d T} = V_K \frac{d \log K}{d T} + V_L \frac{d \log L}{d T} \times V_T$$

In discrete form,

$$\Delta \log Y = \overline{V_K} \; (\Delta \log K) + \overline{V_L} (\Delta \log L) + \overline{V_T}$$

Where,

$\Delta \log Y = \log Y(T) - \log Y(T-1)$

$\Delta \log K = \log K(T) - \log K(T-1)$

$\Delta \log L = \log L(T) - \log L(T-1)$

&

$\overline{V_K} = ½ \left(V_K(T) + V_K(T-1)\right)$

$\overline{V_L} = ½ \left(V_L(T) + V_L(T-1)\right)$

$\overline{V_T}$ gives the average Divisia Index.

The well known studies (Goldar B.N (2004), Unel. B (2003), TSL (2003), Kaur. M (2008) of productivity growth of Indian manufacturing sector used the translog index method for the estimation of total factor productivity growth. So the present study also followed the methodology adopted in Goldar's (2004) study. Goldar (2004) adopted two input frame work model and three input framework model.

Under two input model gross value added is taken as the measure of output, labour and capital inputs are taken as inputs, while in the three input framework gross output is taken as the measure of output, labour, capital and material inputs are taken as inputs. Translog production function of two input framework has been used in this study to estimate the total factor productivity growth.

For the two-input framework, the translog index of TFP growth 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. Δln TFP 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.

5.5 Analysis of Partial Factor Productivity

Partial factor productivity measures the ratio of output to one of the inputs setting aside interdependence of use of other input. Labour productivity $\left(\frac{V}{L}\right)$ is measured as a ratio of value added to total no of persons employed. Increase in labour productivity fundamentally affects the economic growth rate. More specifically, increasing labour productivity is essential for expanding the scale of an economy without relying on an increase in the number of workers. Secondly, there is a relationship between wages and productivity when the labour distribution rate is constant.

Growth rate in labour productivity = Rate of increase in wages (Asian Productivity Organisation).Technological change, improvements in efficiency, improvements in the quality of labour and capital deepening would increase the labour productivity. Advances in technology and improvements in education and training are considered as important factors that can affect labour productivity (Asian Productivity Organisation).Rises in capital intensity is regarded as the crucial factor to explain the growth of labour productivity (Ghose, 1994, pp.147-148). Capital productivity $\left(\frac{V}{K}\right)$ is measured as a ratio of value added to gross fixed capital. Detailed analysis of labour productivity and capital productivity is presented in the following sections.

5.5.1 Estimates of Labour Productivity

Table 5.1 presents estimated growth rate of labour productivity for Karnataka and Indian manufacturing sectors. The productivity growth rate of labour is higher for Karnataka manufacturing (8.7 per cent) during pre-reform period. Capital deepening in the manufacturing sector increased the growth rate of labour productivity during the pre-reform period, since there was a tendency to adopt capital intensive industries and power intensive industries in Karnataka[34].

During I-Phase of liberalisation the growth rate has been sharply declined. The deceleration in the growth rate (3.5 per cent) during this period is due to lack of innovation, product design and infrastructural facilities (Rath, B.N and S.Madheswaran 2005). At the national level lobour productivity growth remains firm in the three sub-periods around 7 per cent. The labour productivity growth is probably linked to the use of new types of capital goods and embodied technology that is more energy efficient and capital intensive. The rigidity in labour laws adds to the incentive for using capital intensive technology and the hiring of additional workers (Virmani (2004), (2005a); Virmani and Hashim 2009).What is to be noted is that during the II-Phase of liberalisation (2000-2011) the Karnataka manufacturing sector experienced a surge in labour productivity.

Table 5.1

Growth Rate of Labour Productivity in Manufacturing Sector of Karnataka at Aggregate Level (1980-81 to 2010-11)

PERIOD	KARNATAKA	INDIA
1980-81 TO 1989-90	8.7	7.9
1990-91 TO 1999-00	3.5	7.0
2000-01 TO 2010-11	6.0	6.7
1980-81 TO 2010-11	6.5	6.4

Source: Computed

[34] Karnataka Development Report (2007)

On an average the labour productivity growth rate of Karnataka manufacturing sector for the entire period is 6.5 percent showing good growth trend, more or less similar to the growth rate of Indian manufacturing sector.

5.5.2 Estimates of Capital Productivity

Karnataka manufacturing sector recorded negative growth rate in terms of capital productivity during the pre-reform period. That is the growth rate is -0.3 per cent during this period. Indian manufacturing sector also registered negative growth rate of -1.6 per cent in this period. Though the government of Karnataka provided many incentives for the industrial development, may be acute shortage of power supply during the 80s retarded the growth rate of capital productivity[35].

