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PRODUCTIVITY, EFFICIENCY AND COMPETITIVENESS OF THE INDIAN MANUFACTURING SECTOR

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PRODUCTIVITY, EFFICIENCY AND COMPETITIVENESS OF THE INDIAN MANUFACTURING SECTOR

ABBREVIATIONS

Abbreviation	Full Form
ASI	Annual Survey of Industries
CD	Cobb-Douglas Production Function
CEA	Central Electricity Authority
CMIE	Centre for Monitoring Indian Economy
CRS	Constant Return to Scale
DEA	Data Envelopment Analysis
DME	Directory Manufacturing Establishment
E	Energy input at constant prices
EME	Emerging Market Economies
EXg	Export Growth
FBT	Food, Beverages and Tobacco
FK	Fixed Capital
FPLL	Fuel, Power, Light and Lubricant
GAA	Growth Accounting Approach
GCI	Global Competitiveness Index
GCR	Global Competitiveness Report
GCIR	GCI rank
GCIS	GCI score
GoI	Government of India
GVA	Gross value added
I	Intermediate inputs (materials and energy)
ILO	International Labour Office
I-O	Input- output absorption matrix
K	Real capital stock
KI	Kendrick Index
L	Labour input
L1	Production workers
L2	Non-production workers = Total Employees-L1
M (N)	Real material inputs, Real total inputs
MFG	Manufacturing
MI	Malmquist Index
N	Total Inputs
NAS	National Accounts Statistics
NDME	Non-directory Manufacturing Establishment
NIC	National Industrial Classification
NSSO	National Sample Survey Office
NVA	Net Value Added

O	Real Output
OAME	Own-account Manufacturing Establishment
pcpa	Percent per annum
PFA	Production Function Approach
RBI	Reserve Bank of India
RGO (Q)	Real Gross output (used in empirical estimation)
RVA	Real value added
RVASD	Real value added obtained by single deflation method
RVADD	Real value added obtained by double deflation method
S	Services input at constant prices
SFPF	Stochastic Frontier Production Function
SI	Solow Index
SSIs	Small Scale Industries
TECRS	Technical Efficiency Constant Return to Scale
TEVRS	Technical Efficiency Variable Return to Scale
TFPG	Total Factor Productivity Growth
TI	Tornqvist Index
TL	Translog
VA	Value Added (Nominal)
WK	Working Capital

Abbreviation	**State**
AP	Andhra Pradesh
BIH*	Bihar and Jharkhand
DEL	Delhi
GUJ	Gujarat
HAR	Haryana
KAR	Karnataka
KER	Kerala
MAH	Maharashtra
MP*	Madhya Pradesh and Chhattisgarh
ORI	Orissa
PUN	Punjab
RAJ	Rajasthan
TN	Tamil Nadu
UP*	Uttar Pradesh and Uttarakhand
WB	West Bengal

EXECUTIVE SUMMARY

India's development strategy placed a heavy emphasis on the creation of a well-diversified industrial base to realise the dream of industry-led development. In order to maximise growth from limited resources, the importance of increasing productivity, efficiency and competitiveness needs no justification. It may not be out of place that though the concepts of productivity, efficiency and competitiveness are indicators of performance, these need not necessarily move in tandem with each other. However, improving these indicators should be conceived merely a means to an end (*i.e.,* social welfare) and certainly not as an end in itself.

This study focuses on the performance of manufacturing sector by taking a disaggregate view of it. It examines the regional dimensions[1] (for 18 states of India), component industries[2] (6 industries within manufacturing sector), organised *versus* unorganised segments of the manufacturing sector, *etc*. The period of study is 1980-81 to 2003-04 for the disaggregated analysis. However, we have extended the study to include the period up to 2004-05 for the 'Selected Public Ltd. Manufacturing Companies' and up to 2007-08 in the case of overall organised manufacturing sector. The study uses both parametric and non-parametric methods to estimate productivity and efficiency of India's manufacturing sector.

Before we report the major findings of the study, we deem it necessary to report a few stylised facts pertaining to India's manufacturing sector. These are as follows. *First*, the average share of manufacturing sector in real GDP has marginally increased from about 13 per cent during 1970-75 to about 15.6 per cent in 2007-08, *i.e.,* approximately by about 2.6 percentage points over a period of almost four decades. Despite the

[1] 1 We have selected 18 states, which are listed as 15 states. These are: Andhra Pradesh, Bihar*, Delhi, Gujarat, Haryana, Karnataka, Kerala, and Madhya Pradesh*, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh* and West Bengal. The three states suffixed with '*' indicate that these were bifurcated in the year 2000. In this study, Bihar* includes Bihar and Jharkhand; Madhya Pradesh* includes Madhya Pradesh and Chhattisgarh; and Uttar Pradesh* includes Uttar Pradesh and Uttarakhand.

[2] The industries selected for detailed investigation are: Food, Beverages & Tobacco, Chemical & Chemical Products, Leather & Leather Products, Metal & Metal Products, Machinery & Transport Equipment and Textiles & Textile Products.

emphasis on manufacturing sector in India's planning process, the contribution of this sector, at best, is modest. It needs to increase so as to absorb more workers and to enable people to improve their standard of living. *Second*, the employment and output generation within the manufacturing sector exhibits a major imbalance. According to the latest available data, the unorganised sector accounts for about 80% of employment and only about 33 % of income of the manufacturing sector. *Third*, as regards the position of manufacturing sector of the various states, Maharashtra, Tamil Nadu and Gujarat are the states which consistently rank as the first three topmost states in terms of both output and employment generation in the organised manufacturing sector. Deterioration of Bihar* and West Bengal, and ascent of Haryana, Karnataka, Punjab and Rajasthan is noticeable in these regards. *Fourth*, over the period of the study, 'Metal' and 'Machinery & Transport Equipment' industries accounted (each of them) for almost one-fifth of gross value added (GVA) of the organised manufacturing sector. These industries are followed by the chemical industry which accounted for about 13 percent of GVA of the organised manufacturing sector. However, in terms of job provision, these are not the topmost industries. Textiles and Food (including beverages & tobacco) industries together account for about 41 per cent of jobs in the organised manufacturing sector. *Fifth*, during 2000-01 to 2008-09, the growth rate of exports (in US $ terms) of Metal and Engineering goods has been highest at about 24 per cent per annum (pcpa) as against the overall growth of exports of about 17 pcpa and that of manufactured products of about 15 pcpa. Growth rates of exports of Textiles and Leather (LEATH) industry have been quite low ranging between 6 and 7 pcpa. *Lastly*, it is not too much to expect that, with the growth of manufacturing sector, workers would benefit in terms of rising per capita real wages. However, the worrisome feature of the organised manufacturing sector in India is stagnancy of per capita real wages of workers. The plight of workers in unorganised sector is much worse, as the wage differentials between organised and unorganised manufacturing sectors are rather sharp.

The major findings of this study are as follows.

- As regards the organised manufacturing sector, the estimates of Total Factor Productivity Growth (TFPG) are sensitive to the methodology applied. For the period 1980-81 to 2003-04, we get the estimates of TFPG for total organised manufacturing sector as 0.92 pcpa by Growth Accounting Approach (GAA) which is almost half of that obtained by the Production Function Approach (PFA), *i.e.*, 1.81 pcpa. Hence, the contribution of TFPG to growth of output by these two approaches lies between 13 to 25 percent. The RBI dataset on public limited companies gives us estimate of TFPG of about 1.5 pcpa for the period 1993-94 to 2004-05.

- The industry-wise performance of organised manufacturing in terms of TFPG as measured by the GAA indicates the worst performance by Food, Beverages and Tobacco (FBT) industry, followed by the Textiles (TEX) industry. The best performers are Machinery and Transport Equipment (MTE) and Chemical (CHEM) industries. The TFPG varied between -0.41 (for FBT) and 1.47 pcpa (for MTE). As indicated earlier, the estimates of TFPG are sensitive to the methodology used. The PFA estimates provide us with the range of TFPG between 3.05 for TEX and 0.97 for Leather (LEATH) pcpa. Also, we do not see complete consistency in the ranking of the industries based on these two alternative approaches.

- The inter-state performance of TFPG of organised manufacturing sector across the states (as measured by the GAA) indicates that Bihar*, Rajasthan and AP turn out to be best performers while the worst performers are Tamil Nadu, Gujarat and Punjab. Bihar* exhibits the highest TFPG of 1.55 pcpa and Tamil Nadu exhibits the lowest TFPG of 0.65 pcpa. This is not surprising if we combine this information with the fact that Bihar* witnessed

a negative growth rate of employment (-1.8 pcpa) and Tamil Nadu witnessed growth rate of employment of 2.5 pcpa in comparison to the corresponding national figure of 0.5 pcpa. Bihar* and West Bengal witnessed growth rates of output in their manufacturing sectors which were lowest across the states, for the former it was 3.7 pcpa and for the latter, it was 3.4 pcpa. That is precisely why, we caution against using TFPG figures unconditionally as indicator of welfare of the masses in general and labourers in particular. It is quite possible that if output growth is low and this low growth rate is accompanied by 'falling levels of employment', it can show up as high TFPG.

- It is not only TFPG, but also the level of TFP that should be paid attention to. Maharashtra features as the best performing state in terms of level of TFP in the organised manufacturing sector and Gujarat ranks as the best performer in terms of TFPG, as per the PFA estimates. These results are not unexpected, given the extent of industrialisation of these two states.
- Though we also attempted estimating efficiency using the ASI unit level data for organised manufacturing and used stochastic frontier production function (SFPF) methodology so as to avoid the outliers affecting our results, the problem of measurement of capital stock cannot be resolved unless the identification codes are provided to the users. Though this is possible only for the census sector. We have reported these results more for the sake of highlighting the data limitations, rather than as findings on efficiency based on the unit level ASI data.
- Using the RBI dataset, we have estimated efficiency of 449 companies for the period 1993-94 to 2004-05, using both data envelopment (DEA) and SFPF approaches. The mean efficiency levels by the former approach range from 0.72 to 0.78 and by the latter approach from 0.66 to 0.67, under the alternative assumptions. These figures highlight the fact that there exists

an ample scope for improving efficiency in the Indian manufacturing sector. The SFPF approach also highlights the lowest mean efficiency of FBT and TEX. These results neatly coincide with the empirical evidence on TFPG emanating from GAA. Moreover, the TFPG measured using the Malmquist Index for this dataset also identifies the FBT and TEX as the poorest performers with TFPG of the former being -1.5 pcpa and of the latter being 0.5 pcpa. Top performers are the MTE and (METAL) and their productivity estimates range between 2.2 and 2.4 pcpa. This throws some light as to why the TEX has been one of the poorest performers on exports front and the Metal and Engineering goods industries have been the top performers.

- The estimation of TFPG for the unorganised sector was constrained due to the data limitations we faced in the construction of capital stock series. In view of this, we estimated labour productivity for the unorganised sector and compared it with that of the organised manufacturing sector. We observe that labour productivity in both organised and unorganised sectors has increased over time. Labour productivity in various component industries of the organised manufacturing sector ranged from 1.6 to 2.2 times in 2000-01 as compared to that in 1989-90. The respective range for the unorganised sector was 1.7 to 2.8 times. In other words, growth of labour productivity in unorganised sector has increased more or less in tandem with that in the organised sector during the above-mentioned period. However the disparity in the levels of labour productivity, are rather sharp and have perpetuated. Organised manufacturing sector had labour productivity which was 13, 14 and 15 times of that witnessed by its unorganised counterpart in years 1989-90, 1994-95 and 2000-01, respectively.

- Considerable research has been done on the issue of whether policy reforms and liberalization have led to improvement in

TFPG and in order to do so, much of the literature depends on use of dummy variables for demarcating 'pre' and 'post' reforms period. Two major problems arise in this context. *First*, it is difficult to isolate the impact of reforms from the other factors which affect TFPG. *Second*, there could be time-lags only after which the impact of reforms could be felt on TFPG. By the use of dummy variable for the pre and post-reform period, we have tried to capture whether TFPG for the organised manufacturing sector (as it was not possible to test it with the other databases used in this study) was higher or lower in the two periods for the various industries and states. It turns out that TFPG has witnessed either deceleration or no acceleration across industries (except for Metal industry) and across states (barring West Bengal and Haryana) as per the GAA. The policy dummy in PFA indicates a shift in production function only for Maharashtra. However, when we take the averages of TFPG over shorter periods (see Table 5.9A and 5.9B), there seems to be revival of TFPG in the post-nineties. Except Bihar*, Madhya Pradesh, Orissa and Rajasthan, all states have witnessed higher TFPG during the post nineties, compared to the preceding quinquennium. Similarly, all industries except metal industry have witnessed revival of TFPG post-nineties period as compared to the preceding quinquennium. In some sense, one could interpret it as an evidence of a J-curve effect of the policy reforms.

- We also tried to isolate the impact of one of the components of the policy reforms and used it along with the other potential determinants of productivity to explain the TFPG of the organised manufacturing sector. Trade barriers (as measured by the ratio of import duties to import payments) turned out to be a significant determinant of TFPG of organised manufacturing sector with a negative sign, indicating that the dismantling of the trade barriers has had a positive impact on TFPG. The

competition to export (as captured by the growth of exports) also turned out to be positively associated with TFPG of the organised manufacturing sector.

- We also tried correlating competitivenss scores (which are for the states as such and not for the manufacturing sector) and TFPG of the organised manufacturing sector at the state level. We could not find a neat relationship between competitivenss of states and TFPG of its organised manufacturing sector.
- Based on the following findings of the study, we reiterate the need to improve productivity and efficiency of India's manufacturing sector. The contribution of TFPG to output growth for organised manufactuing sector ranges between 13 and 25 percent using alternative methodologies. The mean efficiency levels for the RBI dataset ranges between 0.66 and 0.78. Moreover, the ratio of labour productivity of organised to unorganised sector ranges between 13 and 15 combined with the fact that about 80 % of the workers in India's manufacturing sector are in the unorganised sector. The states like Bihar* and West Bengal and industries like Food and Textiles need urgent attention. Needless to mention that this should be achived with growing and not with falling employment if the development process in the country needs to be 'regionally balanced' and 'inclusive'.

PRODUCTIVITY, EFFICIENCY AND COMPETITIVENESS OF THE INDIAN MANUFACTURING SECTOR

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1. Introduction

As a reaction to the colonial past, India's development strategy focused on self-reliance. In pursuit of the same, it placed a heavy emphasis on the creation of a well-diversified industrial[1] base to realise the dream of industry-led development. Though this strategy assigned the prime responsibility of developing heavy industries to the public sector, private sector was also allowed to play a supplemental role. Almost until the beginning of the eighties, a myriad of measures to control the private sector, such as, licensing requirement for installation of capacities, quantitative and tariff restrictions on imported inputs, regulation of monopolies and trade practices, foreign exchange regulation, nationalisation of commercial banks, price controls, *etc.*, constituted an integral part of India's industrial policy. The socialistic fervor in the minds of policy makers got reflected in the policy measure, such as, reservation of labour-intensive manufacturing products for the small scale industries (SSIs), preferential treatment to the SSIs, stringent labour laws against firing of labour in large firms, *etc.* The industrial policy was primarily designed to protect the '*infant*' industries from external competition. Unfortunately, it inhibited internal competition as well. By the end of seventies, Indian manufacturing suffered from high costs of production, sub-standard quality of products and lack of competitiveness of its exports. It is no surprise that the regulatory framework of the pre-1980s, *inter alia*, has been held responsible for low growth rate of output and productivity of India's manufacturing sector (Ahluwalia, 1991).

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[1] Though at times, industry is equated with manufacturing sector, the former is a broader term and in the Indian context, it includes manufacturing, mining and quarrying and electricity sectors, as can be seen from the composition of Index of Industrial Production (IIP). Needless to maintain that this study deals only with manufacturing sector.

The first bout of industrial policy reforms that were initiated in the eighties attempted to lift the economy from industrial stagnation through measures, such as, removal of hurdles on capacity expansion, enabling availability of imported inputs, liberalization of price controls, *etc*. The primary intent of these reforms was to unleash the growth potential of India's industrial sector. The second bout of reform process was initiated in 1990-91 in the wake of macroeconomic crisis. Economic and institutional reforms are being fine-tuned since then, depending on the unfolding of situations both at the external and domestic fronts. It may also be worth noting that the reforms of the eighties were centered primarily on industrial and fiscal sectors, whereas, the reforms initiated in the early nineties were more in the nature of comprehensive macro-economic reforms. Stabilisation and structural adjustment process constituted the core of reforms in the nineties and these were deemed to be pre-requisites for the pursuit of growth and viable balance of payment. In brief, the reforms in the nineties differed in their characteristics from those of the eighties. The reforms in the eighties have been branded as 'pro-business', whereas, the latter as 'pro-market' (Rodrik and Subramanian, 2005 and Kohli, 2006).

It has been argued by Ahluwalia (1991) that the reforms of the eighties resulted in an upward shift in growth rate and productivity of the Indian economy and in particular that of industrial/manufacturing sector. The comprehensive reforms of the nineties gained wide publicity as these pulled the economy from a crisis situation and succeeded in alleviating foreign exchange constraint and controlling inflation. As substantial liberalisation in terms of tariff reductions and removal of quantity restrictions on imported inputs (needed for growth of manufacturing sector) took place during the nineties, it was expected that these reforms would also enable the economy to follow growth and productivity paths higher than those witnessed during the eighties. However, as noted by Rodrik and Subramanian (2005), no such structural break in either growth or productivity is evident after the initiation of reform process of the nineties. Perhaps, the reforms of nineties

targeted primarily the external and financial sectors, which have impacted the real sector indirectly.

The emphasis that needs to be placed on productivity has been well articulated in the literature (Krugman, 1994 and Young, 1995). A higher growth path on account of higher productivity is considered to be a preferable alternative as compared to that due to increased application of inputs. The latter is deemed to be unsustainable due to supply constraints and also due to the phenomenon of diminishing returns. However, this can be a contentious issue, if it pertains to application of labour input, especially so in the context of a labour abundant economy like India. If increased productivity is attained by downsizing employment, it may not bode well for the social fabric and it ought to be a cause of concern to the policy makers. As the basic objective underlying the argument for increasing productivity is to increase social welfare, a situation of rising productivity coupled with shrinking employment may be neither socially desirable nor politically sustainable. A higher growth path, enabled by productivity growth and combined with 'employment generation' ought to be considered as an ideal trajectory from the point of view of sustainable growth of an economy. The link between productivity and social welfare (poverty alleviation) can best operate through employment generation. The importance of productivity in poverty reduction *via* employment generation has been duly emphasised in the World Employment Report 2004-05 (International Labour Office, 2005), by an apt choice of theme for the report, *viz.*, 'Employment, Productivity and Poverty Reduction'. In other words, increase in productivity needs to be conceived merely as a means to an end (*i.e.,* social welfare) and certainly not as an end in itself.

