4. Productivity in Selected Industry Groups in India: 1973-74 to 1997-98

Very often the choice between measures of single and multifactor productivity is regarded as a matter of 'measurability' versus that of 'theoretical appropriateness'. Of the various productivity measures, labour productivity is the oldest and most widely used. The wide usage of labour productivity is due to the fact that it can be used as a proxy for the amount of goods available for consumption per labourer. Hence, increase in labour productivity is very often regarded as an end in itself and in such a situation the role of capital stock gets reduced merely to that of enabling labour productivity to rise. Labour productivity has also been viewed as a superior indicator of the long-term technical progress (or welfare) as compared to per capita real GDP, since the latter ignores the importance of working hours per person/employment rates in the growth process [Maddison, 1987].

Indices of productivity can, at best, enable comparison of the movements of productivity and not the initial productivity gap. Comparisons of productivity, therefore, become more meaningful only if the information on *absolute levels* of productivity complements the estimates of *growth rates* of productivity. In view of this, we have calculated both the levels and indices of various measures of SFP, which have been discussed in sub-section 4.1. In sub-section 4.2, we present the estimates of multifactor productivity indices, *viz*., TP and TFP indices.

4.1 Single Factor Productivity in Selected Industry Groups

In Table 8, we provide the details of various SFP measures, which we have computed in this study. Of these, the first three indicate the *levels* of labour productivity. The remaining ones are *indices* of labour and capital productivity. In this sub-section, our focus is on the level and movement of labour productivity, though the indices of productivity of capital have also been reported. In many of the industrialised countries, labour productivity is calculated as the real value added per man-hour. This leads to a downward adjustment in estimates of productivity in industries (countries) where a higher number of hours are put in by an employee *vis-a-vis* other industries (countries). In general, the number of hours worked per employee tends to be higher in private sector where incentive schemes prevail and labour unions are not very powerful. However, most of the studies on India's manufacturing sector have used the data on number of employees or workers for estimation of labour productivity. We have also used the data on number of employees in the estimation of productivity.

Table 8: Details of Single Factor Productivity Measures Computed in this Study

Sr. No.	Measure of Output	Input	Productivity Measure (Notation)	Level/Index
1	O	L	Labour productivity (OL*)	Level
2	VSD	L	Labour productivity (VSDL*)	Level
3	VDD	L	Labour productivity (VDDL*)	Level
4	O	L	Labour Productivity (OL)	Index
5	O	K1	Capital productivity (OK1)	Index
6	O	K2	Capital productivity (OK2)	Index

7	VSD	L	Labour productivity (VSDL)	Index
8	VDD	L	Labour productivity (VDDL)	Index
9	VSD	K1	Capital productivity (VSDK1)	Index
10	VSD	K2	Capital productivity (VSDK2)	Index
11	VDD	K1	Capital productivity (VDDK1)	Index
12	VDD	K2	Capital productivity (VDDK2)	Index

Note:: See list of abbreviation for the abbreviations used in this Table. Annexure IV details the procedure used for estimation of K1 and K2 series.

4.1.1 Levels of Labour Productivity

In Figure 3.1, 3.2 and 3.3 (data in Table A2), we indicate the annual averages of real output per employee (OL*), real value added per employee (VSDL*), arrived at by using SD method and real value added per employee (VDDL*), arrived at by using DD method, respectively. These are expressed in lakhs of rupees, at 1981-82 prices.

The following observation can be made by a scrutiny of to Figure 3.1, 3.2 and 3.3 *First*, whatever be the measure of labour productivity, an increasing trend in labour productivity is witnessed in the case of most of the industry groups, across the five sub-periods of the study. *Second*, labour productivity has been consistently higher (except during 1973-80, if measured by VDDL*) for the selected industries as a group as compared with that for the manufacturing sector. *Third*, labour productivity measured by OL*, VSDL* and VDDL*, increased consistently for machinery and transport equipment and chemical industries across the five sub-periods. *Fourth*, a predominant role in increasing labour productivity in selected industries and in manufacturing sector has been played by the chemical industry. *Last*, the metal industry was a problematic industry with stagnant and low levels of labour productivity until mid-eighties, as judged by the VDDL* criterion.