Furthermore, the growth rate deteriorated during the I-Phase of liberalisation. The growth rate of capital productivity was -5.9 per cent during this period. The Indian manufacturing sector recorded negative growth rate of -2.1 per cent during this period. This may have been partly due to replacement of obsolescent capital stock by machinery and equipment of much higher minimum efficient scale, which necessitated building ahead of demand. This would have meant that capacity utilisation of new equipment was not initially very high and gradually increased.

Much of the improvement in productivity of capital came from the third sub-period, led by improvement in capacity utilisation. (Veeramani. V and Dasnish Hasim 2012).

[35] Karnataka Development Report (2007)

Table 5.2

Growth Rate of Capital Productivity in Manufacturing Sector of Karnataka at Aggregate Level (1980-81 to 2010-11)

PERIOD	KARNATAKA	INDIA
1980-81 TO 1989-90	-0.3	-1.6
1990-91 TO 1999-00	-5.9	-2.1
2000-01 TO 2010-11	1.9	2.6
1980-81 TO 2010-11	1.0	-1.1

Source: Computed

5.5.3 Estimates of Total Factor Productivity

The analysis of total factor productivity growth of Karnataka manufacturing sector shows that during pre-reform 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.

In contrast to this in the I-Phase of liberalisation or period of the economic reforms witnessed a negative growth rate of total factor productivity. That is the growth rate was 4.0 per cent during pre-reform period decreased to -2.6 during Phase-I. Suresh M Babu and Rajesh Raj S Natarajan (2013) found that greater access to power, transport and communication facilities substantially influence total factor productivity at the regional level. These insufficient infrastructural facilities became major impediment for the total factor productivity growth of Karnataka manufacturing sector during the post-reform 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 the post-iberalisation 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 pre-reform period, 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).The Balance of Payment (BOP) crisis that started in 1990 impacted on the economy severely and in 1991 had its greatest impact on the manufacturing sector. The manufacturing sector was also most directly affected by the trade and foreign exchange reforms of the 1990s [Virmani (2006b)].[36] TFPG was slow in the second sub-period mainly because of the combined effects of the BOP shock and dramatic import liberalisation (removal of quantitative restrictions on capital goods and intermediates and tariff reduction) and exchange rate reforms of the early 1990s (from fixed rate to managed float). The slowdown of economy during late nineties to early 2000s accentuated the fall.

Table 5.3

Growth Rate of Total Factor Productivity in Manufacturing Sector of Karnataka at Aggregate Level (1980-81 to 2010-11)

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

[36] Note however, that reduction of import protection for tradable goods like manufacturing and minerals, will also affect relative prices of non-tradable services.

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 II-Phase of liberalisation. Infrastructural development in Karnataka during Phase-II in terms of economic infrastructure such as transportation and power and social infrastructure such as health and education boosted the total factor productivity growth of the manufacturing sector (Agarwalla, A. 2011). TFPG growth during Phase-II might be the state of Karnataka reaped the benefits of policy reforms of 1991.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 of (1.1) Indian manufacturing sector.

Hitherto the study has analysed the behaviour of the regional economy in terms of productivity growth rates of aggregate manufacturing sector. However, to get a clear picture of the contribution of a sector to the economy's growth, it is important to consider the growth rates of the manufacturing at the disaggregate level.

Thus the following section analyses the productivity growth pattern of manufacturing at the disaggregate level specifically for ten sub sectors.

5.6 Industry Wise Trends in Labor Productivity

The major manufacturing industries, in general, show similar trends in partial factor productivity growth as seen at the aggregate level of manufacturing sector. During pre-reform period all industries registered good growth rate of labour productivity. Food products, Beverages and Tobacco products, Leather products and Non metallic mineral products registered growth rate above 10 per cent of labour productivity during this period. The higher labour productivity is more due to use of more capital per employee. Food Products sector of Karnataka depicts high growth during the eighties. This high growth rate (16.7 per cent) was because of relatively higher growth in output (value added) compared to labour and also it is a function of capital deepening.

During the I-Phase of liberalisation labour productivity increased in only one industry; textiles. The labour productivity growth of Food Products of both Karnataka and India shows deceleration in the second and third sub periods.

The decline in the II-Phase of liberalisation under consideration may be due to the proportionately higher growth in the number of workers as compared to the growth in gross value added (GVA). At the national level increase in labour productivity in this sector could be due to the use of new technology and increased capacity utilisation in the last decade.[37] Over all the growth rate of labor productivity is better for Karnataka manufacturing sector as compared to Indian manufacturing sector.