Though the concepts of productivity, efficiency and competitiveness are indicators of performance, these need not necessarily move in tandem with each other. These terms have rather different conceptual underpinnings and hence, the policy makers need to focus on movement of each of these in accordance with the socio-economic objectives. As regards

the two concepts of productivity, *viz.*, labour productivity and total factor productivity (TFP), these are pertinent for policy makers, since the former has a direct link to standard of living and the latter indicates the economical use of resources in the process of production. '*Productivity*' *per se* is a descriptive measure of performance and it can be estimated[2] independently for a decision making unit, whereas, measurement of '*efficiency*' entails a comparison with a peer group and is a normative measure of performance (Ray, 2004). The concept of '*competitiveness*' has many more dimensions to it, as compared to the concepts of efficiency and productivity. Competitiveness implies increasing share of market in relation to other decision making units[3]. *The Global Competitiveness Report (GCR) 2009-10* published by the World Economic Forum (2009) provides the ranks for Global Competitiveness Index (GCI) and scores for various countries along with their component indices. These indices try to capture both the micro and macro determinants of global competitiveness. The pillars of GCI (as outlined in GCR, 2009) are classified into the *basic requirements* (institutions, infrastructure, macroeconomic stability, and, health & primary education), *efficiency enhancers* (higher education and training, goods and market efficiency, labour market efficiency, financial market sophistication, technological readiness, market size) and *innovation and sophistication factors* (business sophistication and innovation). Hence, the policy makers have to ensure that these basic requirements are provided within the macroeconomic policy frame. The State also has an additional task of providing policy environment to firms that is conducive for enhancing their efficiency and attaining technological and managerial sophistication. In brief, the gains in terms of productivity, efficiency and competitiveness, have to percolate across sectors, regions and income groups so as to enhance the social welfare. The cross-country comparison

[2] In this study, we have used the word 'estimation' in a rather loose sense and it connotes measurement through both parametric and non-parametric methods.

[3] Decision making units are generally firms, but the concept of competitiveness is also applied at industry levels across countries and across countries in the global markets.

shows that India is far lower in terms of GCI rank (GCIR) and GCI score (GCIS) as compared with the other Emerging Market Economies (EMEs). India's GCIR is 49 among 133 countries and the GCIS is 4.3 in the 7 point scale.[4] In terms of the efficiency enhancers sub-index, which includes pillars critical for countries in the efficiency-driven stage, India stands at 33rd place among 134 countries.

Though the study highlights some aspects of competitiveness, it primarily focuses on productivity and efficiency of '*manufacturing sector*' for the following reasons. *First*, manufacturing/industrial sector has received much attention of the policy makers in India in terms of financial allocations in planning process. *Second*, during the process of transition (*i.e.*, when growth of an economy is being driven by manufacturing and tertiary sectors rather than by the primary sector), manufacturing sector is known to generate employment for both unskilled and skilled labour and the employment potential of manufacturing sector is higher as compared to that of the tertiary sector. *Third*, the growth of manufacturing sector is also necessary for the overall growth of the economy, as it can supply inputs and provide market to other sectors. *Lastly*, we also view that the solution to the agrarian crisis will also be found in the growth of output and employment of manufacturing sector.

The motivation for this study was derived from the fact that the Reserve Bank of India has displayed a keen interest in the arena of productivity trends in the Indian economy (Reddy, 2005). Unlike many other countries, India has not witnessed a stylised sectoral growth process during her developmental process. India's service sector led growth in the recent years has been viewed with some apprehension in terms of fostering inequalities across regions and sections of population. Concerns have also been raised about the widening regional and sectoral dispersion of growth

[4] The United States has the second highest score of 5.59 and Burundi had the lowest score of 2.58. The GCIR and GCRS (separated by commas) for some of the emerging economies are provided in brackets: China (29, 4.74), Malaysia (24, 4.87), South Korea (19, 5.00), Taiwan (12, 5.20), Israel (27, 4.80), South Africa (45, 4.34) and Thailand (36, 4.56). Refer World Economic Forum (2009) for more details.

(Ahluwalia, 2000) and jobless growth in the context of economic reform process that gathered momentum in the early nineties.

The objectives of this study are as follows: (i) To estimate productivity and efficiency both at industry[5] and state[6] levels for India's manufacturing sector; and, (ii) To examine the path of efficiency and productivity in the context of economic reforms undertaken by the Indian manufacturing sector; (iii) To provide a comparative view of the performance in organised and unorganised sectors of India's manufacturing sector and, (iv) To identify the determinants of growth and productivity of the Indian manufacturing sector.

The remainder of this study is organised as follows. Section 2 provides some stylised facts about India's manufacturing sector. Section 3 provides a synoptic review of the literature pertaining to efficiency and productivity of India's manufacturing sector. Section 4 presents the details of the coverage of the study, methodology and data used in the study. Section 5 presents the estimates of productivity growth and efficiency obtained by the various methodologies for the different datasets. Section 6 provides the overall view of the results obtained in the study in a holistic perspective and policy implications emanating from the previous sections of the study.

[5] See footnote 2.

[6] See footnote 1.

2. Stylised Facts

The share of manufacturing sector in India's real GDP has risen over the years. However, this increase has not matched the expectations for two main reasons. *First*, the expectations from manufacturing sector were high due to the emphasis on heavy industries led development in the planning process in India; and, *second*, the countries with similar levels of development on the eve of planning in India, especially the East-Asian Economies including China, have been able to make their presence felt in the global market for manufacturing products to a far greater extent than India.

In Box 2.1, we provide the description of concepts and definitions used in the context of disaggregated data in India's manufacturing sector.

Box 2.1: Classification of Manufacturing Sector in India

The manufacturing sector covers all manufacturing, processing and repair & maintenance services units irrespective of their employment size, investment and location. The first classification of the manufacturing sector is into two broad sub-sectors: (i) registered or organised; and, (ii) unregistered or unorganised. The data on manufacturing in the organised sector is collected through Annual Survey of Industries (ASI), annually, whereas, the data on unorganised sector is collected by National Sample Survey Organisation (NSSO).

Registered (Organised) manufacturing sector: The registered manufacturing sector includes all factories covered under sections 2m (i) and 2m (ii) of the Indian Factories Act (IFA), 1948 which refers to the factories employing 10 or more workers and using power or those employing 20 or more workers but not using power on any day of the preceding 12 months (for the entire country except the states of Arunachal Pradesh, Mizoram, and Sikkim and Union Territory of Lakshadweep). It also includes Bidi and Cigar establishments registered under Bidi and Cigar Workers (Condition of Employment) Act, 1966 with the same employment and use of power criteria as mentioned above. All electricity undertakings engaged in generation, transmission and distribution of electricity registered with the Central Electricity Authority (CEA) were covered under ASI irrespective of their employment size, until 1997-98. Since 1998-99, the electricity units registered with the CEA and the departmental units such as railway workshops, RTC workshops, GOVT. MINTS, sanitary, water supply, gas storage, *etc.* are not covered under ASI.

Unregistered (Unorganised) manufacturing sector: The unregistered manufacturing sub-sector, a complement set to the registered manufacturing sub-sector, covers all the residual units which are not covered under the registered manufacturing

sector. Thus, the unregistered manufacturing sector covers all the manufacturing, processing, repair & maintenance services units employing less than 10 workers and using power or less than 20 workers and not using power. The data on unorganised sector is collected through periodic surveys by the NSSO. Further classification of the unorganised sector is as indicated below.

1. ***Own Account Manufacturing Enterprise (OAME):*** These enterprises are engaged in manufacturing and/or repairing activities and are run without any hired worker employed on a regular basis.

2. ***Establishment:*** An establishment employs at least one hired worker on a fairly regular basis. Paid or unpaid apprentices, paid household member/servant/resident worker in an enterprise are considered hired workers. Establishments are further categorised into two types: non-directory and directory manufacturing establishments.

   2.1 Non-directory Manufacturing Establishment (NDME): It is an establishment engaged in manufacturing and/or repairing activities and employs less than six workers (household and hired workers taken together).

   2.2 Directory Manufacturing Establishment (DME): A directory establishment engaged in manufacturing and/or repairing activities employs six or more workers (household and hired workers taken together).

Source: http://mospi.gov.in/mospi_asi.htm (for ASI coverage)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=nad09_2007&type=NSSO (for NAS coverage)
http://mospi.nic.in/rept%20_%20pubn/ftest.asp?rept_id=524&type=NSSO (for unorganised manufacturing coverage)

2.1 Contribution of Manufacturing Sector to Real GDP

In Table 2.1, we provide a synoptic view of the importance of the manufacturing sector and its two components, *viz.*, registered and unregistered manufacturing in India's real GDP. It can be seen from Table 2.1 that the average share of manufacturing sector in real GDP increased from about 13 per cent during 1970-75 to about 15.1 per cent during 2002-07, *i.e.*, approximately by just about 2 percentage points over a period of more than three decades. Even in the year 2009-10, the share of manufacturing sector in India's real GDP is just about 16.1 percent.

During 1970-75, India's real GDP of manufacturing sector was more or less equally distributed between its registered and unregistered segments. Over the years, the growth of real income in the registered manufacturing has been higher than that of unregistered manufacturing sector, resulting

Table 2.1: Contribution of Manufacturing Sector to India's Real GDP

	Average GDP (in Rupees Crore at 1999-2000 Constant Prices)		
Period	Average GDP of Manufacturing Sector	Average GDP of Registered Manufacturing Sector	Average GDP of Unregistered Manufacturing Sector
1970-75	64405	33545	30786
	(13.2)	(6.9)	(6.3)
1975-80	81744	42547	39108
	(13.9)	(7.2)	(6.6)
1980-85	101412	55571	45841
	(14.3)	(7.8)	(6.5)
1985-90	133812	79756	54056
	(14.7)	(8.7)	(6.0)
1990-95	171233	109247	61987
	(14.6)	(9.3)	(5.3)
1995-2000	248504	162847	85657
	(15.7)	(10.3)	(5.4)
2000-05	316307	212370	103938
	(15.1)	(10.1)	(5.0)
2001-06	338105	228619	109486
	(15.0)	(10.2)	(4.9)
2002-07	367898	249583	118315
	(15.1)	(10.3)	(4.9)
2008-09	(15.6)	(10.4)	(5.2)

Note: Figures in parentheses are % share of the respective sector in the Real GDP (1999-2000 prices), except for 2008-09. For this year, figures are based on GDP at 2004-05 constant prices.

Source: http://www.mospi.nic.in/mospi_cso_rept_pubn.htm, National Accounts Statistics – Back series 1950-51 to 1999-2000 and http://www.mospi.nic.in/mospi

in the average contribution of the unregistered sector shrinking to almost half of that of the registered sector during 2002-07. The situation has remained more or less unchanged even during the post 2007 period.

Kochhar *et al* (2006) demonstrate that given the per capita GDP and size of India, the share of manufacturing sector in GDP was in conformity with the stylised growth pattern of other countries. According to them, manufacturing sector in India underperformed since 1981 and this perception about its underperformance is also due to its comparison with China[7]. China was a significant positive outlier (*i.e.*, China's manufacturing

[7] The share of manufacturing sector in China's GDP was 34 per cent in 2007, as compared with 16.1 per cent for India in 2009-10.

sector contributed more to its national income as compared with the historical evidence on countries of similar levels of development) in 1981. To put it differently, India had approximately the normal share of output and employment in manufacturing in 1981, if compared with countries at a similar level of development and size. Over the next two decades, (when reforms were implemented, so as to remove the constraints on manufacturing sector), it failed to keep pace with the growth of manufacturing sector in other countries with similar levels of development. This is not to deny the fact that India has done reasonably well as compared to its own past performance.

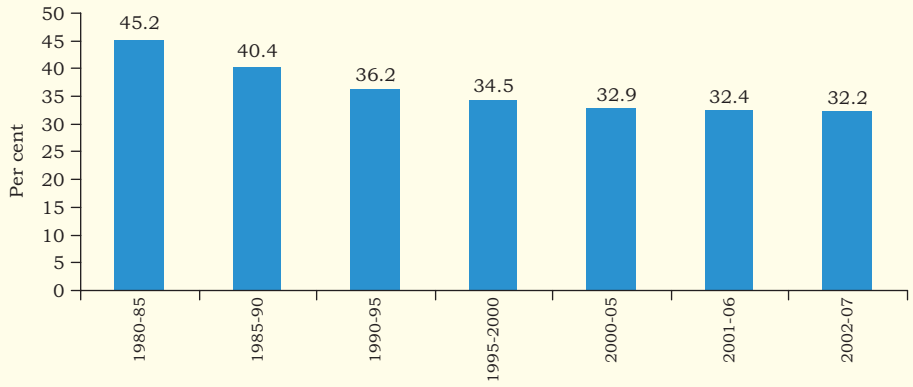
The composition of India's manufacturing sector is also crucial from the point of view of intra-sectoral equity. In Figure 2.1, we provide the proportion of real GDP originating in unregistered manufacturing in the total manufacturing sector.

The unorganised manufacturing sector accounts for about 80 percent of the employment generated in manufacturing sector. However, its contribution to the income generation or to real GDP of manufacturing (as seen in Figure 2.1) is much less in proportion to its employment generation. Furthermore, the relative income contribution of the unregistered sector *vis-à-vis* registered sector in manufacturing has been consistently declining over the years. In the first half of the eighties, this share was approximately 45 per cent and it has fallen to about 32 per cent during 2002-07. Even in 2008-09, the share of unorganised sector in real GDP of manufacturing sector was about 33.2 percent. In brief, the income originating in unregistered segment of India's manufacturing sector is much lower than the proportion of workforce it supports. This has implications for the differences in labour productivity in registered and unregistered segments of India's manufacturing sector.

2.2 Contribution of Manufacturing Sector to Employment

A vast body of literature has accumulated over the problem of lack of tandem between income and employment generation across various sectors in India. Though the composition of GDP in India has undergone

Figure 2.1: Average Share of Unregistered Manufacturing in Real GDP of Manufacturing Sector



Source: Calculated from the data sourced from the various issues of the NAS (CSO).

substantial changes over the years, the dependence of workforce on manufacturing sector has hardly increased. Historically, during the transition process, manufacturing sector has been the main absorber of mass unskilled labour that gets released from agricultural sector. Unlike the East Asian economies, India failed to draw employment from agriculture into manufacturing in any significant magnitude (Kochhar *et al*, 2006).

In Table 2.2, we provide the data on employment generation in the industrial sector of India which includes manufacturing sector. In the year 2000, agriculture in India accounted for almost 60 per cent of total employment which is the highest in comparison to the countries listed in the Table. It is even higher than the respective figure for the lower middle income countries. Industry accounted for just about 18 per cent of total employment, which means the contribution of manufacturing to employment generation is even lower. Though, in the case of India, services sector has been able to absorb much more labour than the manufacturing sector, labour absorption by this sector is lowest as compared to other countries and it is almost similar to that witnessed by the low income

Table 2.2 Sectoral Employment as % of Total Employment

Country/ Countries	Agriculture			Industry			Services		
	1980	2000	2007	1980	2000	2007	1980	2000	2007
India	68.1	59.3	50.2*	13.9	18.2	20.4*	18.6	22.4	29.4*
Brazil *	29.3	24.2	19.0	24.7	19.3	21.0	46.1	56.5	59.0
China	68.7	46.9	44.0	18.2	23.0	18.0	11.7	29.9	16.0
Indonesia	55.9	45.3	41.0	13.2	17.3	19.0	30.2	37.3	40.0
Korea	34.0	10.9	7.0	29.0	28.0	26.0	37.0	61.0	67.0
Malaysia	37.2	18.4	15.0	24.1	32.2	29.0	38.7	49.5	57.0
Mexico	23.5	17.5	14.0	26.5	26.9	26.0	49.0	55.2	60.0
Thailand	70.8	48.8	42.0	10.3	19.0	21.0	18.9	32.2	37.0
Turkey	43.0	34.5	26.0	34.9	24.5	26.0	22.1	40.9	48.0
Low income	74.6	64.5	n.a	8.7	12.3	n.a	16.5	23.2	n.a
Lower middle income	64.0	43.2	n.a	18.5	18.5	n.a	16.4	38.3	n.a

Source: Kochhar et al (2006) and www.worldbank.database.org.
Note: For Brazil, the latest data available is for 2006 and for Turkey it is for 2008 and these have been reported in the Table instead of data for 2007.
* Based on Current Daily Status (2006-07).

countries. In brief, the manufacturing sector in India has failed to generate adequate employment in general and in organised manufacturing sector in particular. This implies inequalities in inter-sectoral and intra-sectoral distribution of purchasing power.

In Table 2.3, we present a synoptic view of the employment generation in India's unorganised sector *vis-à-vis* that in the organised sector.