4.1.2 Movements in Partial Productivity and Capital Intensity Indices

Figures 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 and 4.7 plot yearly movements in labour productivity indices (OL), capital productivity indices (OK1 and OK2) and capital intensities (K1L and K2L) for the various industries/industry groups. Numerical estimates of these indices have been provided in Tables A3, A4, A5, A6, A7, A8, A9 and A10. Trend growth rates of above-mentioned partial productivity indices, *inter alia*, have been reported in Table 9 and yearly movements in these indices have been provided in Figures 4.1 to 4.7. The following observations emerge from scrutiny of Table 9 and Figures 4.1 to 4.7.

First, OL depicted a rising trend in all industries (Table 9). *Second*, in textiles and metal industries (Figures 4.1 and 4.2), OL increased sharply during 1984-85 to 1994-95. Rising OL was accompanied by increasing capital intensities in these two industries (Figure 1A and Table A3). . Thereafter, fluctuations in OL in these industries can be seen. *Third*, in machinery and transport equipment industry, OL increased consistently since the turn of 1980s, followed by a slackening growth of OL in the early nineties (Figure 4.3). Similar trend can be seen for capital intensity in this industry. *Fourth*, chemical industry registered a rising trend in OL during the

1980s (Figure 4.4). The rise was pronounced during the period 1988-89 to 1990-91. OL in this industry increased rather slowly thereafter, until 1996-97. Capital intensity in this industry was stagnant up to the mid-1980s and accelerated thereafter, barring the year 1991-92. *Fifth*, in leather industry, OL showed a rather low rate of growth though the capital intensity registered a sharp increase since 1989-90 (Figure 4.5). *Lastly*, OL and capital intensities increased consistently in selected industries and in manufacturing sector since the 1980s (Figures 4.6 and 4.7).

We regressed labour productivity index (OL) on capital intensity index (K1L) for the various industry groups so as to ascertain whether the former is explained by the latter. We found that for all the industries/industry groups K1L explained OL, t-statistics were significant in all the cases and the adjusted R^2 was above 0.85. In brief, it can be said that capital intensity has facilitated increase in labour productivity. We have already noted a significant correlation between capital intensity and per capita emoluments across industries.

As regards the trend growth rates of OL (estimates provided in Table 9), we observe the following. *First*, trend growth rates of OL were highest in machinery and transport equipment (6.3 per cent per annum) and textile (6.2 per cent per annum). *Second*, chemical and metal industries witnessed trend rates of growth of OL of 5.1 and 5.6 per cent per annum, respectively. *Third*, leather industry recorded the lowest (2.7 per cent per annum) trend rate of growth of OL. *Fourth*, trend rate of growth of OL for the manufacturing sector (5.9 per cent per annum) was marginally lower than that witnessed by the selected industries (6.3 per cent per annum).

As mentioned earlier, increasing capital intensity results in underestimation of capital productivity and overestimation of labour productivity. Capital intensity increased in all industries, which can be verified by the positive growth rates of K1L and K2L. Growth rate of OL was much higher than the growth rate of OK1 and OK2, for all industries. Trend growth rates of OL were higher than of capital productivity, for all the industries. This is expected in a situation of increasing capital intensity.

Table 9: Trend Growth Rates of Single Factor Productivity in the Various Manufacturing Industries in India, 1973-74 to 1997-98

(per cent per annum)

Industry Group	Trend Rates of Growth* of										
	OL	OK1	OK2	K1L	K2L	VSDL	VDDL	VSDK1	VSDK2	VDDK1	VDDK2
Textiles and textile Products (TEX)	6.2	0.7	-0.6	5.5	6.8	4.5	7.5	-0.9	-2.2	2.0	0.7
Metal and metal products (METAL)	5.1	1.1	-0.2	4.0	5.4	3.9	2.0	-	-1.4	-2.0	-3.2
Machinery and transport equipment (MTE)	6.3	1.9	0.6	4.3	5.6	5.1	6.8	0.8	-0.5	2.4	1.1
Chemical and chemical products (CHEM)	5.6	1.9	0.7	3.6	4.9	5.7	10.1	2.0	0.7	6.2	4.9
Leather and leather products (LEATH)	2.7	-2.2	-3.4	5.0	6.3	3.5	7.0	-1.4	-2.6	-	-
Selected Industries (SMFG)	6.3	1.5	0.2	4.7	6.0	5.3	7.6	0.6	-0.7	2.7	1.4
Manufacturing Sector (MFG)	5.9	1.1	-0.2	4.8	6.1	5.4	7.2	0.5	-0.7	2.2	1.0

Note: See list of abbreviations.
* Trend growth rates have been calculated using semi-log trend equations.