Table 5.4
Industry-wise Growth Rate of Labour Productivity of Manufacturing Sector of Karnataka (1980-81 to 2010-11)

Industry Group	1980-1990		1990-2000		2000-2011		1980-2011	
	Kar	Ind	Kar	Ind	Kar	Ind	Kar	Ind
Food Products (20-21)	16.7	14.6	12.5	6	6.2	5.4	7.6	5.7
Beverages & Tobacco (22)	17.4	7	14.2	3.7	4.6	9.4	10.0	5.5
Textiles (23+24+25)	7.3	6.4	8.2	3.1	7.2	6.6	6.9	5.0
Wearing Apparel (26)	9.8	7.2	3.6	1.6	4.0	1.0	4.3	2.8
Wood & Wood Products (27)	4.3	4.3	-1.4	-5.6	16.1	4.4	2.3	3.1
Paper & Paper Products (28)	8.6	4.3	0.6	2.3	7.4	6.6	4.3	4.1
Leather Products (29)	11.6	3.5	0.6	4.3	7.6	3.9	5.4	3.6
Chemical Products (30)	4.9	7.3	0.1	6.2	7.1	6.0	6.2	5.8
Non-Metallic Minerals (32)	10.8	7.9	2.6	6.0	18.4	6.2	6.6	6.4
Basic Metals & Alloys (33)	7.3	3.8	7.0	10.6	8.0	5.1	12.8	6.7

Source: Author's Computation

[37] National Productivity Council New Delhi

5.7 Industry Wise Trends in Capital Productivity

During the pre-reform period the capital productivity growth of six industries; Beverages and Tobacco, Textiles, Wearing Apparel, Wood products, Chemical products and Non metallic minerals follow the basic pattern seen for the manufacturing as whole. The reasons could be low capacity utilisation of the agro-processing industries in this period (Trivedi et al 2011). The decline in other industries might be because of high growth of fixed capital than output during this period.

In I-Phase of liberalisation only Beverages and Tobacco industry experienced positive growth rate of capital productivity. For the rest of the industries capital growth was higher than the output growth during this period.

The negative growth of Food products industry may be due to the fact that the increase in fixed capital per factory is much higher as compared to that of output per factory. This could be due to under utilisation of capacity, which has been caused either by lack of demand or supply factors because of the very nature of food industry[38]. At the national level the fall in capital productivity in Phase-I may be attributed to decline in the capacity utilisation which is due to the capital subsidy, worker's strike and power shortage.

[38] Harry X. Wu et al (2007)

Table 5.5

Industry-wise Growth Rate of Capital Productivity of Manufacturing Sector of Karnataka (1980-81 to 2010-11)

Industry Group	1980-1990		1990-2000		2000-2011		1980-2011	
	Kar	Ind	Kar	Ind	Kar	Ind	Kar	Ind
Food Products (20-21)	4.5	1.6	-1.2	-2.6	-2.5	-1.0	-0.8	-2.5
Beverages & Tobacco (22)	-1.5	-5.3	2.3	-8.5	0.01	0.4	-1.5	-4.9
Textiles (23+24+25)	-8.3	-5.1	-4.3	-8.8	-1.8	1.5	-4.7	-4.5
Wearing Apparel (26)	-1.6	-2.2	-4.8	-6.9	0.6	-2.7	-2.4	-3.5
Wood & Wood Products (27)	-6.4	-5.3	-19.7	-14.3	14.0	-1.1	-5.0	-5.2
Paper & Paper Products (28)	7.9	-4.4	-3.0	-6.7	1.1	2.3	2.0	-2.7
Leather Products (29)	4.2	-0.4	-7.9	-4.3	6.3	3.1	-2.8	-1.7
Chemical Products (30)	-0.8	0.9	-0.6	-0.5	-1.7	3.5	0.7	-0.1
Non-Metallic Minerals (32)	-1.6	-6.8	-8.8	-6.3	10.6	4.7	-1.5	-1.6
Basic Metals & Alloys (33)	1.0	-2.0	-13.9	2.7	2.9	0.7	-0.9	-0.5

Source: Author's Computation

However, in the II-Phase all industries except Food products, Textiles and Chemical products, experienced positive growth rate of capital productivity. The capital growth of these industries is higher than the output growth. Interestingly the capital growth of the rest of the industries is lesser than the output growth. However, the performance in terms of capital productivity growth is better for Karnataka manufacturing industries as compared to Indian manufacturing industries.

5.8 Industry Wise Trends in Total Factor Productivity

Total Factor Productivity growth across manufacturing industries substantially conforms to the total factor productivity growth found for total manufacturing. TFPG estimates for two-digit industries are shown in Table 5.8. The estimated growth rate of TFP for the pre-reform period is positive for nine out of the ten industries. The technical efficiency of the industries improved TFPG during this period . After the implementation of the first phase of liberalisation in 80s, the technical efficiency of all the industries improved in 1990 as compared to 1980. While no industry has reached their potential level of efficiency and all were below their production frontiers. For all industries the technological innovation was almost absence; however this was compensated by the technical efficiency during the pre-reform period (Kalirajan,K. and M.H.Balasubrahmanya 2009).