It can be seen from Table 2.3 that the contribution of unorganised sector in employment generation in manufacturing sector hovers around 80 per cent or so. In other words, the share of organised sector in total employment generation of manufacturing sector is just about one-fifth. This, when put together with the data reported in Table 2.1, indicates that only about 32 per cent of income of the total manufacturing sector was generated in the unorganised sector, which employs almost 80 per cent of labour of the manufacturing sector. In other words, we see not only the disproportion between income and employment generation across sectors, but also within the manufacturing sector, *i.e.*, between its organised and unorganised segments. Moreover, we also observe from Table 2.3 that economically

Table 2.3 Employment in Unorganised Sector *vis-à-vis* Organised Manufacturing Sector in India

State/Country	Employment in Unorganised sector as a % of Total Employment in Manufacturing Sector			
	1989-90	1994-95	2000-01	2005-06
Andhra Pradesh	79.4	70.4	78.4	75.9
Bihar	85.3	88.0	91.1	91.8
Delhi	79.7	80.5	88.4	79.1
Gujarat	70.0	69.9	66.4	69.6
Haryana	63.3	52.1	58.3	60.5
Karnataka	96.8	94.0	81.1	78.1
Kerala	83.8	65.7	77.4	81.4
Madhya Pradesh	76.3	74.4	84.7	87.2
Maharashtra	67.3	64.6	71.7	71.4
Orissa	93.7	94.1	94.5	93.3
Punjab	59.6	55.2	67.5	60.6
Rajasthan	83.2	76.0	83.2	82.8
Tamil Nadu	78.0	71.2	75.2	72.7
Uttar Pradesh	86.6	88.4	91.2	89.5
West Bengal	89.2	85.4	91.1	91.4
India (excluding J. & K.)	80.9	78.2	82.3	81.2
Total employment ('00)	432383	423611	450685	448964

Source: Based on the data from the 45th, 51st, 56th and 62nd rounds of NSS (for unorganised manufacturing sector) and from ASI (for the organised manufacturing sector).

backward states have much higher proportion of employment in unorganised manufacturing in comparison to that in the organised manufacturing.

2.3 Growth of India's Organised Manufacturing Sector: A Profile

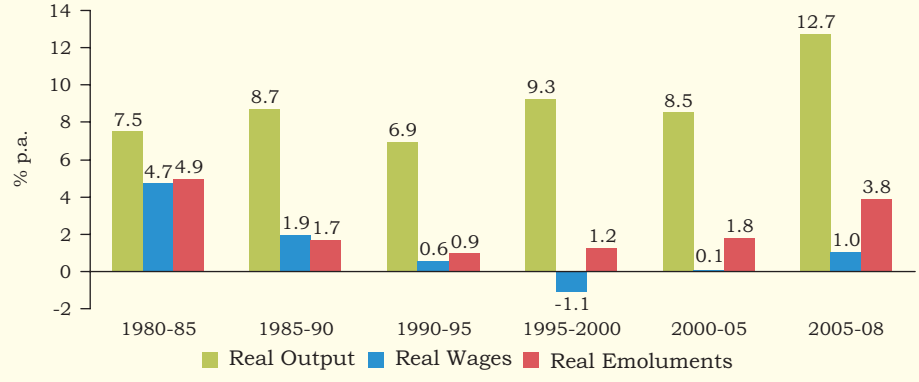
In this sub-section, we highlight various dimensions of growth of India's organised manufacturing sector. In Figure 2.2, we plot the average growth rates of real output, real wages and real emoluments[8] in India's organised manufacturing sector.

It can be seen from the Figure 2.2 that average growth of output of the organised manufacturing sector during the various quinquennia

[8] Nominal output has been deflated by the WPI for manufacturing sector in order to obtain real output, whereas, nominal wages and emoluments have been deflated by CPI for industrial workers, CPIiw (brought to the base 1980-81, using the data on inflation as measured for the CPIiw, from the various series with different base years) for conversions of nominal wages and employments into their real counterparts.

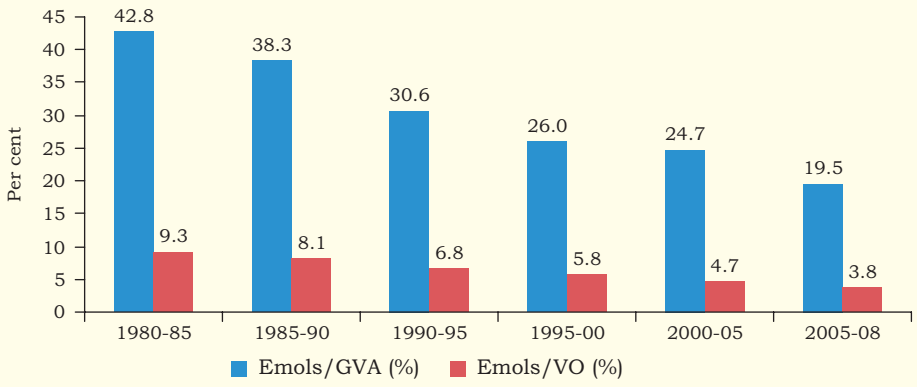
spanning from 1980-85 to 2005-08 ranged between 6.9 and 12.7 pcpa. The growth performance of the manufacturing sector had been rather impressive since the eighties itself. The pro-business policies of the eighties, according to Rodrik and Subramanian (2004), were responsible for a markedly improved growth performance of the Indian economy during the eighties as compared to the earlier three decades. There does not seem to be a statistically significant 'improvement' in the growth performance of the Indian manufacturing sector in the early nineties, *i.e.*, after the initiation of the next bout of economic reforms. Nonetheless, the growth momentum of the eighties has been 'maintained' during the pro-market reforms of the nineties. It can be seen from Figure 2.2 that the growth performance of manufacturing sector has indeed been impressive in the last three years. Hashim, et al (2009) argue that the major liberalization undertaken during 1990s led to structural transformation of the Indian economy. Therefore, the enormity of change associated with transition from old inefficient structure to a new globally more efficient structure was characterised initially by a slowdown in GDP growth in sectors undergoing such transition.

Figure 2.2: Average Growth of Real Wages, Real Emoluments and Real Ouptut



Source: Calculated using the ASI data.

Figure 2.3: Average Ratio of Emoluments (Emols) in Gross Value Added (GVA) and Value of Output (V/O)

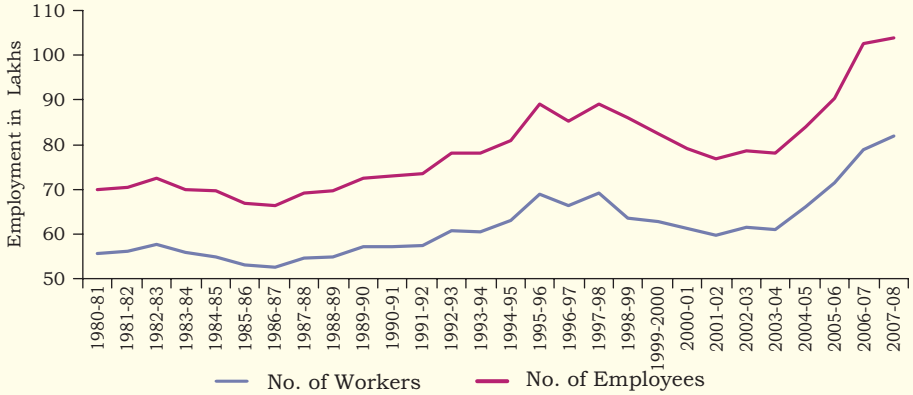


Source: Calculated using the ASI data.

Figure 2.3 indicates that the ratio of emoluments to both gross value added and value of output has registered a consistent decline since the eighties. In the first half of the eighties, the average ratio of emoluments to gross value added (value of output) was about 43 (9.3) per cent which declined to about 25 (4.7) per cent during 2000-05 period. This has further gone down to 19.5 (3.8) percent during 2005-08 period, despite an impressive growth performance of the economy. In other words, the ratio of wages and emoluments in income generated in organised manufacturing has shrunk over the years.

Figure 2.4 highlights the employment situation in the organised manufacturing sector of India. As can be seen from Figure 2.4, almost up to 1986-87, employment in organised sector witnessed a declining trend. After that almost for the next ten years, employment trend was positive. Thereafter, again we see a period of not only jobless but job loss growth. This situation has been arrested in the earlier years of the next decade and the latter half of the next decade presents an impressive performance on the employment front.

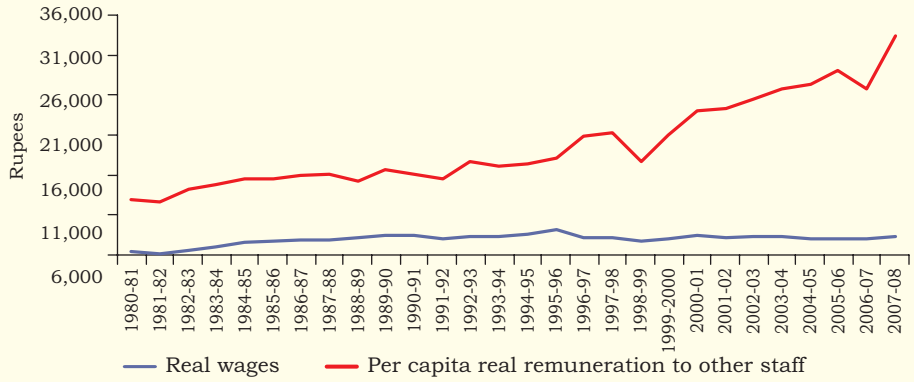
Figure 2.4: Employment in India's Organised Manufacturing Sector (in Lakhs)



Source: Calculated using the ASI data.

One of the areas of concern regarding the reform process in Indian manufacturing sector has been the deceleration in the rate of growth of real emoluments (see Figure 2.2). Growth of real emoluments has been shrinking over the years and it was in fact negative during the latter half of the nineties. However, we see a revival in the same since the mid-nineties and a 'U' shaped pattern in the growth of real emoluments can be seen in Figure 2.2. Emoluments consist of wages to the shop-floor workers (skilled and unskilled) and compensation to the 'other supporting staff', including the managerial staff. However, the worrisome feature of Indian manufacturing sector is stagnancy of per capita real wages. In Figure 2.5, we plot the per capita real wages and per capita real remuneration to staff other than workers. It can be seen that the growth rate of compensation to supporting staff has increased since the late nineties, in relation to the workers directly engaged in production process. This can have an adverse effect on the motivation for the shop-floor workers. It also explains as to why most of the engineering graduates do not prefer to pursue their engineering skills on the shop-floor and instead prefer to take up managerial positions. It is necessary for manufacturing

Figure 2.5: Per capita Real Wage and Remuneration in Organised Manufacturing sector



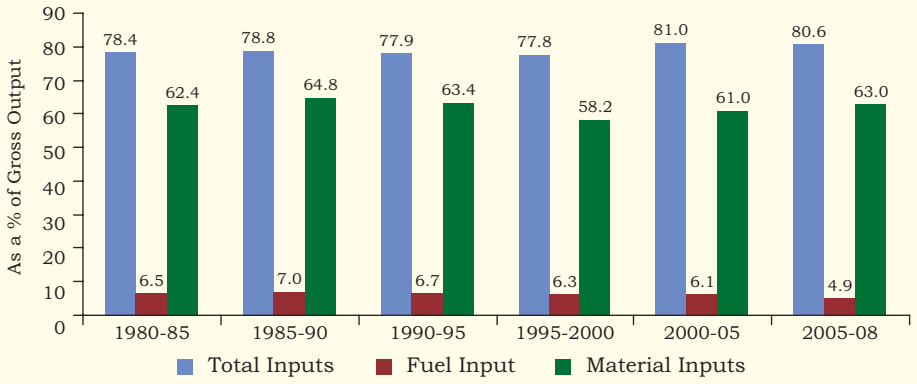
Source: Calculated using the ASI data.

Note: Nominal wages and emoluments have been deflated by CPI for industrial workers, CPIiw (brought to the base 1980-81, using the information of inflation as measured for the CPIiw, from the various series with different base years) for conversions into their real counterparts.

sector to retain technologists who are engaged in production process and for this the real per capita incomes to technologists have to move in tandem with those for the other managerial staff. Productivity increases depend both on technology as well as managerial improvements and we can ill-afford to neglect either of these.

Another concern pertaining to India's manufacturing sector has environmental point of view, *i.e.*, the growth of manufacturing sector has been material resource intensive. Figure 2.6 highlights this phenomenon. Total value added constitutes barely 20 per cent of the value of output in India's organised manufacturing sector. The ratio of material inputs to total value of output has ranged between 58 and 65 per cent and the respective range for the fuel inputs is between 6 and 7 per cent. If we compare it with the resource intensity in the United States (see Figure 2.7), the proportion of value added in gross output is about half as compared to about one fifth in India. Material inputs account for about two-thirds of value of output in India in comparison to just about

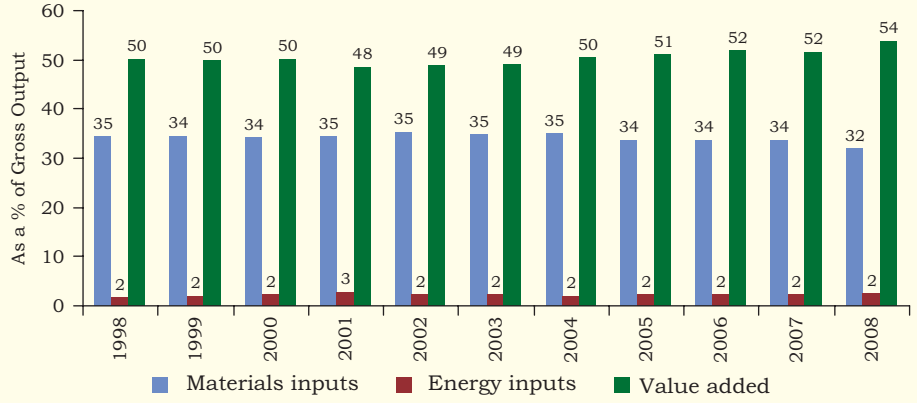
Figure 2.6: Resource Intensity of India's Organised Manufacturing Sector



Source: Calculated using the ASI data.

one-third in the United States. Fuel inputs account for about 5 to 7 percent of value of output in India as compared to merely 2 percent in the United States. For Germany, the average ratio of value added to

Figure 2.7: Resource Intensity Manufacturing Sector of the US



Source: Calculated using data from http://www.bea.gov/industry/gpotables/gpo_action.cfm.

gross output was about one-third during 1998-2007, *i.e.*, for the last 10 years for which the data are available[9]. It is true that the composition of the manufacturing sector of the US or Germany and that of India are quite different. However, if the Indian manufacturing sector is not able to add as much value to the intermediate inputs, as is done by the other countries, it will need restructuring in order to be globally competitive. In other words, there is scope for improving efficiency and productivity in Indian manufacturing sector, if we have to benchmark India with the globally competitive advanced nations. Even in China, the average ratio of value added to gross output of the industrial sector during 1998-2007 was about 29 per cent (China Statistical Yearbook, 2009), In other words, benchmarking against the most competitive economies is mandated, if we need to compete with the manufacturing giants in this era of globalization.

In this study, we have selected six major industry groups (listed in Table 2.4) across the eighteen states of India (these include the three states which were created in the year 2000). In Table 2.4 and 2.5, we provide the relative positions of the various industries and states in India's organised manufacturing sector. It may be mentioned here at the outset that we have been able to do the aggregate country level analysis in this study for the period 1980-81 to 2007-08. However, for the state by industry analysis of organised manufacturing sector, the time-span of the study is 1980-81 to 2003-04 and we have used the ASI 2-3 digit level data. We also procured the unit level data from ASI for the time-span 1993-94 to 2003-04 and estimated productivity for this dataset as well[10]. For the company level data obtained from the RBI, we have been able to do industry level analysis from 1993-94 up to 2004-05.

It can be seen from Table 2.4 that 'metal' and 'machinery & transport equipment' industries are the two major industries and each

[9]Source: Calculation based on data sourced for Germany from http://www.euklems.net/
[10] For 1995-96, there is a gap in the unit level data as the ASI data was not available for this year.

Table 2.4: Shares of Selected Industries in the Organised Manufacturing Sector (2007-08)

Sr. No.	Industry	NIC 2004 code	As a % of Total Organised Manufacturing Sector					
			Fixed Capital	Persons Engaged	Emolu-ment	Total Inputs	Gross Output	Gross Value Added
1	Food and Beverages#	15 & 16	8.36	18.38	10.34	13.70	12.67	8.53
2	Chemical & Chemical Products	24	14.70	8.54	12.21	10.26	10.85	13.25
3	Leather & Leather Products	19	0.48	2.12	1.23	1.03	0.86	0.17
4	Metal & Metal Products	27 & 28	22.33	12.74	17.63	17.75	18.51	21.59
5	Machinery & Transport Equipment	29-35	14.44	17.43	26.77	19.23	19.42	20.17
6	Textiles & Textile Products	17 & 18	10.39	20.00	13.45	7.28	7.22	6.97
	SMFG (total of the above)		**70.7**	**79.2**	**81.6**	**69.2**	**69.5**	**70.7**
	MFG @		**845132**	**104525**	**105443**	**2225525**	**2775709**	**550184**

Notes: For various industries and selected industries (SMFG) as a group, the data presented are as a per cent of all India total.
@ : All variables for MFG except Persons Engaged, are in Rs. crore. Persons Engaged are in numbers.
# : We have also covered Tobacco industry in this study, wherever possible.
Source: ASI, 2004-05

one of these accounted for about one-fifth of GVA in the organised manufacturing sector. These industries are followed by the chemical industry which accounts for about 13 percent of GVA of the total organised manufacturing sector. However, in terms of job provision, these are not the topmost industries. Textiles and Food industries together account for about 38 per cent of jobs in the organised manufacturing sector. Leather industry is the least important industry from the chosen industries. We have included this industry in our analysis despite its low share in value added in organised manufacturing in India, because its contribution to export earnings has been higher than its importance in the production contribution in the organised manufacturing sector. Table 2.5 (and Tables 2.5a to 2.5f) highlights the importance of various selected manufacturing industries in the selected states. The following observations can be made regarding the ranking of the organised manufacturing sector of the various states of India (also refer to Annexure 2.1 and Annexure 2.2).

- Looking at the average contribution to the national output of organised manufacturing sector, the five topmost states (in the descending order of importance) are: Maharashtra; Gujarat; Tamil Nadu; West Bengal and UP. The five bottom states are: Delhi; Orissa; Rajasthan; Kerala and Bihar*.
- In 1980-81, Maharashtra, Gujarat, Tamil Nadu, West Bengal, and UP* ranked topmost states in terms of their contribution to value of output of organised manufacturing sector. Of these states, Maharashtra, Gujarat, Tamil Nadu and West Bengal together accounted for more than 50 per cent of value of output of India's organised manufacturing sector. Orissa, Delhi, Rajasthan and Haryana were the states with lowest contribution to the output of organised manufacturing sector in India.
- Maharashtra topped in terms of output contribution in 1980-81 and the contribution of Gujarat was almost half of that of Maharashtra. However, by 2007-08, Gujarat has significantly caught up with Maharashtra in terms of its share in the output.
- In 2007-08, Maharashtra continues to be the topmost State in terms of value of output of manufacturing sector in the country. West Bengal lost its position as one of the topmost 5 states. Gujarat, Andhra Pradesh, Karnataka, Haryana and UP* improved their shares significantly in terms of output contribution in 2007-08 as compared with 1980-81 position. Growth of Hyderabad and Bengaluru's IT industry in the recent years seems to be related to the improvement of ranking of manufacturing sectors of the respective states.
- The share of Maharashtra, West Bengal, Bihar*, UP*, MP* in total employment in organised manufacturing declined over the period 1980-81 to 2007-08. As against this, the relative contributions of employment of Tamil Nadu, Gujarat, AP, Karnataka, Punjab, Haryana and Rajasthan increased over this period.