In Tables A3-A9, we have provided estimates of labour productivity indices (VSDL and VDDL) and capital productivity indices (VSDK1, VSDK2, VDDK1 and VDDK2). These indices (excluding VSDK2 and VDDK2) have been plotted in Figures 5.1, 5.2, 5.3, 5.4, 5.5, 5.6 and 5.7. Since the movements in VSDK1 (VDDK1) imitate those in VSDK2 (VDDK2), we have not plotted VSDK2 and VDDK2 series in these figures. We observe the following after a scrutiny of these figures.

In the textile industry three distinct phases can be seen. The first phase was observed during 1973-74 to 1982-83, the second during 1983-84 to 1993-94 and the third during 1994-95 to 1997-98 (Figure 5.1). In the first phase, the trend growth rates of OL, VSDL and VDDL were 4.4, 2.0 and 4.7 per cent per annum, respectively. Acceleration in growth rate of labour productivity took place during the second phase and the corresponding figures rose to 8.2, 7.3 and 9.9 per cent per annum, respectively. In the third phase we see a deceleration in growth rates of labour productivity and the above-mentioned rates declined to 3.1, -4.6 and –6.0 per cent per annum.

In metal industry both VSDL and VDDL (Figure 5.2) moved closely until 1987-88. Thereafter, the divergence between VSDL and VDDL in this industry is evident, especially before 1990-91. It is pertinent to note that this industry was dominated by the public sector and the output and prices in this industry were, by and large, administered, especially in the pre-1991 period. In this industry, acceleration in growth of labour productivity took place in the early nineties. Trend growth rates in OL, VSDL and VDDL accelerated from 4.7, 2.1 and –1.7 (1973-74 to 1991-92) to 6.9, 12.8 and 17.2 per cent per annum (1992-93 to 1997-98), respectively.

In machinery and transport equipment industry (Figures 5.3) the turnaround in labour productivity growth rate seems to have taken place at the turn of the eighties itself. In this industry, three phases of labour productivity growth can be seen. The years 1979-80 and 1991-92 can be treated as cut-off years for the three sub-periods. Growth rates of labour productivity in this industry accelerated in the second and the third sub-periods as compared to the first and the second sub-periods, respectively. The trend rates of growth in OL, VSDL and VDDL in the first (second) period were 4.5 (7.0), 2,4 (5.6) and 3.4 (8.1) per cent per annum, respectively. Growth rates in these variants of labour productivity further accelerated in the third sub-period.

Growth rates of labour productivity in chemical industry were rather low during the seventies and these accelerated in the post 1979-80 period (Figures 5.4). The trend growth rates of OL, VSDL and VDDL during the seventies were 2.9, -0.5 and 2.8 per cent per annum, respectively. The corresponding figures were 6.3, 8.2 and 11.5 per cent per annum, respectively, for the period 1980-81 to 1997-98.

In leather industry (Figure 5.5), VDDL movements have been quite erratic as compared to those in VSDL. In leather industry, the time-span of the study can be divided into two sub-periods, from the point of view of the performance of growth of labour productivity. These two sub-periods are pre-1990-91 years and the period thereafter. However, acceleration in trend growth rates was significant only in the case of OL and VDDL in this industry. If the effect of relative prices is removed, during the earlier half of the 1980s and 1990s, substantial improvement in labour productivity seems to have taken place in this industry.

Acceleration in growth rates of OL, VSDL and VDDL can be observed in the case of selected industries and also for manufacturing sector during the period 1980-81 to 1997-98 as compared with the pre-1980-81 period (Figure 5.6 and 5.7). Trend growth rates of these variants of labour productivity in selected industries (manufacturing sector) were 4.9 (4.2), 1.9 (1.9) and 2.7 (2.8) per cent per annum, respectively, during the pre-1980-81 period. These accelerated to 6.7 (6.2), 6.7 (6.3) and 8.6 (8.1) per cent per annum, respectively, in the period thereafter.