During the I-Phase of liberalisation TFPG has increased for only one industry; Beverages. It is interesting to note that why TFPG was negative for the rest of the industries in this period. This is because technical efficiency realisation growth has declined across industries.

Table 5.6

Industry-wise Growth Rate of Total Factor Productivity of Manufacturing Sector of Karnataka (1980-81 to 2010-11)

Industry Group	1980-1990		1990-2000		2000-2011		1980-2011	
	Kar	Ind	Kar	Ind	Kar	Ind	Kar	Ind
Food Products (20-21)	8.6	5.8	2.4	-0.2	0.01	0.8	1.6	0.01
Beverages & Tobacco (22)	1.6	-2.0	4.7	-5.1	-0.1	1.9	0.1	-2.3
Textiles (23+24+25)	1.7	1.6	-1.1	-4.2	2.4	3.3	1.3	-0.4
Wearing Apparel (26)	3.3	1.1	-1.2	-4.8	2.7	-1.0	-0.4	-1.7
Wood & Wood Products (27)	-0.2	-2.0	-7.3	-9.6	7.2	1.6	-1.5	-1.1
Paper & Paper Products (28)	7.0	-0.9	-1.6	-3.3	4.9	3.6	3.1	-0.1
Leather Products (29)	5.5	1.5	-7.7	-1.6	6.2	3.4	-1.8	0.1
Chemical Products (30)	0.6	2.7	-0.8	0.7	1.5	4.0	1.7	1.1
Non-Metallic Minerals (32)	1.0	-2.2	-5.9	-3.2	11.6	4.7	-0.8	0.5
Basic Metals & Alloys (33)	7.1	0.1	-6.1	4.6	3.4	1.7	4.2	1.5

Source: Author's Computation

Though there was positive technological innovation in all the industries during this period, which is overshadowed by the negative technical efficiency of the industries, as a result most of the industries registered negative TFPG (Kalirajan. K and M.H.Balasubrahmanya 2009).Agricultural growth has also been an important factor in influencing industrial productivity. The slowdown in agricultural growth during Phase-II seems to have been important cause of the deceleration in total factor productivity growth of the industries. Though the Food products industry registered positive growth of TFPG the growth rate is relatively less in this period, but this industry generated high employment opportunities during the same period be a cause of concern for policy makers. Chemicals and Chemical sector is characterised by a diversity of products and producers (including many small scale ones) so that the diffusion of technology may have been slower, in the I-Phase of liberalisation.[39]

During the II-Phase of liberalisation the growth rate of total factor productivity improved for nine out of ten industries. Though the relative performance of manufacturing industries of Karnataka in terms of total factor productivity growth is better than India, the Karnataka manufacturing industries not show any significant improvement.

From the above analysis the study observed that the Total Factor Productivity growth of Karnataka manufacturing sector decreased in Phase-I. Hence the study accepts the hypothesis that Total Factor Productivity growth decreased in the post reform period.

5.9 Sum Up

This chapter is an enquiry into the long-term manufacturing growth process of the regional economy of Karnataka in terms of partial factor productivity and the comprehensive method of total factor productivity for the period 1980-81 to 2010-2011.Analysis of the growth of the manufacturing sector of the economy reveals the following:

The performance of manufacturing sector in terms of labour productivity at the aggregate level in the eighties, the manufacturing sector of Karnataka has predominated which has largely been brought about by capital deepening in the manufacturing sector. In the I-Phase and in the II-Phase the Karnataka manufacturing

[39](Prof. Sharma R.K and Prof. Seema Bathla (2007)

sector has lagged behind. Nevertheless for the entire period our analysis of labour productivity growth depicts more or less similar trends for both Karnataka and Indian manufacturing sector. The increase in the capital productivity growth in the last decade can be largely attributed by the financial development and best investment climate in the state.

Based on the findings of earlier studies Goldar.B (2004), Balakrishnan.P and Pushpangandan.K (1994), Kaur. M and Ravikiran (2008) and Unel.B (2003) on TFP growth in Indian manufacturing as well as the evidence presented in this chapter, it would be right to conclude that there has been a decrease, not an increase, in the growth rate of TFP in Indian manufacturing sector in Phase-I. This does not mean that reforms failed to have a favorable effect on industrial productivity. Rather, (Goldar and Kumari, 2003; Topalova, 2003) have shown in their studies that trade liberalisation had a positive effect on industrial productivity. Goldar and Kumari (2003) have presented econometric evidence that indicates that the slowdown in TFP growth in Indian manufacturing in the post-reform (Phase-II) period is attributable to a large extent to deterioration in capacity utilisation. Trivedi et al (2011) demonstrated with empirical evidence that some of the components of policy reforms, such as, reduction in trade barriers have led to improvement in productivity growth.