- As regards industry-wise position of various states, Maharashtra, UP*, AP, Gujarat and Tamil Nadu are states that top in the production of food, beverages and tobacco, whereas, Orissa, Bihar*, Delhi, Rajasthan and Haryana belong to the bottom (refer Table 2.5a).
- As regards the chemical industry, Gujarat and Maharashtra are the two major states which account for more than half of the national output of this industry. Worth noting is the fact that the relative contribution of Maharashtra to the national output of chemical industry has registered a substantial decline over the period of the study, whereas, exactly the opposite is true for Gujarat. The average contribution of Tamil Nadu, UP* and AP to output ranged between 5 to about 8 per cent (refer Table 2.5b).
- Leather industry is concentrated mainly in three states, *viz.*, Tamil Nadu, UP* and West Bengal. In 1980-81, these three states accounted for about 84 per cent of the national output of leather industry and the respective figure was 70 per cent in 2003-04. Tamil Nadu and West Bengal have registered decline in terms of their relative contributions to output of leather industry and the opposite is true for UP*. Haryana also has emerged as one of the largest producers of leather goods in the recent years (refer Table 2.5c).
- Maharashtra, MP*, Bihar* and Gujarat accounted for about 47 per cent of national output of metal industry in 2003-04. The other major metal producing states are Tamil Nadu, UP*, West Bengal, and AP (refer Table 2.1d).
- Machinery and Transport Equipment industry is located mainly in Maharashtra, Tamil Nadu, Haryana, UP*, Karnataka and Gujarat. Of these states, only Maharashtra's relative contribution to national output of this industry has declined, whereas, reverse is true for all the other states. Notable among these are Haryana, UP* and Karnataka (refer Table 2.5e).

- The leading states (in descending order of importance) in the case of production of textiles industry during the period of study have been Tamil Nadu, Maharashtra, Gujarat, Punjab and Rajasthan. In 1980-81, the leading states were Maharashtra, Gujarat, West Bengal, Tamil Nadu and Punjab. By 2003-04, Maharashtra lost its first position to Tamil Nadu and West Bengal did not remain one of the five topmost states. Gujarat and Punjab retained their second and fifth positions respectively, whereas, Rajasthan climbed to the fourth position.
- Two states which have performed poorly in terms of manufacturing production in all industries are Bihar* and West Bengal. Both these states slipped down by 5 notches in 2003-04 as compared with their ranking in 1980-81. Two states which performed well consistently in all industries are Haryana and UP*. The ascent of Haryana is notable. It has moved from the rank 12 to the rank 7 as regards overall manufacturing output. Though Maharashtra has retained its top position, this is mainly due to its significantly larger production compared to other states in 1980-81 (refer Annexure 2.1).
- Maharashtra, West Bengal, Tamil Nadu, Gujarat UP* and Andhra Pradesh were the topmost states in terms of employment generation in 1980-81. By 2003-04, West Bengal did not occupy its place in one of the five topmost states. Andhra Pradesh caught up as the third topmost employment generating states. Maharashtra lost its first rank to Tamil Nadu. Gujarat and UP* retained their fourth and fifth positions, respectively.
- The fall in positions of Bihar* and West Bengal in terms of employment generation in manufacturing sector has been significant and it is true for all industries. As against this, the rise of Haryana's manufacturing sector as employment provider is laudable. In brief, Bihar* and West Bengal have performed poorly on both employment and output counts, whereas, opposite is true in the case of Haryana (refer Annexure 2.2).

Table 2.5: Profile of Organised Manufacturing Sector across Various States of India

Employment in Various States as a % of Total Employment

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	8.0	4.3	1.5	8.7	2.1	4.7	3.2	16.4	3.5	1.3	2.6	1.9	9.3	8.4	11.8	87.8
2007-08	10.0	0.7	1.2	10.0	4.9	6.9	3.4	13.0	2.4	1.8	5.3	3.5	14.8	7.2	4.9	90.0
Average	9.0	2.5	1.4	9.4	3.5	5.8	3.3	14.7	3.0	1.5	3.9	2.7	12.1	7.8	8.4	88.9

Emoluments in Various States as a % of Total Emoluments

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	4.9	5.1	1.5	7.9	2.0	4.1	2.3	21.2	3.6	1.6	1.8	1.8	8.4	5.8	14.5	86.5
2007-08	7.4	0.3	1.3	10.5	5.2	7.9	2.2	19.5	2.4	2.4	3.6	2.6	11.6	6.5	4.8	88.2
Average	6.2	2.7	1.4	9.2	3.6	6.0	2.2	20.3	3.0	2.0	2.7	2.2	10.0	6.1	9.7	87.3

Total Inputs Used in Various States as a % of Total Inputs Used

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	5.1	4.7	2.1	11.7	2.9	3.8	3.4	22.2	3.5	1.6	4.1	2.3	10.6	5.8	9.1	92.9
2007-08	6.6	0.9	1.0	16.8	4.7	6.5	2.2	17.9	2.8	1.5	3.6	2.8	9.8	7.4	4.2	88.6
Average	5.8	2.8	1.6	14.2	3.8	5.2	2.8	20.0	3.2	1.5	3.9	2.5	10.2	6.6	6.6	90.7

Value of Output of Various States as a % of Total Output

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	4.9	4.6	1.9	11.1	2.8	3.9	3.2	22.1	3.7	1.6	3.7	2.2	10.2	5.7	9.3	91.2
2007-08	6.6	0.8	1.0	16.1	4.5	6.6	2.0	18.7	2.8	1.7	3.5	2.8	9.6	7.0	3.9	87.6
Average	5.7	2.7	1.4	13.6	3.6	5.3	2.6	20.4	3.3	1.7	3.6	2.5	9.9	6.3	6.6	89.4

Note: See list of abbreviations for the full name of the state.

Source: Calculated from the various issues of Annual Survey of Industries.

Table 2.5a: Profile of Food, Beverages and Tobacco Industry Across Various States of India

Employment in Various States as a % of Total Employment

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	22.0	3.7	0.6	5.2	1.2	5.8	7.8	12.9	3.2	0.8	2.9	1.1	9.4	17.6	4.6	98.7
2003-04	26.4	1.2	0.5	3.8	2.2	4.5	10.3	13.5	3.2	1.6	4.6	1.2	7.7	9.3	4.3	94.2
Average	26.2	1.8	0.6	4.8	2.1	4.3	7.9	12.2	3.5	1.0	4.1	1.1	8.4	12.6	4.3	94.9

Emoluments in Various States as a % of Total Emoluments

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	18.9	2.9	1.4	6.0	1.3	4.9	4.7	17.1	2.1	0.5	3.6	1.1	7.8	15.3	7.0	94.6
2003-04	15.6	0.8	1.4	6.1	3.1	7.1	5.4	19.2	3.1	0.9	5.2	1.8	7.7	12.7	4.1	94.2
Average	15.9	1.8	1.5	5.9	2.5	6.2	4.8	20.1	3.3	0.8	4.9	1.6	8.0	14.5	4.1	95.8

Total Inputs Used in Various States as a % of Total Inputs Used

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	10.7	1.9	3.2	11.9	1.9	5.1	4.0	16.5	3.4	0.9	6.5	2.3	9.4	10.5	6.7	94.8
2003-04	13.0	1.0	2.0	9.9	3.2	5.6	3.6	15.0	9.0	1.2	4.9	3.3	7.5	13.5	3.7	96.1
Average	12.7	1.2	2.0	9.4	3.3	5.3	3.4	17.1	7.4	1.3	5.8	3.0	7.8	12.2	3.9	95.7

Value of Output of Various States as a % of Total Output

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	10.8	2.0	3.0	11.5	1.9	5.2	4.1	15.9	3.3	0.8	6.4	2.2	9.5	11.2	6.4	94.4
2003-04	11.9	1.1	1.9	9.4	2.8	6.4	3.6	15.1	8.1	1.1	5.2	3.1	7.4	13.7	3.7	94.3
Average	11.5	1.4	1.9	8.9	3.2	5.8	3.5	17.5	6.9	1.2	6.0	2.8	7.9	12.6	3.9	95.0

Note: See list of abbreviations for the full name of the state.

Source: Calculated from the various issues of Annual Survey of Industries.

Table 2.5b: Profile of Chemical Industry Across Various States of India

Employment in Various States as a % of Total Employment

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	6.8	4.1	1.4	14.1	1.3	3.6	3.4	26.9	2.6	1.1	1.6	1.8	15.4	5.5	8.6	98.2
2003-04	7.8	0.7	1.0	23.4	1.9	3.9	2.3	17.2	3.5	1.3	1.6	2.3	18.3	5.7	4.1	95.1
Average	6.6	2.5	1.2	19.5	1.5	3.4	3.1	20.9	3.1	1.3	1.9	1.9	18.1	6.4	5.6	97.2

Emoluments in Various States as a % of Total Emoluments

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	4.2	4.9	1.0	13.3	0.9	1.8	4.2	41.4	2.1	0.8	1.7	1.2	7.3	4.8	8.7	98.4
2003-04	5.6	0.8	0.9	26.3	1.8	4.1	3.4	26.7	2.4	1.1	2.2	1.9	8.0	5.1	2.7	92.9
Average	5.4	2.0	0.9	23.0	1.5	3.3	3.9	30.6	2.5	1.2	2.2	1.7	8.2	5.8	4.4	97.5

Total Inputs Used in Various States as a % of Total Inputs Used

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	4.6	1.9	1.6	17.7	1.3	2.8	3.8	35.2	3.1	0.8	2.2	2.1	10.0	4.5	6.4	98.0
2003-04	5.9	0.4	0.9	31.2	1.7	3.2	1.8	19.4	3.2	1.3	2.5	3.4	6.3	6.2	4.7	91.9
Average	5.7	1.0	1.0	28.6	1.6	2.6	2.6	23.4	3.4	1.5	2.6	2.8	7.4	6.7	3.7	96.2

Value of Output of Various States as a % of Total Output

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	4.5	1.6	1.5	17.6	1.3	2.9	4.0	36.3	2.9	0.7	2.4	1.9	9.9	4.4	6.1	98.0
2003-04	5.9	0.4	0.8	31.8	1.6	3.2	1.7	19.5	3.1	1.0	2.3	3.2	6.0	6.2	4.5	91.1
Average	5.8	0.7	1.0	28.9	1.5	2.7	2.6	24.0	3.3	1.2	2.5	2.8	7.2	6.8	3.5	96.2

Note: See list of abbreviations for the full name of the state.

Source: Calculated from the various issues of Annual Survey of Industries.

Table 2.5c: Profile of Leather Industry Across Various States of India

Employment in Various States as a % of Total Employment

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	2.1	4.3	0.5	1.0	0.2	0.8	0.0	3.1	1.6	0.1	1.7	0.5	38.2	17.7	27.2	99.1
2003-04	1.0	1.2	3.0	0.4	5.1	2.0	1.0	1.8	1.5	0.0	3.7	2.2	40.0	25.1	10.2	98.1
Average	2.2	2.3	1.8	0.7	3.4	3.8	0.7	3.1	1.9	0.1	2.9	0.8	47.1	16.6	11.2	98.6

Emoluments in Various States as a % of Total Emoluments

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	1.0	5.5	0.6	0.5	0.2	0.5	0.0	3.0	1.5	0.0	1.4	0.4	33.7	12.8	37.5	98.5
2003-04	0.6	2.3	3.4	0.4	6.5	2.0	1.6	1.9	3.3	0.0	3.6	2.1	33.3	19.9	17.5	98.2
Average	1.3	3.0	2.7	0.7	5.3	3.5	1.2	3.9	3.1	0.1	3.3	1.1	40.0	14.6	15.1	98.5

Total Inputs Used in Various States as a % of Total Inputs Used

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	1.4	3.7	0.5	0.5	0.4	0.7	0.0	4.2	2.5	0.0	1.7	0.5	51.8	13.7	18.3	100.0
2003-04	0.5	0.5	4.1	0.1	5.8	1.4	2.9	2.0	4.0	0.0	3.4	0.4	39.6	19.5	12.5	96.6
Average	1.4	1.3	4.4	0.5	4.8	3.7	2.4	2.8	3.8	0.0	3.0	0.4	44.2	15.6	10.1	98.8

Value of Output of Various States as a % of Total Output

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	1.5	3.9	0.6	0.5	0.5	0.7	0.0	4.0	2.2	0.0	1.7	0.5	50.4	13.4	20.0	99.9
2003-04	0.5	0.6	4.1	0.0	6.8	1.5	2.8	2.1	3.8	0.0	3.4	0.4	38.3	20.0	12.0	96.4
Average	1.3	1.3	4.4	0.3	5.2	3.7	2.5	3.0	3.7	0.0	3.0	0.5	43.4	15.8	10.1	98.6

Note: See list of abbreviations for the full name of the state.

Source: Calculated from the various issues of Annual Survey of Industries.

Table 2.5d: Profile of Metal Industry Across Various States of India

Employment in Various States as a % of Total Employment

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	3.7	13.6	1.6	5.2	3.3	4.1	0.9	16.7	6.6	4.6	4.8	1.9	6.5	6.0	19.6	99.1
2003-04	5.6	9.3	1.1	7.5	3.1	3.8	1.1	14.7	9.2	6.0	4.8	2.3	9.4	8.2	10.8	96.8
Average	5.4	12.9	1.4	6.4	3.1	4.3	1.0	14.7	8.9	5.3	4.6	2.3	7.0	6.1	14.9	98.3

Emoluments in Various States as a % of Total Emoluments

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	1.7	18.1	0.8	2.9	2.2	3.7	0.9	18.3	9.2	7.1	2.5	1.7	4.8	4.2	21.6	99.6
2003-04	6.4	17.1	0.6	3.7	2.0	3.3	0.8	13.0	14.9	10.1	2.0	1.4	8.3	4.4	10.5	98.5
Average	5.5	17.9	0.7	3.8	2.0	3.9	0.9	15.0	12.6	7.7	2.3	1.8	6.6	4.4	13.6	99.0

Total Inputs Used in Various States as a % of Total Inputs Used

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	2.5	13.0	1.9	5.4	4.4	4.1	0.9	19.7	7.5	6.1	6.4	2.3	4.8	6.2	14.1	99.2
2003-04	5.4	6.8	0.7	8.9	5.0	4.0	0.8	19.2	8.6	4.8	5.0	2.5	6.7	6.8	7.0	92.2
Average	5.9	10.2	1.2	8.2	4.6	4.2	0.8	17.2	9.2	5.1	5.3	2.8	6.2	6.8	8.2	97.4

Value of Output of Various States as a % of Total Output

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	2.5	13.1	1.7	4.9	4.2	4.2	0.9	19.8	9.1	6.2	5.7	2.4	4.8	5.8	14.2	99.3
2003-04	6.1	9.0	0.7	8.3	4.6	4.4	0.7	17.9	9.8	5.5	4.2	2.3	6.2	6.6	6.9	93.1
Average	6.1	12.5	1.1	7.7	4.1	4.2	0.8	16.4	10.2	5.7	4.7	2.6	5.8	6.7	7.9	97.6

Note: See list of abbreviations for the full name of the state.

Source: Calculated from the various issues of Annual Survey of Industries.

Table 2.5e: Profile of Machinery & Transport Equipment Industry Across Various States of India

Employment in Various States as a % of Total Employment

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	5.1	3.9	2.4	6.5	4.2	6.5	1.4	22.9	3.0	0.3	3.9	2.6	11.8	7.7	16.8	98.9
2003-04	6.1	2.0	1.8	8.0	9.4	9.0	1.5	20.0	3.4	0.3	5.8	1.9	13.3	8.6	4.9	95.9
Average	5.6	3.7	2.5	7.3	6.4	7.7	1.4	20.4	3.3	0.4	5.1	2.2	13.0	8.8	10.5	98.2

Emoluments in Various States as a % of Total Emoluments

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	5.3	4.6	1.7	4.4	3.5	7.2	1.5	27.2	2.9	0.3	2.1	2.4	11.7	6.9	17.6	99.2
2003-04	5.6	2.6	1.0	5.3	10.5	11.0	1.5	25.6	3.2	0.2	3.1	1.4	13.3	8.7	4.3	97.3
Average	5.6	3.5	1.8	5.2	7.7	8.2	1.5	27.2	3.3	0.2	3.2	1.8	12.0	8.2	7.6	98.3

Total Inputs Used in Various States as a % of Total Inputs Used

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	4.9	4.5	2.8	5.9	5.8	6.1	1.4	27.8	3.0	0.5	4.6	2.1	13.1	6.4	10.4	99.5
2003-04	3.3	2.1	1.3	6.0	14.5	9.2	0.6	23.7	2.7	0.2	3.4	1.4	13.3	11.0	2.0	94.9
Average	3.7	2.6	2.1	6.7	11.8	7.6	0.8	25.6	3.2	0.3	4.4	1.6	12.3	9.4	3.7	97.6

Value of Output of Various States as a % of Total Output

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	4.8	4.9	2.5	5.7	5.5	6.5	1.5	28.2	3.0	0.5	4.1	2.1	12.6	6.5	11.0	99.4
2003-04	3.6	2.3	1.2	5.8	14.1	9.4	0.7	22.6	2.7	0.2	3.2	1.5	13.7	10.7	2.0	93.8
Average	4.0	2.7	2.0	6.5	11.3	7.9	0.9	25.5	3.1	0.3	4.1	1.6	12.4	9.3	4.0	97.5

Note: See list of abbreviations for the full name of the state.

Source: Calculated from the various issues of Annual Survey of Industries.