As regards the trend growth rates in partial productivity measures (for the entire time-span of the study), the following observations can be made after a scrutiny of Table 9. First, labour productivity has risen at a higher rate than capital productivity. Second, capital productivity growth rates estimated by capital stock series K1 are higher than those estimated by K2. Third, estimates of trend growth rates of OL are higher than growth rates of VSDL for all industry groups, barring chemical and leather industries. This implies that real inputs (valued at output prices) per employee have risen at a lower rate than real output in the case of all industries, except in chemical and leather industries. Fourth, growth rates of VDDL are higher than those obtained by VSDL for all industry groups except for metal industry. This has been caused by a faster rate of inflation in input prices *vis-à-vis* the output prices in all the industries included in this study (except for the metal industry) and in the manufacturing sector.

4.2 Multifactor Productivity Indices for the Selected Industries

The details of various multifactor productivity indices, which we have computed in this study, have been provided in Table 10. We have used translog index set out in equation (5) for estimating growth rates of total productivity indices (TP1 and TP2). Growth rates of total factor productivity indices (TFPS1, TFPS2, TFPD1 and TFPD2) were calculated using equation (6). These growth rates were then used to obtain the productivity indices by setting 1973-74 as the base year.

Table 10: Details of Multifactor Productivity Indices Computed

Sr. No.	Measure of Output	Inputs	Productivity Index
1	O	L, K1, N	Total productivity (TP1)
2	O	L, K2, N	Total productivity (TP2)
3	VSD	L, K1	Total Factor productivity (TFPS1)
4	VSD	L, K2	Total Factor productivity (TFPS2)
5	VDD	L, K1	Total Factor productivity (TFPD1)
6	VDD	L, K2	Total Factor productivity (TFPD2)

Note: See the list of abbreviations.

Two sets of numbers are of interest in an inter-industry growth-accounting exercise. *First*, the rates of growth of multifactor productivity across industries and *second*, the contributions of multifactor productivity in explaining the growth of output/real value added. Table 11 and

Figures 6.1, 6.2, 6.3, 6.4, 6.5, 6.6, and 6.7 provide us with the information related to the first set of numbers.

Table 11: Trend Growth Rates of Productivity in Various Industries in India, 1973-74 to 1997-98
(per cent per annum)

Industry Group	Trend Rates of Growth*					
	TP1	**TP2**	**TFPS1**	**TFPS2**	**TFPD1**	**TFPD2**
Textiles and textile Products (TEX)	1.17	1.05	2.25	1.83	5.25	4.81
Metal and metal products (METAL)	-	-	1.58	0.96	-	-
Machinery and transport equipment (MTE)	1.09	0.89	2.79	2.16	4.41	3.77
Chemical and chemical products (CHEM)	1.96	1.75	3.15	2.33	7.40	6.54
Leather and leather products (LEATH)	0.56	0.46	0.90	-	4.27	3.71
Selected Industries (SMFG)	1.12	0.95	2.71	2.09	4.90	4.27
Manufacturing Sector (MFG)	0.99	0.82	2.61	1.95	4.37	3.69

Note: See the list of abbreviations.
* Trend growth rates have been calculated using semi-log trend equations.

A scrutiny of Table 11 allows us to make the following observations. *First*, the trend growth rates of productivity indices compiled with K1 as the measure of capital stock (*viz*., TP1, TFPS1, TFPD1) are marginally higher than the trend rates of growth of productivity estimated with K2 capital stock series (*viz*., TP2, TFPS2 and TFPD2), for all industry groups. This is due to the fact that the trend rates of growth of K1 have been less than those of K2 (Table 6). *Second*, whatever be the measure of MFP considered, the rates of growth of productivity for manufacturing sector have been marginally lower as compared with the corresponding figures for the selected industries. *Third*, trend growth rates in TP1 (TP2) have been lower than trend growth rates in TFPS1 (TFPS2). *Fourth*, trend rates of growth in TFPS1 (TFPS2) have been lower than those of TFPD1 (TFPD2), except for metal industry. This has been on account of rising relative prices in all the industries, except in the metal industry. *Last*, the ranking of the industries remains unchanged irrespective of whether we use the criterion of trend growth rate of TP1or TP2 or TFPD1 or TFPD2. It undergoes a change if the criteria of trend growth rates of TFPS1 and TFPS2 are used. Despite these differences in rankings, chemical industry emerges as the best performer. Leather and metal industries turn out to be poor performers, judged by the growth rates of all the variants of MFP mentioned above.