Table 2.5f: Profile of Textiles Industry Across Various States of India

Employment in Various States as a % of Total Employment

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	3.9	0.8	1.9	18.5	1.6	3.8	1.6	20.1	4.7	0.7	2.8	3.0	10.8	5.6	18.8	98.5
2003-04	3.7	0.3	2.5	9.5	4.4	10.4	1.8	8.9	2.3	0.2	4.6	4.8	27.0	4.4	11.5	96.6
Average	4.5	0.6	2.0	13.8	2.3	6.0	1.7	15.3	4.1	0.8	4.5	4.3	17.4	5.4	14.5	96.8

Emoluments in Various States as a % of Total Emoluments

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	2.5	0.6	1.9	18.7	1.3	2.5	1.8	23.1	4.0	0.6	1.9	2.3	8.8	5.6	19.8	95.5
2003-04	1.9	0.1	2.0	6.7	2.8	5.6	1.1	10.2	2.0	0.1	3.0	2.9	12.7	2.8	8.8	62.8
Average	2.9	0.4	2.4	11.4	2.3	5.5	1.7	17.4	3.4	0.5	4.2	4.1	15.3	4.7	15.0	94.3

Total Inputs Used in Various States as a % of Total Inputs Used

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	3.1	0.4	2.8	20.9	2.5	2.2	1.9	22.7	2.8	0.4	6.2	3.9	9.9	4.8	10.8	95.3
2003-04	3.3	0.0	3.9	12.5	4.5	4.0	1.2	11.2	3.3	0.1	6.2	6.7	24.7	5.3	4.0	91.0
Average	3.8	0.1	4.0	14.9	3.4	3.8	1.2	14.4	3.5	0.2	7.0	6.5	19.1	4.7	4.9	92.6

Value of Output of Various States as a % of Total Output

State	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	Selected States
1980-81	3.0	0.4	2.5	20.4	2.2	2.4	1.9	23.1	3.2	0.4	5.3	3.8	10.1	4.8	12.0	95.6
2003-04	3.3	0.0	3.8	12.5	4.6	4.6	1.2	11.2	3.6	0.1	6.1	6.4	24.5	5.0	4.6	91.5
Average	3.6	0.1	4.1	14.4	3.3	4.2	1.3	14.6	3.8	0.2	6.8	6.3	19.0	4.6	5.5	92.9

Note: See list of abbreviations for the full name of the state.

Source: Calculated from the various issues of Annual Survey of Industries.

In other words, Maharashtra, Tamil Nadu, Gujarat and UP* are the states which consistently appear in the first five topmost states in terms of both output and employment generation in the organised manufacturing sector. The deterioration of Bihar* and West Bengal and the ascent of Haryana are noticeable.

2.4: Contribution of Manufacturing Sector to India's Exports

In Table 2.6, we provide the contribution of manufacturing sector to exports of the Indian economy. It can be seen from Table 2.6 that India's

Table 2.6: Composition of India's Exports (in Mn US $)

Sr No.	Commodity/Year	2000-01	2001-02	2002-03	2003-04	2007-08	2008-09	EXg
I.	**Primary products**	**7126.2** (16.0)	**7163.6** (16.3)	**8706.1** (16.5)	**9901.8** (15.5)	**27530.8** (16.9)	**25385.4** (13.7)	**15.2**
	A. Agriculture and allied products	**5973.2** (13.4)	**5901.2** (13.5)	**6710** (12.7)	**7533.1** (11.8)	**18408.2** (11.3)	**17603.0** (9.5)	**12.8**
	B. Ores and minerals (METAL)	**1153** (2.6)	**1262.4** (2.9)	**1996** (3.8)	**2368.7** (3.7)	**9122.6** (5.6)	**7782.4** (4.2)	**23.6**
II.	**Manufactured goods**	**34335.2** (77.1)	**33369.7** (76.1)	**40244.5** (76.3)	**48492.1** (76.0)	**102955.3** (63.2)	**123221.2** (66.5)	**15.3**
	C. Leather and manufactures (LEATH)	**1944.4** (4.4)	**1910.1** (4.4)	**1848.3** (3.5)	**2163** (3.4)	**3583.9** (2.2)	**3520.6** (1.9)	**6.8**
	D. Chemicals and related products (CHEM)	**5885.9** (13.2)	**6051.8** (13.8)	**7455.3** (14.1)	**9445.9** (14.8)	**21177.5** (13.0)	**22791.3** (12.3)	**16.2**
	E. Engineering goods (MTE)	**6818.6** (15.3)	**6957.8** (15.9)	**9033** (17.1)	**12405.4** (19.4)	**37305.0** (22.9)	**47250.2** (25.5)	**24.0**
	F. Textile and textile products (TEX)	**11285** (25.3)	**10206.5** (23.3)	**11617** (22.0)	**12791.5** (20.0)	**19385.6** (11.9)	**20011.9** (10.8)	**6.6**
	Sum (C to F)	**25933.9** (58.2)	**25126.2** (57.3)	**29953.6** (56.8)	**36805.8** (57.7)	**81452.0** (50.0)	**93574.0** (50.5)	**15.3**
	G. Gems and jewellery	**7384** (16.6)	**7306.3** (16.7)	**9029.9** (17.1)	**10573.3** (16.6)	**19711.4** (12.1)	**27979.5** (15.1)	**16.0**
	H. Handicrafts (excluding handmade carpets)	**661.5** (1.5)	**549** (1.3)	**785.3** (1.5)	**499.7** (0.8)	**n.a**	**n.a**	**n.a**
	I. Other manufactured goods	**355.8** (0.8)	**388.3** (0.9)	**475.6** (0.9)	**613.3** (1.0)	**1791.9** (1.1)	**1667.7** (0.9)	**18.7**
III.	**Petroleum products**	**1869.7** (4.2)	**2119.1** (4.8)	**2576.5** (4.9)	**3568.4** (5.6)	**28345.3** (17.4)	**26867.8** (14.5)	**34.5**
IV.	**Others**	**1229.2** (2.8)	**1174.3** (2.7)	**1192.3** (2.3)	**1880.3** (2.9)	**4072.6** (2.5)	**9820.6** (5.3)	**26.0**
Total Exports		**44560**	**43827**	**52719**	**63843**	**162904**	**185295**	**17.2**

Source: Handbook of Statistics on Indian Economy, 2007-08, RBI
Note: (i) Figures in parentheses are percentage of total exports for the respective year. (ii) EXg denotes compound annual growth rate (CAGR) of exports in percentage.

exports have multiplied almost 4.2 times during 2008-09 over 2000-01. Manufactured exports as well as exports of selected industries have multiplied by 3.6 times during this time-span. Share of exports of manufacturing sector as also leather, chemical and textiles industries[11] in India's exports have declined especially during the post-2003-04 period (which is mainly due to rise in exports of petroleum products) despite their impressive compound growth of about 15.3 pcpa in US $ terms. The exports of selected industries account for about half of India's export earnings. The major change which we see as regards composition of exports of selected industries is in terms of decline in contribution of textiles and leather (traditional) industries and a rise in share of engineering goods. The compound rates of growth of exports (EXg) of traditional manufactured goods, such as leather and textiles were quite low (about 7 pcpa) in comparison to the engineering goods (24 pcpa) and chemical industry (16 pcpa).

2.5: Summary

- The average share of manufacturing sector in real GDP has marginally increased from about 13 per cent during 1970-75 to about 16.1 per cent in 2009-10, *i.e,* approximately by about 3.1 percentage points over a period of more than three decades. Thus, this increase has not matched the expectations from this sector.
- During 1970-75, India's real GDP of manufacturing sector was more or less equally distributed between its registered and unregistered segments. Over the years, the growth of real income in the registered manufacturing has been higher than that of unregistered manufacturing sector, resulting in the average contribution of the latter to real GDP of manufacturing sector shrinking to almost half of that of the registered sector in 2007-08.

[11] It may be noted that food, beverages and tobacco (FBT) industries do not feature in the list of exporting industries.

- The average contribution of unregistered manufacturing sector to real GDP of manufacturing has been consistently declining over the years. In the earlier half of the eighties, this share was approximately 45 per cent and it has fallen to about 33 per cent in 2008-09.
- The unorganised manufacturing sector employs (2005-06, the latest year for which the data are available for unorganised sector) almost 80 per cent of workforce manufacturing sector. In other words, we see the disproportion not only between income and employment generation across sectors, but also within the two segments of manufacturing sector, *i.e.*, between its organised and unorganised segments. Moreover, we also observe that economically backward states, such as, Bihar* and West Bengal have much higher proportion of employment in unorganised manufacturing in comparison to that in the organised manufacturing.
- There are six major concerns regarding the growth of manufacturing sector. These pertain to growth of output, growth of employment, real wages and emoluments, resource intensity, inequalities within the manufacturing sector and regionally imbalanced growth of manufacturing sector.

    1. Despite the emphasis on manufacturing sector in India's planning process, the contribution of this sector, is at best, modest and it needs to be increased so as to enable people to improve their standard of living.

    2. As regards employment in organised sector, it witnessed a declining trend almost up to 1986-87. After that employment trend was positive until mid-nineties. Thereafter, again we see a period of not only jobless but jobloss growth. Though this trend has been arrested in the present decade the employment contribution of this sector should increase.

3. The discouraging side of the reform process is in terms of growth of real wages and real emoluments in the organised manufacturing sector, especially since the nineties. Growth of real wages (*i.e.,* to skilled and unskilled shop-floor workers) has been shrinking over the years and it was in fact negative during the latter half of the nineties. As against it, we see the revival of growth rate of emoluments (*i.e.*, compensation to both workers and the 'other supporting staff', including the managerial staff). To put it differently, the growth rate of compensation to supporting staff has increased in relation to the workers who are directly engaged in production process. This can have an adverse effect on the morale of the shop-floor workers, especially the skilled ones. This also explains the fact that most of the engineering graduates do not prefer to pursue their engineering skills on the shop-floor, instead prefer managerial positions. The reform process cannot neglect this issue, if productivity and innovations need to drive India's growth process. It would also be interesting to examine the role of the labour market flexibility in employment generation. This would be possible if the ASI provides the data on employment of those workers and supporting staff who are permanent and contracturally employed.

4. Growth process in the organised manufacturing sector has been resource intensive. Total non-primary inputs constitute almost 80 per cent of the value of output. The ratio of material inputs to total inputs has ranged between 58 to 65 per cent and the respective range for the fuel inputs is between 6-7 per cent. This has implications for both environmental degradation as well as sustainability of growth of manufacturing sector in the years to come. The proportion of value added to the gross output in the US is more than half and for Germany it is one third, as compared to India's one-

fifth. It is almost 29 percent for China. This has implications for competitiveness, especially in a globalised world where the costs of material inputs are rising.

5. The employment and output generation in organised and unorganised manufacturing sector exhibit a major imbalance. The unorganised sector accounts for almost 80 per cent employment and generates only about 33 per cent of output of the manufacturing sector. This causes sharp inequality between the per capita output (and also wages) between the organised and unorganised segments of India's manufacturing sector.

6. Maharashtra, Tamil Nadu and Gujarat, are the states which consistently appear in the first three topmost states in terms of both output and employment generation in the organised manufacturing sector. Deterioration of Bihar* and West Bengal, whereas, ascent of Haryana, Karnataka, Punjab and Rajasthan is noticeable.

- 'Metal' and 'Machinery & Transport Equipment' industries are the two major industries in India and each one of these accounted for almost one-fifth of GVA in the organised manufacturing sector during the period of the study. These industries are followed by the chemical industry which accounted for about 13 percent of GVA of the total organised manufacturing sector. However, most of the jobs are provided by Textiles and Food (including beverages & tobacco) industries. These industries together account for about 41 per cent of jobs in the organised manufacturing sector.
- During 2000-01 to 2008-09, the growth rate of exports of Metal and Engineering goods has been highest at about 24 pcpa as against the overall growth of exports of about 17 pcpa and that of manufactured products of about 15 pcpa. Growth rates of exports of Textiles and leather industries are quite low ranging between 6 to 7 pcpa.

Annexure 2.1: Ranks of Various States Based on their Output Contribution in Respective Industry

State	MFG	FBT	CHEM	LEATH	METAL	MTE	TEX
Ranks based on Output Contribution: 1980-81							
AP	6	**4**	**5**	8	12	9	9
BIH*	7	13	12	**5**	**3**	8	14
DEL	14	11	13	10	14	12	10
GUJ	**2**	**2**	**2**	11	8	6	**2**
HAR	12	14	14	12	10	7	12
KAR	8	8	8	9	11	**4**	11
KER	11	9	7	14	15	14	13
MAH	**1**	**1**	**1**	**4**	**1**	**1**	**1**
MP*	9	10	9	6	**4**	11	8
ORI	15	15	15	15	**5**	15	15
PUN	10	6	10	7	7	10	**5**
RAJ	13	12	11	13	13	13	7
TN	**3**	**5**	**3**	**1**	9	**2**	**4**
UP*	**5**	**3**	6	**3**	6	**5**	6
WB	**4**	7	**4**	**2**	**2**	**3**	**3**
Ranks based on Output Contribution: 2003-04							
AP	**5**	**3**	**5**	12	8	7	12
BIH*	12	14	15	11	3	10	15
DEL	15	13	14	5	14	13	10
GUJ	**2**	**4**	**1**	14	4	6	**2**
HAR	7	12	12	4	10	2	7
KAR	6	7	7	10	11	5	8
KER	13	10	11	8	15	14	13
MAH	**1**	**1**	**2**	9	1	1	**3**
MP*	8	5	9	6	2	9	11
ORI	14	15	13	15	9	15	14
PUN	10	8	10	7	12	8	**5**
RAJ	11	11	8	13	13	12	**4**
TN	**3**	6	**4**	**1**	7	**3**	**1**
UP*	**4**	**2**	**3**	**2**	6	**4**	6
WB	9	9	6	**3**	**5**	11	9
Ranks based on Average Output Contribution: 1980-81 to 2003-04							
AP	**5**	**3**	**5**	11	7	8	11
BIH*	11	14	15	12	**2**	11	15
DEL	14	13	14	**5**	14	12	9
GUJ	**2**	**4**	**1**	14	**5**	6	**3**
HAR	9	11	12	**4**	12	**3**	12
KAR	6	8	9	6	11	5	8
KER	13	10	10	10	15	14	13
MAH	**1**	**1**	**2**	8	**1**	**1**	**2**
MP*	7	6	7	7	3	10	10
ORI	15	15	13	15	9	15	14
PUN	10	7	11	9	10	7	**4**
RAJ	12	12	8	13	13	13	**5**
TN	**3**	**5**	**3**	**1**	8	**2**	**1**
UP*	**4**	**2**	**4**	**2**	6	**4**	7
WB	8	9	6	**3**	**4**	9	6

Annexure 2.2: Ranks of Various States Based on their Employment Generation in Respective Industry

State	MFG	FBT	CHEM	LEATH	METAL	MTE	TEX
Ranks based on Employment Contribution: 1980-81							
AP	6	**1**	**5**	6	11	7	7
BIH*	8	9	7	**4**	**3**	9	14
DEL	14	15	13	11	14	13	11
GUJ	**4**	7	**3**	9	7	**5**	**3**
HAR	12	12	14	13	12	8	12
KAR	7	6	8	10	10	6	8
KER	10	**5**	9	15	15	14	13
MAH	**1**	**3**	**1**	**5**	**2**	**1**	**1**
MP*	9	10	10	8	**4**	11	6
ORI	15	14	15	14	9	15	15
PUN	11	11	12	7	8	10	10
RAJ	13	13	11	12	13	12	9
TN	**3**	**4**	**2**	**1**	**5**	**3**	**4**
UP*	**5**	**2**	6	**3**	6	**4**	**5**
WB	**2**	8	**4**	**2**	**1**	**2**	**2**
Ranks based on Employment Contribution: 2003-04							
AP	**3**	**1**	**4**	12	9	7	10
BIH*	13	13	15	11	**4**	11	14
DEL	15	15	14	6	14	13	11
GUJ	**4**	9	**1**	14	7	6	**4**
HAR	9	11	11	**4**	12	**3**	8
KAR	7	7	7	8	11	**4**	**3**
KER	10	**3**	9	13	15	14	13
MAH	**2**	**2**	**3**	9	**1**	**1**	**5**
MP*	11	10	8	10	**5**	10	12
ORI	14	12	13	15	8	15	15
PUN	8	6	12	**5**	10	8	7
RAJ	12	14	10	7	13	12	6
TN	**1**	**5**	**2**	**1**	**3**	**2**	**1**
UP*	**5**	**4**	**5**	**2**	6	**5**	9
WB	6	8	6	**3**	**2**	9	**2**
Ranks based on Average Employment Contribution: 1980-81 to 2003-04							
AP	**3**	**1**	**4**	9	8	8	7
BIH*	9	12	10	8	**3**	10	15
DEL	14	15	15	11	14	12	12
GUJ	**4**	6	**2**	13	6	6	**4**
HAR	12	11	13	**5**	12	7	11
KAR	7	7	7	**4**	11	**5**	**5**
KER	11	**5**	8	14	15	14	13
MAH	**1**	**3**	**1**	6	**2**	**1**	**2**
MP*	8	10	9	10	**4**	11	10
ORI	15	14	14	15	9	15	14
PUN	10	9	11	7	10	9	8
RAJ	13	13	12	12	13	13	9
TN	**2**	**4**	**3**	**1**	**5**	**2**	**1**
UP*	6	**2**	**5**	**2**	7	**4**	6
WB	**5**	8	6	**3**	**1**	**3**	**3**

3. Productivity and Efficiency in Indian Manufacturing Sector: A Review of Literature

The available literature reviews on studies of productivity in the Indian manufacturing sector have been undertaken by Krishna (1987) and Goldar and Mitra (2002). The former review considered three major studies, *viz.*, Brahmananda (1982), Ahluwalia (1985) and Goldar (1986), *i.e.*, those studies published in the eighties. The review by Goldar and Mitra (2002) encompassed the studies of earlier vintage as well as the recent ones[12]. The studies reviewed by Goldar and Mitra (2002) have been broadly classified by them into two groups: (i) studies published until 1991 (*first group*); and, (ii) studies published thereafter (*second group*). The temporal coverage of the first group of studies varied between 1946 and 1985.

Keeping in view the fact that the temporal coverage of this study begins with 1980-81 and that the studies encompassing the period before 1980-81 have already been reviewed competently by the studies mentioned above, we will focus this review on the studies that cover mainly the time-span of the eighties and thereafter.

The studies on productivity of Indian manufacturing sector can be classified broadly as follows: (i) studies that provide estimates of productivity growth either for aggregate manufacturing sector or at various levels of disaggregation (states/industries), using alternative databases and methodologies for different time-spans; (ii) studies that test the sensitivity of productivity growth estimates to the alternative proxies for output, *viz.*, real gross output (O) or real value added obtained by single deflation method (RVASD) or real value added obtained by double deflation method (RVADD); (iii) studies that deal with the turnaround of productivity growth, if any, in response to policy reforms undertaken in the Indian economy (the first bout initiated in the eighties[13] and the second bout in the nineties); and, (iv) studies that attempt to ascertain the determinants of productivity,

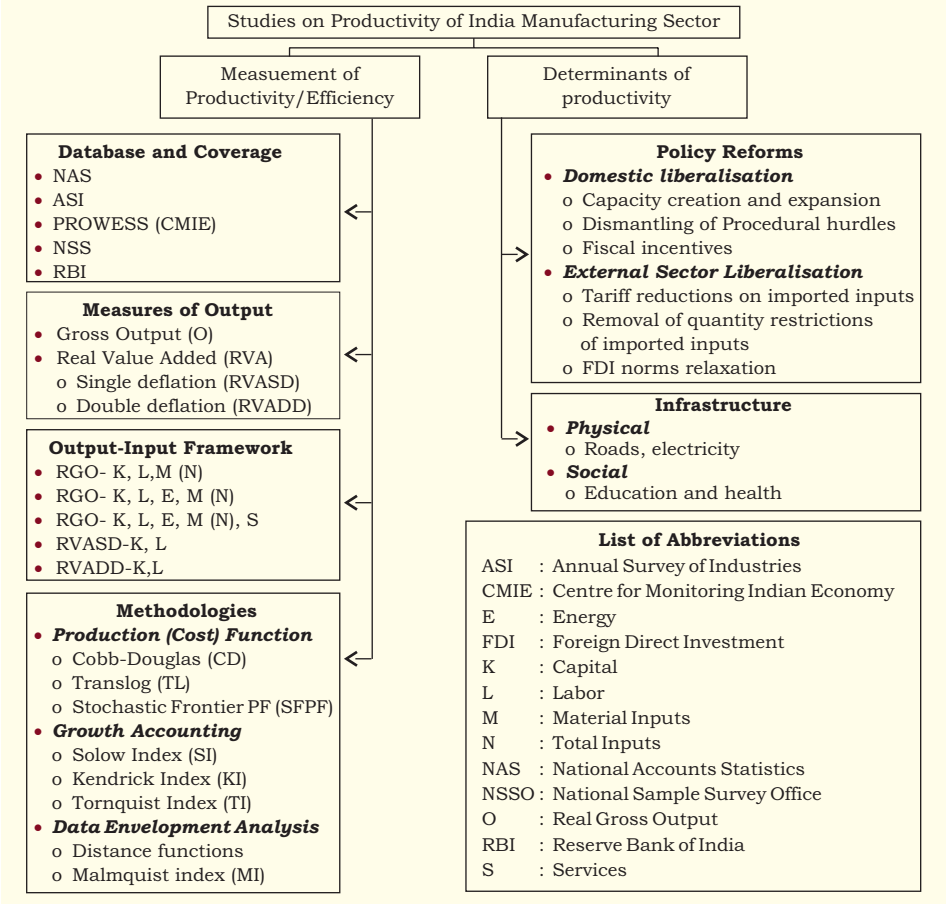
[12] Studies published during 1962 to 1998 have been covered in their review.

[13] Some studies have also considered mid-eighties as the reform period. (See Srivastava 1996)

such as, the role of infrastructure, investment climate, education, policy reforms (usually examined in an inter-state perspective).

In Chart 3.1, we present a synoptic view of the criteria for classifying the studies on the productivity of Indian manufacturing sector.

Chart 3.1: Classification of Studies on Productivity on Indian Manufacturing Sector



The studies reviewed by us differ in respect of: (i) the database used and the coverage (spatial/temporal/sectoral) of the study; (ii) the proxy used for level of production; (ii) the inputs included and their measurement; (iii) methodology used for estimation of productivity and efficiency; and, (iv) time-span covered. Due to these differences, the various studies have obtained different estimates/magnitudes of TFPG and efficiency levels. The output of these studies can be classified in terms of: (a) The estimates of TFPG; and, (b) the research question answered by the study, over and above providing the estimates of TFPG. The main research questions that have been raised in these studies are as follows. *First*, whether there has been acceleration/deceleration or absence thereof in TFPG of manufacturing sector as a consequence of economic reforms in the Indian economy? *Second*, has trade liberalisation (which is only one of the components of the overall economic policy reforms) made any impact on the TFPG of manufacturing sector? *Third*, does the provision of infrastructure (social, physical or investment climate) matter in determining the TFPG? *Fourth*, whether the economic reforms have impacted different industries/ regions/states differently? *Lastly*, whether the growth of output of Indian manufacturing sector has been driven by TFPG or by intensive use of inputs?

3.1: Databases Used

As indicated in Chart 3.1, mainly five databases have been used in the studies on productivity/efficiency in the Indian manufacturing sector. The information on databases used by the various studies is given in Table 3.1.

Manufacturing sector in National Accounts Statistics (NAS) includes both registered and unregistered segments. Hence, the studies which use NAS database have wider coverage as compared to the other databases. The problem with this database is the non-availability of employment series on an annual basis for unregistered manufacturing sector. Hence, employment series used in the studies based on NAS data has to be

Table 3.1 Databases Used and Coverage of the Studies

Sr. No.	Study	Database (disaggregation level, if any)	Temporal Coverage
1	Ahluwalia (1991)	ASI (industry groups at 3 digit levels & 4 use-based industries)	1959-60 to 1985-86
2	Mohanty (1992)	NAS (Registered & Unregistered)	1970-71 to 1988-89
3	Balakrishnan & Pushpangadan (1994)	ASI	1970-71 to 1988-89
4	Dholakia & Dholakia (1994)	ASI	1970-71 to 1988-89
5	Majumdar (1996)	CMIE & ASI	1950-51 to 1992-93
6	Rao (1996a)	ASI	1973-74 to 1992-93
7	Rao (1996b)	ASI	1973-74 to 1992-93
8	Srivastava (1996)	RBI data on Public Limited Companies (industries at 2 digit level)	1980-81 to 1989-90
9	Krishna & Mitra (1998)	CMIE, PROWESS, firm level data (industry groups)	1986-1993
10	Pradhan & Barik (1998)	ASI (8 polluting industries)	1962-63 to 1992-93
11	Gangopadhyay & Wadhwa (1998)	ASI (industries at 2 digit level)	1973-74 to 1993-94
12	Pradhan & Barik (1999)	ASI (8 polluting industries)	1963-93
13	Mitra (1999)	ASI (panel data for industry groups at state level)	1976-77 to 1992-93
14	Hulten & Srinivasan (1999)	ASI	1973-93
15	Balakrishanan et al (2000)	PROWESS (CMIE), firm level data	1988-89 to 1997-98
16	Goldar (2000) evel industries)	ASI (2 digit li 1980-81 to 1997-98	
17	Trivedi al (2000)	ASI (2 digit level industries)	1973-74 to 1997-98
18	Unni et al (2001)	ASI (organised) and NSSO (unorganised); 5 use-based industry groups arrived after aggregation of 2-3 digit level industries	1978-79, 1984-85, 1989-90 & 1994-95
19	Aghion *et al* (2003)	ASI	1980-1997
20	Goldar & Kumari (2003)	ASI	1981-82 to 1997-98
21	Trivedi (2003)	ASI (2 digit industries aggregated into 5 industry groups for selected states of India)	1980-81 to 1997-98

Table 3.1 Databases Used and Coverage of the Studies *(Concld.)*

Sr. No.	Study	Database (disaggregation level, if any)	Temporal Coverage
22	Tata Services Ltd (2003)	ASI, PROWESS (CMIE), Private mfg: all firms and Top 50 firms, Major Tata Companies	1981-82 to 2001-2002
23	Unel (2003)	ASI (industry groups)	1979-80 to 1997-98
24	Das (2004)	ASI (industries at 3 digit level also aggregated into use-based industries)	1980-81 to 1999-2000
25	Goldar (2004)	ASI	1979-80 to 1990-2000
26	Pradhan & Barik (2004)	ASI (8 polluting industries)	1963-64 to 1994-95
27	Topalova (2004)	PROWESS (CMIE), firm level data	1989-2001
28	Trivedi (2004)	ASI (industry groups, at state level)	1980-81 to 2000-01
29	Virmani (2004)	NAS	1950-51 to 2003-04
30	Veeramani & Goldar (2005)	ASI (selected states and industries)	1980-2000
31	Bhaumik, *et al* (2006)	ASI (3 digit firm level data for 15 states)	1984-97
32	Raj & Duraiswamy (2006)	NSSO	1978-79, 1984-85, 1989-90, 1994-95 and 2000-01
33	Banga & Goldar (2007)	ASI (panel data for industry groups)	1980-81 to 1999-2000
34	Bosworth *et al* (2007)	NAS	1960-61 to 2004-05
35	Ray (2002)	ASI (selected states)	1986-87 to 1995-96
36	Mukherjee & Ray (2004)	ASI (selected states)	1986-87 to 1999-2000
37	Sivadasan (2007)	ASI Unit level	1987-90 & 1994-95
38	Gupta (2008)	ASI Industry level	1973-2003
39	Raj & Mahapatra (2009)	ASI & NSSO (3 states)	1981 to 2003
40	Goldar *et al* (forthcoming)	ASI and NSSO	1989-90 to 2004-05 for ASI & 1989-90 to 2005-06 for NSS data
41.	Kathuria (2010)	ASI Unit level and NSSO	1994-95, 2000-01 and 2005-06

intrapolated/extrapolated using different assumptions. Bosworth *et al* (2007), Mohanty (1992) and Virmani (2004) have used the NAS data. They had to make various assumptions so as to arrive at the estimates of labour input in order to proceed with the estimates of productivity [14].

As against it, ASI database provides a much more detailed industry/state level classification and both primary and non-primary input details are available on an annual basis. Hence, this database has been most widely used among the researchers. However, this database includes only registered manufacturing sector. We have already seen that the registered sector accounts for merely 20 per cent of employment though its contribution in terms of output is about 68 per cent of the total manufacturing sector.

A large number of studies, such as, Aghion *et al* (2003), Ahluwalia (1991), Balakrishnan & Pushpangadan (1994), Banga & Goldar (2007), Das (2004), Dholakia & Dholakia (1994), Gangopadhyay & Wadhwa (1998), Goldar (2004), Hulten & Srinivasan (1999), Majummdar (1996), Mitra (1999), Mukherjee & Ray (2004), Pradhan & Barik (1998), Pradhan & Barik (1999), Pradhan & Barik (2004), Rajesh & Mahapatra (2009), Rao (1996a), Rao (1996b), Ray (2002), Tata Services Ltd (2003), Trivedi *et al* (2000), Trivedi (2003), Trivedi (2004), Unel (2003), among others, have used the ASI data. The studies which have dealt with the industry/state level issues related to productivity have used disaggregated data up to two or three digit level National Industrial Classification (NIC) for the various states or for India as a whole.

The CSO has also started compiling unit level (micro) data for the organised sector and it is available for most of the years since 1993-94. However, this database has been rarely used by the researchers. Construction of capital stock series (at replacement cost) for unit level

[14] Mohanty (1992) derived annual estimates of labour inputs for inter censual years by linear interpolation of the 1970-71 and 1980-81 census workforce data, whereas, for the eighties, he assumes growth rate of employment to be 0.387 and 6.005 per cent for the registered and unregistered manufacturing sectors, respectively.

data is a challenging task, as the estimates of capital stock in earlier years are not available. One of the main reasons for underutilisation of this data is that permanent serial numbers or identification codes for the units included in the sample are not available partly due to the sampling procedure and partly on the grounds of maintaining confidentiality. Hence, it is not possible to construct either a balanced or an unbalanced panel from this dataset, something that would be of interest to researchers when using the micro level data. In view of this, despite its richness in terms of information content, this dataset is also grossly underutilised. Only a few researchers, *viz.*, Sivadasan (2007), Bhaumik, *et al* (2006) and Kathuria, *et al* (2010) have used the unit level ASI dataset sourced from the CSO .

PROWESS database of CMIE consists of data on companies and is compiled from their financial statements. More often than not, this database does not include labour input and hence, is not particularly suited for productivity measurement. The problem of construction of labour input series for this dataset is similar to that for the NAS data. The studies by Balakrishanan *et al* (2000), Topalova (2004) and Krishna & Mitra (1998) have used this database and had to make various assumptions for the construction of labour input series. However, PROWESS database has the advantage that it is micro level database and it is possible to construct a panel from this database and also stratify performance of the companies according to their size or some other criteria. This dataset encompasses only a subset of organised manufacturing sector, as the financial statements are issued mandatorily only for the listed companies. As can be seen from Table 3.1, this database also has not been used as intensively by the researchers as is the case with the ASI database.

The RBI dataset has advantages and limitations which are more or less akin to the PROWESS dataset, as both the datasets are based on information culled out from the audited annual accounts of the companies. The RBI standardises the data items presented in annual accounts of companies through a normalization process, which is based on accounting

principles. However, the firm level data compiled by the RBI is not publicly available. Despite the fact that the identification of firms is confidential, the codes are given to companies and hence it is possible to construct a balanced/unbalanced panel from the RBI dataset. Only Srivastava (1996) and Srivastava (2000) studies have used this dataset.

More detailed data (at industry and state levels) on unorganised manufacturing sector is available from the 'reports' of the various enterprise surveys conducted by the NSSO. This dataset is available only for a few years and at times not exactly comparable across the different surveys. The enterprise level data is also maintained by the NSSO and it is an enormously rich dataset, but again it is not possible to construct a panel from this dataset. In addition, there is a problem of constructing a reliable capital stock series for the enterprises included in this dataset. Unni *et al* (2001), Raj & Mahapatra (2009), Raj & Duraiswamy (2006) and Goldar & Mitra (2008), Kathuria, et al (2010) have used NSSO data for analysing the performance of unorganised sector in terms of employment, output and/or productivity growth rates. Most of these studies have also used ASI data for organised sector so as to provide a comparison between organised and unorganised segments of the Indian manufacturing sector.

Jayadevan (1996), Mitra (1999), Unni *et al* (2001), Ray (2002), Sunil Kumar (2003), Aghion (2003), Trivedi (2003), Mukherjee & Ray (2004), Trivedi (2004), Raj & Duraiswamy (2006), Raj and Mahapatra (2009), and Goldar and Mitra (2008) have used state-level disaggregation to investigate the state level performances and/or determinants of productivity. Quite a few studies, such as Ahluwalia (1991), Krishna & Mitra (1998), Pradhan & Barik (1998), Gangopadhyay and Wadhwa (1998), Pradhan and Barik (1999), Mitra (1999), Trivedi, *et al* (2000), Trivedi (2003), Unel (2003), Das (2004), Pradhan & Barik (2004), Trivedi (2004), Veeramani and Goldar (2005), *etc.*, have estimated TFPG at industry levels using the ASI dataset.

In brief, the research on productivity on Indian manufacturing sector has been gaining popularity among researchers. As is evident from the above discussion, ASI industry/state level database has been the most often used database, since it provides the essential information required for estimation of productivity. The data limitations for micro level data compiled both by CSO and NSSO need to be addressed by the Ministry of Statistics and Programme Implementation, GoI, so as to enable the researchers to exploit the rich information content embedded in these datasets.

3.2: Output-Input Framework and Methodologies Used

Productivity estimates are sensitive to measurement of output and inputs, besides that to the methodology used. There has been a debate over the appropriate measure of output and the corresponding inputs to be used for productivity measurement. The three alternatives proxies of output used in the various studies are: (i) real value added obtained by single deflation (RVASD); (ii) real value added obtained by double deflation (RVADD); and (iii) real gross output (RGO). The NAS data is compiled using the RVASD methodology. ASI provides data on nominal value added and prior to Balakrishnan and Pushpangadan (1994) researcher in India mainly used RVASD as a measure of output. Balakrishnan and Pushpangadan (1994) refuted the claim of Ahluwalia (1991) regarding turnaround in TFPG of organised manufacturing sector arguing that such a conclusion was arrived at due to the use of inappropriate proxy for measurement of output, *viz.*, RVASD. They recommended use of RVADD instead of RVASD. A number of researchers, *viz.*, Ahluwalia (1994), Dholakia and Dholakia (1994), Goldar (1994), Pradhan and Barik (1998), Rao (1996a), Rao (1996b) and Shastry (1994), *etc.,* contributed to this lively debate. Since the use of RGO does not involve the assumption of separability of production function, we find that the studies after 1994 have taken a greater recourse to the use of RGO as the measure of output and in view of this the input framework has been extended to include material inputs as well.

Table 3.2 details the input-output and methodological framework adhered to in the various studies on TFPG[15].

The input framework in the case of use of RVASD and RVADD (as proxies to output) has to be confined to labour and capital. The input framework has to be modified to include material and other inputs in the case of use of RGO as a proxy for production. As can be seen from Table 3.2, various studies have used input frameworks which are not the same. The input frameworks used range from the use of two inputs, *viz.*, K[16] and L (capital stock and labour, respectively) to five inputs, *viz*, K, L, E (energy), M (material inputs), N (total inputs) and S (services). It is pertinent to note here that some studies have used the two variants of labour inputs, *viz.*, production workers (L1) and non-production staff (L2, which is obtained by subtracting L1 from the total number of employees). Studies, such as, Bosworth *et al* (2007), Veeramani (2005) have adjusted for labour quality as well.

We have refrained from discussing the construction of capital input series in the studies covered in this survey, not because of lack of its importance, but due to the elaboration it requires. Usually capital stock series are available at book value and need conversion into one at replacement cost. Quite a few studies have attempted such conversions adhering to the various assumptions about the capital stock in the benchmark year, the rate of depreciation and the rate of inflation deemed relevant to capital goods which have been proxied either by investment deflator or the WPI of machinery and transport equipment. Then the perpetual inventory method (PIM), is used which requires the estimates of capital stock for the benchmark year and capital formation for the successive years. However, some of the studies have simply used the capital stock series at book values, which is inappropriate.