Estimates of TP1 and TP2 - measured on the Y-axis (right side) in Figures 6.1 to 6.7 - have been provided in Table A11, whereas, estimates of TFPS1, TFPS2, TFPD1 and TFPD2 - measured on the Y-axis (left side) in Figures 6.1 to 6.7 - have been provided in Table A12. Though the trend rates of growth of various measures of productivity have differed, the movements in these indices have been more or less in similar direction, with the exception of metal industry.

4.2.1 Textile Industry

For textile industry (Figure 6.1), we observe a rising trend in TP1, TP2, TFPS1, TFPS2, TFPD1 and TFPD2 until 1993-94. Thereafter, productivity has declined in this industry. We have already seen that there was a significant deceleration in labour productivity in this industry in the post 1993-94 period. It is also interesting to note the co-movements in TP and TFPD indices. The textile industry is one of the largest industries in India and accounted for about 9.2 per cent of nominal value added by the organised manufacturing sector during the period 1995-96 to 1997-98 (Table 4). This industry provides employment to over 20 million people (Economic Survey, 1996-97, Government of India). Several policy measures have been announced by the Government to make this industry internationally competitive. The major policy measures include the Textile Policy Statement of March 1981, which aimed at modernisation and export-orientation of textile industry. This industry was delicensed in August 1991. The Textile Control Order 1986 was repealed in December 1992 and replaced by the Textile (Development and Regulation) Order 1992 which was subsequently replaced by Textile (Development and Regulation) Order 1993. Under the revised order, the provision of licence/registration certificate in respect of textile industry including powerloom, was abolished. Changes were also made in EXIM policy with effect from April 1, 1993. Under this policy, import of capital goods was allowed at a concessional tariff of 15 per cent, with an export obligation of four times the value of the machinery. The Government announced a new Export Entitlement Distribution policy 1994-96 (quota policy) on September 4, 1993 for export of various textile items to the countries where such exports are covered under the bilateral trade agreements. As a result of the successful conclusion of Uruguay round of GATT talks in held in December 1993, it has been agreed to phase out Multi-Fiber Agreement (MFA) within 10 years. In accordance with the requirement of Agreement on Textile and Clothing (ATC), a new long-term quota policy for 1997-99 has been announced in October 1996. This is to ensure greater transparency and higher unit value realisation for exports under quota items.

Since the textile industry has been provider of employment to a substantial labour force in India and that this industry depended to a large extent on unskilled labour, industrial unrest has been quite common in this industry. Despite the fact that the labour unions were quite active in this industry, employment in this industry has declined over the years. Decline in employment in this industry was rather sharp in the mid-eighties, which took place after a major strike in this industry in the early eighties. In fact, this is the only industry among the selected industries, which did not witness any growth of employment. Though the textile industry performed relatively better than the other industry groups, especially during the eighties, it is being viewed as a sunset industry in the nineties. This is in accordance with the decline in productivity in this industry in the post 1993-94 period.

4.2.2 Metal Industry

Multifactor productivity performance in metal industry displays three distinct phases (Figure 6.2). In this industry, TP1 and TP2 do not show any trend during 1973-74 to 1988-89. A sharp fall in productivity indices in metal industry is displayed in the subsequent two/three years followed by an upward trend during the nineties. TP1 (TP2) in this industry declined at an average annual growth rate of 0.5 per cent per annum during 1985-86 to 1989-90. However, it registered a growth of 2.8 (2.7) per cent during 1991-92 to 1997-98. TFPS1 and TFPS2

registered positive trend growth rates during the period of the study. However, the growth rates of TFPD1 and TFPD2 were not significantly different from zero. TFPS1, TFPS2, TFPD1 and TFPD2 hardly displayed any trend until the late eighties. Thereafter, we observe sharp fluctuations in these indices. It is also worth noting that this is one of the industries in which productivity has continued to rise consistently in the nineties.

In the post-Independence period, the new undertakings in a vast segment of metal industry were to be undertaken by the public sector. Iron and steel industry was one of the core industries which was de-reserved in 1991 (*vide* the Industrial Policy Statement of July 1991). Besides this, a substantial upward revision in iron and steel prices (37.44 per cent) was effected in 1991-92, as against a general increase of 9.74 per cent in manufactured prices. The pricing and distribution of iron and steel were deregulated with effect from January, 1992 and increases in prices fixed by the integrated steel plants were effected so as to neutralise increases in input cost of this industry. Import duties on steel items were reduced by 20 per cent in 1991-92 along with the deregulation of iron and steel industry. This was to moderate the rise in market prices of iron and steel. In the subsequent years also the import duties on items of steel have been reduced apart from removing all quantitative restrictions on these imports. In brief, reduction in tariff and non-tariff controls over imports of iron and steel industry, the process of liberalisation seems to have positively affected this industry. Metal industry is also one of the larger industries in India's manufacturing sector, its contribution to the nominal value added being similar to that of textile industry in the recent years.

4.2.3 Machinery and Transport Industry

Machinery and transport equipment industry is the largest among the selected industries, as per the criterion of nominal value added. It accounted for about one-fifth of the nominal value added in India's organised manufacturing sector over the period of the study. Productivity growth in this industry has exhibited an upward trend - albeit with fluctuations- since 1979-80 (Figure 6.3). We have already seen that labour productivity also accelerated in this industry at the turn of the eighties. Growth rates of all the variants of MFP for this industry have been higher than those witnessed by metal and leather indutries. However, growth rate of MFP in this industry was lower than witnessed by chemical industry.

The Industrial Policy Statement of 1980 had many proposals for reducing procedural hurdles, such as, regularisation of installed capacities (in excess of licensed capacities) in 34 industries, incentives for export promotion, simplification of licensing procedures, improved access to financial assistance, etc. The year 1982 was declared as 'Productivity Year' in recognition of the need for improved performance of the Indian industries. Further liberalisation in industrial policy took place with the announcement of a spate of policy measures. The hallmark of this liberalisation was delicensing of 25 broad categories of industries, which included machinery and transport equipment industry. Broad-banding, capacity re-endorsement, expansion of capacity, loosening of controls over the MRTP companies, etc., were some of the other ingredients of 1985-86 policy statement. The liberalisation measures initiated in this policy statement were carried forward more vigorously in the nineties.

4.2.4 Chemical Industry

In the case of chemical industry (Figure 6.4), the increasing trend in productivity indices continued during the entire decade of 1980s. However, in the nineties deceleration in productivity growth took place in this industry,. As already mentioned, the growth rate of all variants of MFP were higher than for other industries investigated in this study (Table 11)

In chemical industry, a number of policy initiatives have been undertaken in the recent years. In 1993, delicensing was effected for most of the bulk drugs and automatic approval of foreign equity up to 51 per cent in most drugs and formulations was granted. Modifications of the Drugs Policy were undertaken in 1990-91 and further modifications were carried out in 1994. The number and the span of drugs under price controls were drastically reduced in 1994. Chemical industry in India did rather well during the 1980s. However, as a signatory to the GATT, India was required to enact legislation which would require adherence of the Indian firms to both product and process patents. The threat of introduction of product patenting could be one of the factors constraining the potential growth and productivity in this industry.

4.2.5 Leather Industry

Leather industry is the smallest of the selected industries in terms of the employment generated, stock of real capital, nominal value added (Table 6). However, its contribution to exports (Table 2) has been much higher as compared with its relative position in India's manufacturing sector. Leather industry recorded output growth of about 8.2 per cent per annum, during the period 1973-74 to 1997-98. Growth rates of employment (5.4 per cent per annum) and real capital stock have been the highest among the selected industries. There has been marginal growth in TP1, TP2, TFPS1 and TFPS2 indices in this industry, though TFPD1 and TFPD2 indices indicate positive growth rates of 4.3 per cent and 3.7 per cent, respectively (Figure 6.5). In other words, though leather industry has performed well in terms of growth of output and contribution to exports, its record has not been impressive as regards growth of multifactor productivity.

Since 1970s, there has been a steady s change in the leather industry. On the export front, there has been a gradual switch in production from semi-finished hides and skins to finished leather and leather manufactures. During the early nineties, leather manufactures accounted for about 70 per cent of leather exports. This was partly due to duty-free imports of raw-hides and skins and easing of norms for importing machinery and other inputs. Exports of raw-hides and skins has been banned. Manufacture of finished leather was delicensed with effect from April, 1993. The domestic manufacture of components for shoe industry is being encouraged through measures like promoting joint ventures and duty rationalisation on inputs required for the manufacture of such components. For the integrated development of this industry, the Government is implementing the National Leather Development Programme (NLDP) with the assistance of the United Nations Development Programme (UNDP). Besides this, a programme of technological upgradation has been launched through selected institutions/agencies in the country. The Council for Leather Exports has launched an image building programme (Leather Blitz) in the US market for boosting the exports of value-added leather products. A large raw material base of hides and skins available in India is the main strength of the industry. In other words, the competitive edge

of Indian leather products in the global markets seems to emanate from advantages in terms of availability of raw-materials rather than efficiency in resource utilisation.