[15] We have not included Goldar *et al* (forthcoming) in Table 3.2, as it deals only with partial productivity measures. We have retained this study in Table 3.1, as it is one of the few studies that provide the latest trends in India's unorganised manufacturing sector.

[16] Some researchers have also used variants of capital stock, such as, fixed (FK) and working capital (WK).

Table 3.2: Methodology Used and Details of Input-Output Framework

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	Output Measure	Inputs included	Source of weights for compiling Price Deflator Index for inputs, if RVADD or RGO are used as output proxies
1	Ahluwalia (1991)	GAA (TL)	RVASD	K & L	–
2	Mohanty (1992)	PFA (CD)	RVASD	K & L	–
3	Balakrishnan & Pushpangadan (1994)	GAA (TL)	RVADD	K & L	Coefficients of I-O 1973-74 & 1983-84 tables
4	Dholakia and Dholakia (1994)	GAA (TL)	RVASD (RVADD)	K & L (K, L & M)	Coefficients of I-O1973-74 table
5	Majumdar (1996)	DEA	RGO	FK, WK, L1 & L2	Material inputs/ energy/services not included in estimation. Only two forms of capital and labour treated as inputs.
6	Rao (1996a)	GAA (SI)	RVASD, RVDD, RVADD*	K & L (K, L & M)	Coefficients of I-O 1973-74 table
7	Rao (1996b)				
8	Srivastava (1996)	GAA (TL), PFA* (CD and TL)	RGO	K, L & M	Tornqvist index for inputs derived from the Index for industrial raw materials and index for power and fuel
9	Krishna & Mitra (1998)	PFA* (CD)	RGO	K, L & M	72-sector I-O table obtained from the World Bank
10	Pradhan & Barik (1998)	GAA (TL)	RGO	K, L & M	Coefficients of I-O 1991-92 table
11	Gangopadhyay & Wadhwa (1998)	GAA (TL), PFA (CD and TL, with and without industry effects)	RVASD	K & L	–
12	Pradhan & Barik (1999)	CF (TL) cost function	RGO	K, L & M	Coefficients of I-O 1991-92 table
13	Mitra (1999)	Frontier PF (CD)	RVADD	K, L, E & M	Coefficients of I-O 1989-90 table

Table 3.2: Methodology Used and Details of Input-Output Framework *(Contd.)*

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	Output Measure	Inputs included	Source of weights for compiling Price Deflator Index for inputs, if RVADD or RGO are used as output proxies
14	Hulten & Srinivasan (1999)	GAA (TL)	RVADD	K, L & M	Tornquist index for inputs price derived from input prices of 2-digit industry levels
15	Balakrishanan *et al* (2000)	PFA*	RGO	K, L & M	Coefficients of I-O 1989-90 table
16	Goldar (2000)	GAA (TL)	RVASD, RVADD & RGO	K& L and K, L & I	Coefficients of I-O 1989-90 table
17	Trivedi, *et al* (2000)	GAA (TL)	RVASD, RVADD (RGO)	L & K (L, K & N)	Coefficients of I-O 1991-92 table
18	Unni *et al* (2001)	GAA (SI)	RVASD	K & L	–
19	Aghion *et al* (2003)	GAA (TL)	RVASD	L1, L2, K	–
20	Goldar & Kumari (2003)	GAA (TL)	RGO	K, L & I	Coefficients of I-O 1989-90 table
21	Trivedi (2003)	GAA (TL)	RGO	K, L & N	Coefficients of I-O 1993-94 table
22	Tata Services Ltd .(2003)	GAA (TL)	RGO	K, L & M	Coefficients of I-O 1993-94 table
23	Unel (2003)	GAA (TL)	RVASD	K & L	–
24	Das (2004)	GAA (TL)	RGO	K, L, E & M	Coefficients of I-O 1983-84, 1989-90 & 1993-94 table
25	Goldar(2004)	GAA (TL)	RGO, RVASD	K, L, E & M	Coefficients of I-O 1993-94 table
26	Pradhan & Barik (2004)	GAA (TL)	RGO	K, L, E & M	Coefficients of I-O 1991-92 table
27	Topalova (2004)	PFA (CD) @	RGO	K, L, E & M	Appropriate price deflators from NAS
28	Trivedi (2004)	GAA (TL)	RGO	K, L & N	Coefficients of I-O, 1978-79, 1983-84, 1989-90 & 1993-94 tables
29	Virmani (2004)	PFA (CD)	RVASD	K & L[$]	–

Table 3.2: Methodology Used and Details of Input-Output Framework *(Concld.)*

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	Output Measure	Inputs included	Source of weights for compiling Price Deflator Index for inputs, if RVADD or RGO are used as output proxies
30	Veeramani & Goldar (2005)	Multilateral TFP index	RVASD (RGO)	K & L^ (K, L, E, M & S)	Coefficients of I-O 1993-94 table
31	Bhaumik *et al* (2006)	Olley-Pakes algorithm	RVASD	K & L	–
32	Raj & Duraiswamy (2006)	DEA (Malmquist index)	RVASD	K & L	–
33	Banga and Goldar (2007)	PFA (CD)	RGO	K, L, E, M & S	Coefficients of I-O 1993-94 table
34	Bosworth et al (2007)^	GAA (SI)	RVASD	K & L$	–
35	Ray (2002)	DEA, Malmquist and Tornqvist Index	RGO	K, L1, L2, E & M	WPI for FPLL for deflating E and index of industrial raw materials price for deflating Mindustrial raw materials price for deflating M
36	Mukherjee & Ray (2005)	DEA	RGO	K, L1, L2, E & M	Not specified
37	Sivadasan (2007)	PFA (CD)#, SI,	RVASD (RGO)	K, L1 & L2 (K, L1, L2 & M)	Not specified
38	Raj & Mahapatra (2009)	GAA (TL), MI & DEA	RVASD	K & L	–
39	Kathuria, Raj and Sen (2010)	PFA (CD)	RVADD	K & L	–
40.	Gupta (2008)	GAA, Index Number Approach and DEA	RVADD, RGO	K & L	–

Notes: Refer to the list of Abbreviations for abbreviations used in this Table.
* Hall (1988) framework has been used to estimate productivity
@ refer Levinsohn and Petrin (2003), Aw, Chen, and Roberts (2001), Pavcnik (2002) and Fernandes (2003) for more details on methodology
$ Indicates data for L are from NSS and other sources, see Virmani (2004, pp 10-11) for more details on this.
^ Adjustment for quality of labour made
# Levinsohn and Petrin (2003) procedure has been used.

The use of RVADD and RGO necessitates computation of material/ input price indices. As can be seen from Table 3.2, quite a few studies have used only one input-output absorption matrix for obtaining weights for material inputs/total inputs used by industries/manufacturing sector. Fixed weights imply that the input structure does not change over time even as technology and input prices change. This seems to be an untenable assumption, especially if one is trying to assess the impact of policy reforms on TFPG. Balakrishnan and Pushpangadan (1994) did test the sensitivity of productivity estimates to the alternative weighting diagrams for material inputs derived from 1973-74 and 1983-84 I-O absorption matrices and demonstrated that it does not alter their conclusion of 'no turnaround in TFPG in the eighties'. Though the insensitivity of TFPG estimates or turnaround to the two set of I-O coefficients may be true for the data set analysed by them, this cannot be presumed on theoretical grounds. Whilst constructing the input price index it is desirable to incorporate the changes in weights of various inputs which are expected to take place over time. To best of our knowledge Das (2004) and Trivedi (2004) are the only studies, which have incorporated changing weights derived from the various available I-O matrices. A few studies, such as, Srivastava (1996) and Hulten and Srinivasan (1999) have used Tornquist indices of inputs for the aggregation of inputs.

3.3: Methodologies Used

In Table 3.2, we have also provided a synoptic view of the methodologies used by the various studies on the TFPG for the Indian manufacturing sector[17]. As outlined in Chart 3.1, there are three major alternative approaches, *viz.*, production function Approach (PFA)/Cost Function Approach (CFA), Growth Accounting Approach (GAA) and Data Envelopment Analysis (DEA) for estimation of TFPG and/or efficiency levels and changes. PFA/ CFA and Stochastic Frontier Production Function (SFPF)

[17] A more detailed discussion on methodologies used in this study has been provided in Section 4 of this study.

approaches are parametric approaches and involve estimation of parameters. These approaches require assumptions about the underlying production functions. As against it, GAA and DEA are non-parametric approaches. The DEA does not require any prior assumption about the underlying functional form for production technology used by the firms/ industry. This approach yields estimates of efficiency, *i.e.*, it provides estimates of efficiency of various firms in relation to the most efficient firm for which efficiency is set at unity. Thus, as mentioned earlier, efficiency is a relative concept. Malmquist index of productivity is also based on the concept of the distance functions.

As can be seen from Table 3.2, most of the studies in India have adhered to GAA and used the translog (TL) production function as the underlying form of the production function. It collapses into Cobb-Douglas (CD) production function, if the interaction terms are not significant. The studies using GAA have also used factor shares as the weights for the inputs. This implies the assumption of perfectly competitive market structure. Restricting the sum of weights for factor shares to unity implies constant returns to scale (CRS). A few studies, such as, Majumdar (1996), Ray (2002), Mukherjee and Ray (2005), Raj and Duraiswamy (2006), Raj & Mahapatra (2009) have used the DEA and have provided estimates of efficiency. A couple of studies, such as, Bhaumik et al (2006) and Sivadasan (2007) have also tried to overcome the problem of endogeneity in the use of capital by following procedures laid down in Olley & Pakes and Levinsohn & Petrin (2003)

3.4: Efficiency and Productivity Estimates

In the preceding three sections, we have detailed the differences in the time-period, input-output frameworks and methodologies used in the various studies. In view of this, it is natural that these studies yield disparate estimates of efficiency and productivity and it is rather difficult to arrive at some consensus regarding; (i) estimates of TFPG/efficiency; (ii) Contribution of TFPG to growth; and, (iii) The turnaround in productivity

growth in response to policy reforms. Tables 3.3A and 3.3B provide a synoptic view of these aspects of the various studies surveyed in this section. It is pertinent to note here that wherever possible, we have tried to estimate the rates of growth of production as used in the respective studies and the contribution of TFPG to growth from the information provided in these studies so as to enable us some meaningful comparisons across studies.

It can be seen from Tables 3.3A & 3.3B that, in general, the estimates of TFPG obtained with RVADD as a proxy for output are much higher as compared with those obtained with RVASD or RGO. In view of empirical evidence provided by Pradhan and Barik (1998) about non-separability of inputs in production function, the productivity estimates based on RGO seem to be preferable to the alternative estimates. For the organised manufacturing sector, TFPG estimates based on RGO confirm that the contribution of TFPG to output growth has been rather modest.

As regards the unorganised manufacturing sector, the estimates of TFPG seem to be rather unreliable in view of the data limitations. Unni *et al* (2001) provide the estimates of TFPG and real value added for unorganised manufacturing. If we extrapolate the contribution of TFPG to growth from these data, the conclusions arrived at are rather bizarre. The problem seems to lie in the inaccurate measurement of capital. Hence, it would be better to focus on labour productivity rather than TFPG for unorganised sector.

As regards the turnaround of TFPG, different cut-offs for demarcating pre-reform from post-reform periods have been used in the various studies. In general, the beginning of the eighties, mid-eighties and beginning of the nineties have been considered cut-off for pre-reform and post-reform periods.

3.5 Turnaround and Determinants of Productivity and Efficiency

In this section, we discuss the turnaround of productivity and efficiency for the organised and unorganised manufacturing sectors. As

Table 3.3A: Estimates of Productivity and Efficiency for Indian Organised Manufacturing Sector

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	Proxy for Production	Period	TFPG (% p.a.) or Mean Efficiency	Growth Rate of Production (% p.a.)	Contribution of TFPG to Growth of Output (%)
1	Ahluwalia (1991)	GAA (TL)*	RVASD	1959-60 to 1985-86	-0.40	5.30	-7.55
				1959-60 to 1965-66	0.20	9.10	2.20
				1966-67to 1975-76	-0.20	4.70	-4.26
				1965-66 to 1979-80	-0.30	5.00	-6.00
				1980-81 to 1985-86	3.40	7.50	45.33
2	Mohanty (1992)	PFA (CD)	RVASD	1970-71 to 1988-89	0.01	5.90	0.16
				1970-71 to 1979-80	0.00	5.00	-0.06
				1980-81 to 1988-89	-0.01	8.10	-0.08
3	Balakrishnan & Pushpangadan [1994]	GAA (TL)	RVADD	1970-71 to 1988-89	3.07	9.32	32.93
				1970-71 to 1979-80	5.59	11.80	47.37
				1980-81 to 1988-89	-0.11	5.93	-1.80
		GAA (TL)	RVASD	1970-71 to 1988-89	0.45	5.40	8.33
				1970-71 to 1979-80	0.02	5.09	0.39
				1980-81 to 1988-89	2.42	6.94	34.87
4	Dholakia & Dholakia [1994]	GAA (TL)	RVASD	1970-71 to 1988-89	-0.11	5.27	-2.09
				1970-71 to 1979-80	-1.69	3.13	-53.99
				1980-81 to 1988-89	1.89	8.01	23.60
		GAA (TL)	RVADD	1970-71 to 1988-89	1.58	7.59	20.82
				1970-71 to 1979-80	0.56	5.85	9.57
				1980-81 to 1988-89	2.86	9.81	29.15
5	Majumdar [1996]¥	DEA	RGO	1950-51 to 1992-93	0.87		
				1960-61 to 1992-93	0.84		
				1970-91 to 1992-93	0.86		
				1980-81 to 1992-93	0.92		
6	Rao [1996a]	GAA (SL)	RGO	1973-74 to 1992-93	1.30		
				1973-74 to 1980-81	-0.20		
				1981-82 to 1992-93	2.10		
			RVADD	1973-74 to 1992-93	2.20		
				1973-74 to 1980-81	4.60		
				1981-82 to 1992-93	-0.20		
			RVADD*	1973-74 to 1992-93	2.00	6.10	32.79
				1973-74 to 1980-81	5.50	10.60	51.89
				1981-82 to 1992-93	-2.20	2.30	-95.65

Table 3.3A: Estimates of Productivity and Efficiency for Indian Organised Manufacturing Sector *(Contd.)*

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	Proxy for Production	Period	TFPG (% p.a.) or Mean Efficiency	Growth Rate of Production (% p.a.)	Contrib-ution of TFPG to Growth of Output (%)
7	Rao [1996b]	GAA (Solow Index) applied at disaggregate level and then weighted	RVADD*	1973-74 to 1992-93 1973-74 to 1980-81 1981-82 to 1992-93	2.30 6.50 -2.80	6.10 10.60 2.30	37.70 61.32 -121.74
8	Srivastava [1996]	GAA (TL)	RGO	1980-81 to 1989-90 1980-81 to 1984-85 1985-86 to 1989-90	-1.36 to-1.47 -0.22 to -0.35 -2.27 to -2.37	7.73 6.58 8.64	-17.6 to -19.0 3.3 to 5.3 -26.3 to -27.4
		PFA@ (CD and TL)		1980-81 to 1989-90 1980-81 to 1984-85 1985-86 to 1989-90	0 to 1.2 0 to -0.8 0.4 to 2.1	7.73 6.58 8.64	0.0 to 15.5 0.0 to -12.2 4.6 to 24.3
9	Pradhan, G. and K. Barik (1998)	GAA (TL)	RGO	1962-63 to 1992-93 1963-71 1972-81 1982-92	1.00 -2.09 3.06 -1.23		
10	Gangopadhyay & Wadhwa (1998)	GAA (TL)	RVASD	1973-74 to 1993-94 1974-80 1981-85 1986-90 1991-93	3.61 1.17 5.44 5.01 3.88		
		PFA (TL, (without fixed effects) PFA (TL, with industry effects)	RVASD	1973-74 to 1993-94	-0.20 -0.26		
11	Pradhan & Barik (1999)	CFA (TL)		1963-64 to 1992-93 1965-66 1975-76 1985-86 1992-93	0.074 0.076 0.085 0.063 0.051		

Table 3.3A: Estimates of Productivity and Efficiency for Indian Organised Manufacturing Sector *(Contd.)*

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	Proxy for Production	Period	TFPG (% p.a.) or Mean Efficiency	Growth Rate of Production (% p.a.)	Contrib-ution of TFPG to Growth of Output (%)
12	Mitra [1999]	Frontier PF (CD)	RVADD	1976-77 to 1992-93	3.43		
				1976-77 to 1984-85	0.76		
				1985-86 to 1992-93	5.57		
				1976-77 to 1992-93	0.46		
				1976-77 to 1984-85	0.47		
				1985-86 to 1992-93	0.46		
13	Hulten & Srinivasan [1999]	GAA (TL)	RVADD	1973-93	2.20	7.10	31.00
				1973-82	2.18	6.80	32.00
				1983-92	2.10	7.50	28.00
				1973-93 $	5.40	7.10	76.00
				1973-82 $	5.00	6.80	74.00
				1983-92 $	5.70	7.50	76.00
14	Goldar (2000)	GAA (TL)	RVASD	1981-82 to 1997-98	3.36		
				1981-82 to 1989-90	4.52		
				1990-91to 1997-98	1.86		
			RVADD	1981-82 to 1997-98	5.79		
				1981-82 to 1989-90	8.97		
				1990-91to 1997-98	2.92		
			RGO	1981-82 to 1997-98	1.49		
				1981-82 to 1989-90	2.13		
				1990-91to 1997-98	0.90		
15	Trivedi, *et al* [2000]	GAA TL	RGO	1973-74 to 1997-98	0.99	7.80	12.69
			RVASD		2.61	7.20	36.25
			RVADD		4.37	9.00	48.56
16	Unni et al (2001)	GAA (SL)	RVASD	1978-95	-0.10	6.60	-1.52
				1978-90	1.13	5.90	19.15
				1978-85	-0.26	4.60	-5.65
				1985-90	4.00	7.50	53.33
				1990-95	-1.28	8.20	-15.61
17	Goldar & Kumari (2003)#	GAA (TL)	RGO	1981-82 to 1997-98	1.40 (1.50)		
				1981-82 to 1990-91	1.89 (1.60)		
				1990-91 to 1997-98	0.69 (1.30)		