4.2.6 Selected Industries and manufacturing Sector

Selected manufacturing industries accounted for about 58 per cent of the nominal value added and 53 per cent of employment provided by India's manufacturing sector, during the period 1995-96 to 1997-98. During the period 1973-74 to 1997-98, trend growth rates of output, employment and real capital stock (K1) in these industries were of the order of 7.7, 1.4 and 6.1 per cent per annum, respectively. Productivity indices in this industry group exhibited an increasing trend since 1980-81 (Figure 6.6). Though there was no turnaround in TP1 and TP2 indices for this group of industries, TFP indices of all varieties indicated 1980-81 to be the year of turnaround. As already mentioned, rate of growth of productivity in selected industries as a group was marginally higher than that witnessed by the manufacturing sector as a whole. Manufacturing sector (Figure 6.7) displayed trends similar to those witnessed by selected industries. This is on account of the wide coverage of selected industry group in the manufacturing sector.

4.3 Correlation between Various Multifactor Productivity Indices

In Table 12, we have reported the correlation coefficients between the following six pairs of productivity indices, *viz.*, TP1 & TFPS1, TP2 & TFPS2, TFPS1 & TFPD1, TFPS2 & TFPD2, TP1 & TFPD1 and TP2 & TFPD2. We have not reported the correlation coefficients between TP1 & TP2, TFPS1 & TFPS2 and TFPD1 & TFPD2, as these are expected to have a value of approximately equal to unity due to systematic difference between K1 and K2 series.

Table 12: Correlation Coefficients between Various Productivity Indices

Industry Group	TP1 & TFPS1	TP2 & TFPS2	TFPS1 & TFPD1	TFPS2 & TFPD2	TP1 & TFPD1	TP2 & TFPD2
Textiles and Textiles Products	0.911	0.882	0.944	0.919	0.988	0.989
Metal and Metal Products	0.721	0.696	0.559	0.570	0.851	0.872
Machinery and Transport Equipment	0.963	0.943	0.984	0.974	0.981	0.980
Chemical and Chemical Products	0.931	0.883	0.935	0.887	0.998	0.998
Leather and leather products	0.700	0.646	0.715	0.667	0.997	0.995
Selected Manufacturing	0.956	0.927	0.985	0.968	0.981	0.981
Manufacturing Sector	0.964	0.945	0.981	0.968	0.993	0.994

It can be seen from the above table that for all industries, correlation coefficients between TP1 & TFPS1 are above 0.91, except for metal and leather industries. For these industries also the correlation coefficients are as high as 0.70 or more. Similar observations can be made for the correlation coefficients between TP2 & TFPS2, TFPS1 & TFPD1 and TFPS2 and TFPD2. It is quite interesting to find that the correlation coefficients between TP1 & TFPD1 and TP2 & TFPD2 are higher than 0.85 for all industry groups including metal and leather industries. In Table 11, we have noted that the rates of growth of productivity as measured by TP, TFPS and TFPD indices differ widely. The magnitudes of correlation coefficients reveal that TP & TFPD

indices have higher correlation in all industries, than those obtained for the pairs of TP & TFPS and TFPS & TFPD indices.

4.4 Productivity Growth of Indian Manufacturing Sector: Empirical Evidence in Literature

We provide a synoptic view of the growth rates of productivity obtained by a few recent studies on productivity in India's manufacturing sector (Table 13). Estimates of productivity presented in the above table are not strictly comparable, as they pertain to different time-periods and have not been obtained using the same methodology.

Table 13 : Alternative Estimates of Trend Growth Rates of Total Factor Productivity

(per cent per annum)

Study (Year)	Period	TFPG (SD)	TFPG (DD)
Ahluwalia (1985)	1959-60 to 1979-80	-0.6	-
Ahluwalia (1991)	1959-60 to 1985-86	-0.4	-
Brahmananda (1982)	1950-51 to 1980-81	-0.2	-
Balakrishnan and Pushpangadan (1994)	1970-71 to 1988-89	0.5	3.1
Majumdar (1996)@	1950-51 to1992-93	1.7@@	
Mohan.Rao (1996a)	1973-74 to 1992-93	1.3 (2.0*)	2.2
Pradhan, G. and K. Barik (1998)	1963-64 to 1992-93	0.6**	
Present Study	1973-74 to 1997-98	1.95** (0.8**)	3.7

@ Estimates of efficiency in this study have used Data Envelopment Approach (DEA).
@@ Though the study spans over the period 1950-51 to 1992-93, we report the estimates for the sub-period 1973-74 to 1992-93.
* Growth rate of TFPG have been obtained indirectly from the estimates of TPG.
** Estimate of TFPGS2 (TPG2).

The estimates of productivity growth obtained by double deflation method are higher than those obtained with single deflation method, for the given time-periods. This in turn implies that relative prices have risen over the period of time. Moreover, all the studies that include the post-1985-86 period report positive growth rates of productivity. This implies a better productivity performance of the Indian manufacturing sector in the post-1985 period. It is also worth noting that the growth rate of productivity obtained using the data envelopment approach (DEA) are close to the estimate of productivity growth obtained by the single deflation method in this study.

4.5 Contribution of Productivity to Growth in Indian Industries

Economists have shown keen interest in the sources of growth. Expansion of economic activity driven by productivity improvements is regarded as sustainable. In the context of recent international developments, it has been argued that since the growth of the East-Asian economies was primarily due to factor accumulation and not the outcome of productivity growth, it is inappropriate to treat their growth performance as miraculous (Krugman, 1994).

Table 14: Contribution of Productivity to Growth in Various Industries in India, 1973-74 to 1997-98

Industry Group	Trend Growth Rates (per cent per annum)			Ratios of Productivity Growth Rates to Growth Rates of Output or Real Value Added (percentages)					
	O	VSD	VDD	TPG1 /OG	TPG2 /OG	TFPGS1/ VSDG	TFPGS2/ VSDG	TFPGD1/ VDDG	TFPGD2/ VDDG
Textiles and textile Products (TEX)	6.4	4.7	7.7	18.3	16.4	47.9	38.9	68.2	62.5
Metal and metal products (METAL)	6.8	5.6	3.7	-	-	28.2	17.1	-	-
Machinery and transport equipment (MTE)	8.3	7.1	8.8	13.1	10.7	39.3	30.4	50.1	42.8
Chemical and chemical products (CHEM)	9.1	9.2	13.7	21.5	19.2	34.2	25.3	54.0	47.7
Leather and leather products (LEATH)	8.2	9.1	12.7	6.8	5.6	9.9	-	33.6	29.2
Selected Industries (SMFG)	7.7	6.8	9.1	14.5	12.3	39.9	30.7	53.8	46.9
Manufacturing Sector (MFG)	7.8	7.2	9.0	12.7	10.5	36.3	27.1	48.6	41.0

Note: See the list of abbreviations.

In Table 14, we have presented the ratios of growth rates of TPG1 and TPG2 to growth rate of real output (OG), which measure the contribution of productivity to the growth of output. During the span of the study, the contribution of TPG1 to the total output was rather low for selected industries as a group (14.5 per cent) and also for the manufacturing sector (12.7 per cent). Highest contributions of productivity to growth of output were registered for chemical (21.5 per cent) and textile (18.3 per cent) industries. In metal industry, the contribution of total productivity to growth of real output was insignificant. The contribution of TPG1 to growth of output in machinery and transport equipment was of the order of 13.1 per cent. The respective figure for leather industry was 6.8 per cent. Contributions of TPG2 to the growth of output for various industries/industry groups were marginally lower than the corresponding figures for TPG1.

The contribution of growth of productivity, measured by TFPGS1, to the growth of VSDG1, gives us much higher figures than the ratios of TPG1 (TPG2) to OG. The ranking of the industries, as per the criterion of contribution of productivity to growth, also undergoes a change. In other words, measurement of productivity and the contribution of productivity to growth is sensitive to whether we use the real output or real value added as a measure of production. This implies that material inputs cannot be treated as separable from factor inputs in production process. Moreover, the estimates of productivity and contribution of productivity to growth display a high sensitivity to the choice of deflation method, i.e., if we compare the ratio of TFPGD1 (TFPGD2) to VDDG1 (VDDG2), with the corresponding figures used in the single deflation method.