Table 3.3A: Estimates of Productivity and Efficiency for Indian Organised Manufacturing Sector *(Contd.)*

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	Proxy for Production	Period	TFPG (% p.a.) or Mean Efficiency	Growth Rate of Production (% p.a.)	Contrib-ution of TFPG to Growth of Output (%)
18	Trivedi (2003)	GAA (TL)	RGO	1980-81 to 1997-98	1.60	8.00	20.00
19	TSL (2003)	GAA (TL)	RGO	1981-82 to 1999-00	0.79	7.66	10.30
				1981-82 to 1992-93	0.68	7.57	9.00
				1993-94 to 1999-00	0.97	7.81	12.40
				1991-92 to 2001-02	2.56	8.55	29.90
				1991-92 to 2001-03	3.46	11.74	29.50
				1981-82 to 2001-02	2.96	5.61	52.80
				1981-82 to 1992-93	1.80	5.46	33.00
				1993-94 to 2001-02	4.37	5.80	75.30
20	Unel (2004)	GAA (TL)	RVASD	1979 -97	1.4(3.1)@		
				1979 -90	1.8(3.2)@		
				1990-91	-8.8(-7.2)@		
				1991-97	2.5(4.7)@		
21	Das (2004)	GAA (TL)	RGO	1980-81 to 1999-00	-3.88#		
				1980-81 to 1989-90	7.3#		
				1990-91 to 1999-00	-0.18#		
22	Goldar (2004)	GAA (TL)	RGO	1981-82 to 1990-91	0.92		
				1991-92 to 1999-00	0.65		
				1980-81 to 1990-91	1.37		
			RVASD	1979-80 to 1990-91	2.14		
				1991-92 to 1997-98	1.00		
				1991-92 to 1999-00	1.57		
		PFA (TL)	RGO	1979-80 to 1990-91	2.23		
				1991-92 to 1997-98	1.08		
				1991-92 to 1999-00	1.65		
23	Pradhan & Barik (2004)	PFA (TL)	RGO	1963-64 to 1994-95	0.56	6.59	8.50
		GAA (TL)			0.59	6.81	8.66
24	Trivedi (2004)	GAA (TL)	RGO	1980-81 to 2000-01	1.00	7.80	12.80
				1980-81 to 1991-92	1.90	7.50	25.30
				1992-93 to 2000-01	0.70	8.60	8.10
		PFA (CD)		1980-81 to 2000-01	0.80	7.80	10.30

Table 3.3A: Estimates of Productivity and Efficiency for Indian Organised Manufacturing Sector *(Contd.)*

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	Proxy for Production	Period	TFPG (% p.a.) or Mean Efficiency	Growth Rate of Production (% p.a.)	Contrib-ution of TFPG to Growth of Output (%)
25	Virmani (2004)	PFA (augmented)	RVASD	1950-51 to 1979-80	-0.30		
				1950-51 to 1964-65	0.40		
				1965-66 to 1979-80	-0.80		
				1980-81 to 2003-04	2.00		
				1980-81 to 1991-92	1.30		
				1992-93 to 2003-04	2.80		
26	Banga and Goldar (2007)	PFA(CD)	RGO (CD)	1980-81 to 1999-00	0.59 (0.80)£	7.63	7.70
				1980-81 to 1989-90	0.88 (0.50)£	7.21	12.20
				1989-90 to 1999-00	0.26 (1.30)£	8.12	3.20
27	Bosworth et al (2007)	GAA (CD)	RVASD	1960-61 to 2004-05	0.90		
				1960-61 to 1979-80	0.20		
				1980-81 to 2004-05	1.50		
				1960-61 to 1973-74	1.10		
				1973-74 to 1983-84	-0.30		
				1983-84 to 1993-94	2.10		
				1993-94 to 1999-00	0.30		
				1999-00 to 2004-05	1.40		
28	Ray (2002)	MI	RGO	1986-87 to 1995-96	0.81		
				1986-87 to 1990-91	0.17		
				1991-92to 1995-98	1.45		
		TI	RGO	1986-87 to 1995-96	0.49		
				1986-87 to 1990-91	0.23		
				1991-92to 1995-98	0.74		
29	Mukherjee & Ray (2005)#	DEA	RGO	1986-2000	0.95		
				1986-91	0.96		
				1991-2000	0.94		
				1991-96	0.96		
				1996-2000	0.91		
30	Rajesh & Mahapatra (2009)	GAA (TL)	RVASD	1981 to 2003	0.44		
				1981 to 1991	1.40		
				1992–2003	-0.52		
		DEA ¥		1981 to 2003#	0.78		
				1981 to 1991#	0.77		
				1992–2003#	0.78		

Table 3.3A: Estimates of Productivity and Efficiency for Indian Organised Manufacturing Sector *(Concld.)*

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	Proxy for Production	Period	TFPG (% p.a.) or Mean Efficiency	Growth Rate of Production (% p.a.)	Contrib-ution of TFPG to Growth of Output (%)
31	Kathuria, Raj and Sen (2010)	PFA (CD)	RVASD (Levinsohm and Petrin methodology)	1994-20012001-05 1994-2005	0.043.14 0.64		
32	Gupta (2008)	GAA	RGO	1971-80 1980-90 1991-97 1998-2003 1970-2003	2.8 5.1 2.5 6.9 4.1		
			RNVA	1971-80 1980-90 1991-97 1998-2003 1970-2003	2.9 2.4 0.1 4.3 2.4		

Notes: We have calculated the contribution of productivity to growth in the case of studies which report both TFPG and rate of growth of proxy of output used in the study.

* Though Ahluwalia (1991) has also estimated production function, she preferred the GAA estimates to PFA estimates. Hence, we have reported only the latter.

@ See Hall, R (1988) for further elaboration on methodology

¥ Indicate efficiency level

\# Figures are corrected for capacity utilisation.

Table 3.3B: Estimates of Productivity and Efficiency for Indian Unorganised Manufacturing Sector

Sr. No.	Study	Methodology for TFPG Estimation (underlying form of production function)	**Output Measure**	Period	Estimate of TFPG % p.a.	Growth Rate of Production (% p.a.)	Contrib-ution of TFPG to Growth of Output (%)
1	Mohanty (1992)	PFA (CD)	RVASD	1970-71 to 1988-89	0.0850	4.40	1.93
				1970-71 to 1979-80	-0.0006	4.50	-0.01
				1980-81 to 1988-89	0.0003	5.40	0.01
2	Unni et al (2001)	GA (SI)	RVASD	1978-95	-2.47	6.40	-38.6
				1978-90	-2.66	9.10	-29.2
				1978-85	-14.57	15.50	-94.0
				1985-90	11.37	1.50	758.0
				1990-95	-3.13	0.40	-782.5
3	Raj & Duraiswamy (2006)	MI	RVASD	1978-85	-6.30		
				1985-90	7.80		
				1990-95	0.40		
				1995-01	1.70		
				1978-79 to 1989-90	-1.00		
				1989-90 to 2000-01	0.70		
4	Rajesh & Mahapatra (2009)	MI	RVASD	1978–2001	0.1000		
				1978-79 to 1989-90	-0.3000		
				1994–95 to 2000–01	0.6000		
		DEA(estimates of Technical Efficiency)		1978–2001	0.7090		
				1978-79 to 1989-90	0.6210		
				1994–95 to 2000–01	0.8420		
5	Kuthuria, Raj and Sen (2010)	PFA (CD)	RVASD (Levinsohm and Petrin methodology)	1994-20012001-05	-4.01-16.0		
				1994-2005	-10.14		

can be seen from Table 3.3A and 3.3B, the studies on unorganised sector have been very few.

3.5.1 Organised Manufacturing Sector

Studies by Ahluwalia (1991), Dholakia and Dholakia (1994), Majummdar (1996), Gangopadhyay & Wadhwa (1998), Srivastava (1996), Mitra (1999), Tata Services Limited (TSL, 2003), Topalova (2004) and Unel (2003) find that change in policy regime in India has been associated with higher TFPG and/or efficiency. However, the timing of the change of policy regime in these studies differs. Ahluwalia (1991), Dholakia and Dholakia (1994), Majummdar (1996), Gangopadhyay and Wadhwa (1998), among others, have used the eighties as the beginning of the liberalised policy regime and compared it with the earlier period. Srivastava (1996) and Mitra (1999) compared the post mid-eighties with the earlier period and treat the former as a period of liberalised policy regime. Ray (2002), Unel (2003) and Topalova (2004) treat the nineties as the period of reform period and compare it with earlier period.

Mohanty (1992), Balakrishnan & Pushpangadan (1994), Rao (1996a), Pradhan & Barik (1998), Hulten & Srinivasan (1999), Unni et al (2001), Das (2004), Goldar (2004), Trivedi (2004), Banga and Goldar (2007), among others, find that TFPG has decelerated during the post-reforms period. Again, like the studies quoted in the above paragraph, these studies also use different periodisation for the pre and post-reform periods. However, except for a couple of studies, the mounting empirical evidence points out to the deceleration of TFPG during the nineties, as compared to that in the eighties. Some studies attribute it to the poor capacity utilisation during 1990s while others attribute it to the lag between reforms and impact on productivity growth. It is also noteworthy that quite a few of these studies have used policy dummy to demarcate the pre-reform from the post-reform period, with the exception of a few studies which have used the specific variables pertaining to tariff reduction, FII and FDI inflows, *etc.*, as a proxy for the liberalised regime.

3.5.2 Unorganised Manufacturing Sector

The studies by Mohanty (1992) and Unni, *et al* (2001) do not indicate any acceleration in TFPG for the unorganised sector in the wake of liberalisation, irrespective of the periodisation of reform period. As against it, Raj and Duraiswamy (2006) and Raj and Mahapatra (2009) indicate increase in TFPG and efficiency for the unorganised sector during the reform period. In fact, a recent study by Kuthuria *et al* (2010) finds a steady decline in TFPG in unorganised manufacturing sector over the period 1994-2005.

3.5.3 Determinants of TFPG across States

Besides the policy reforms, various state-specific characteristics have also been used by the researchers to investigate the determinants of TFPG. Jaydevan (1996), Ray (1997), Mitra (1999), Ray (2002), Kumar (2003), Aghion (2003), Trivedi (2003), Trivedi (2004), Mukherjee and Ray (2004), and Topalova (2004) are among a few studies which also deal with the estimation and/or determinants of productivity across states. The estimates of TFPG provided by some of these studies are provided below in Table 3.4. It can be seen from Table 3.4 that TFPG estimates by Mitra (1999) are rather high as compared to the other studies. This is mainly due to the use of RVADD used as the output proxy. The differences between TFPG in other studies are not too wide. Both Mitra (1999) and Ray (2002) indicate improvements in TFPG in response to policy reforms. However, Mukherjee and Ray (2004) do not indicate any substantial improvement in efficiency at the all India level as a result of reforms and also do not indicate any substantial changes in ranking of the states or convergence of efficiency in response to economic reforms in India. The inter-state variations in TFPG are high in the study by Mitra (1999). There is some problem in ranking of states according to TFPG since in the case where output fall is lower than fall in employment rate, it gets reflected in high or rising TFPG and such a state can get a higher rank, despite its poor overall performance.

Table 3.4: Estimates of TFPG and Efficiency for Indian Organised Manufacturing Sector

Study (year)→	Jaydevan (1996)	Ray (1997)	Mitra (1999)						Ray (2002)			Trivedi (2003)
Time-span →	1976-87	1969-85	1976-84		1985-92		1976-92		1986-90	1991-95	1986-95	1980-97
Region/State ↓	TFPG	TFPG	TFPG	TEFF	TFPG	TEFF	TFPG	TEFF	TFPG	TFPG	TFPG	TFPG
AP	1.10	-5.20	0.84	0.49	3.18	0.44	2.18	0.46	-0.10	1.80	1.00	1.80
BIH*	1.20	-3.00	4.16	0.46	3.14	0.47	3.58	0.46	4.10	0.20	1.90	1.90
GUJ	1.10	0.40	1.92	0.45	6.69	0.48	4.47	0.46	0.50	2.30	1.50	1.30
HAR	1.00	-3.10	-0.51	0.48	4.26	0.44	1.66	0.46	0.00	1.30	0.70	–
KAR	0.90	-5.50	1.98	0.44	6.97	0.48	4.48	0.46	0.90	1.40	0.40	1.90
KER	1.20	-4.80	3.50	0.43	6.69	0.49	5.32	0.46	0.20	-0.10	-0.20	–
MP*	1.40	-2.50	2.21	0.46	5.34	0.47	3.68	0.46	0.90	3.20	2.20	1.80
MAH	1.00	-1.90	0.11	0.46	5.94	0.46	4.00	0.46	0.00	2.30	1.30	2.10
ORI	0.30	-5.00	-5.18	0.53	5.84	0.42	0.70	0.47	1.70	1.40	1.30	–
PUN	1.00	0.30	11.61	0.58	9.36	0.40	1.13	0.49	-2.20	0.70	-0.60	–
RAJ	1.00	-2.70	-0.85	0.48	6.14	0.45	3.03	0.46	-0.20	2.90	1.10	2.30
TN	1.00	-0.60	-3.70	0.48	8.57	0.45	n.a.	n.a.	-0.10	1.10	0.50	1.50
UP*	1.50	-4.20	4.44	0.41	8.29	0.53	6.25	0.47	-1.30	2.50	0.90	1.90
WB	0.60	-5.50	0.60	0.53	-0.09	0.49	0.28	0.47	-1.50	1.50	0.20	1.00
All India	**1.00**	**-2.90**	**0.76**	**0.47**	**5.57**	**0.46**	**3.43**	**0.46**	**0.20**	**1.50**	**1.50**	**1.60**

Note: TFPG is pcpa and Technical Efficiency (TEFF) is in levels.

Table 3.4: Estimates of TFPG and Efficiency for Indian Organised Manufacturing Sector *(Concluded)*

Study →	Kumar (2003)				Trivedi (2004)			Mukherjee and Ray (2004)				
Time-span →	1969-80	1980-91	1991-95	1969-95	1980-92	1992-2001	1980-2001	1986-2000	1986-91	1991-2000	1991-96	1996-2000
Region/State ↓	TFPG	TFPG	TFPG	TFPG	TFPG	TFPG	TFPG	(Ranks based on Technical Efficiency)				
AP	1.10	0.72	-2.07	0.63	1.70	1.30	1.30	21	21	20	20	21
BIH*	-2.79	2.52	-3.14	0.14	3.10	2.00	1.70	5	5	4	5	5
GUJ	-0.23	0.32	2.03	0.24	0.30	2.20	0.70	10	13	10	15	6
HAR	2.15	-0.85	-0.97	0.20	–	–	–	19	20	19	21	18
KAR	-1.91	1.99	3.95	0.73	2.70	-1.30	1.20	15	11	14	10	16
KER	-1.08	3.36	-7.30	0.88	–	–	–	13	12	13	14	12
MP*	1.00	1.90	1.24	1.53	2.00	1.50	1.30	11	10	12	11	10
MAH	-3.03	2.40	0.82	0.30	1.70	-0.10	0.90	6	6	7	7	8
ORI	-3.86	2.61	-1.86	-1.10	–	–	–	8	8	8	9	9
PUN	0.25	2.14	2.07	1.46	–	–	–	22	22	21	22	17
RAJ	1.17	0.35	7.20	1.17	1.90	1.90	1.40	18	19	16	17	11
TN	4.34	-7.00	-16.04	-3.88	1.80	0.40	0.60	16	15	15	12	14
UP*	-2.22	4.06	2.16	1.62	2.50	-2.90	0.30	17	17	17	16	15
WB	-1.59	-1.41	2.53	-1.17	0.80	1.20	0.60	20	18	22	18	22
All India	**-0.26**	**2.34**	**1.71**	**1.35**	**1.90**	**0.70**	**1.00**	**0.94**	**0.96**	**0.94**	**0.96**	**0.91**

Note: TFPG is pcpa and Technical Efficiency (TEFF) is in levels.

The case of Bihar* has been pointed out by Ray (2002) and Trivedi (2003, 2004).

Some of the other studies have used the various characteristics of states which are considered as pertinent to exploiting the advantage of reforms at the state levels. These factors have been predominantly geographical location of states which makes them more suitable for water/surface transport, investment climate, labour regime as to whether it is pro-labour or pro-business or neutral. These characteristics have been provided in Table 3.5.

Table 3.5: Classification of states According to Various Characteristics

State	Geographical Characteristic	Labour Regime	IC Ranks and Category		
			2009	2002	
AP	C	EF	4	4	G
BIH*	L	N	13	14	NC
DEL	L	-	8	2	B
GUJ	C	WF	3	3	G
HAR	L	N	5	8	G
KAR	C	EF	1	5	G
KER	C	EF	2	10	P
MAH	C	WF	7	1	B
MP*	L	EF	13	9	P
ORI	C	WF	12	17	NC
PUN	L	N	10	6	G
RAJ	L	EF	16	16	NC
TN	C	EF	9	7	G
UP*	L	N	15	12	P
WB	C	WF	6	11	P

EF : Employer Friendly, WF: Worker Friendly, N: Neutral
G : Good, B: Best, NC: Not Classified
C : Coastal and L: Land locked
Note: Abbreviations used in the table are as follows:
Source: Geographical indicators as reported in Topalova (2004)
Labour regime as reported in Topalova (2004) from Besley and Burgess (2002)
IC Ranks and Category (2002) from FACS 2002 (quoted in Veeramani, 2005) and
IC Ranks (2009) as reported in Iarossi, Giuseppe (2009)

4. Coverage of the Study and Methodology

4.1. Coverage of the Study and Data Details

This study can be considered both a continuum and a complement to the previous studies, *viz.*, Trivedi *et al* (2000), and Trivedi (2004). These studies encompassed only organised manufacturing sector. The present study is more comprehensive as compared to the previous studies as regards the datasets used and its coverage which are as follows:

i) ***Use of micro level data***: Unlike the earlier studies, it uses four major datasets for estimation[18] of productivity. This study makes use of not only the meso (industry) level data, as was the case with the earlier studies, but also uses the micro (unit) level data.

ii) ***Inclusion of data for Non-government Public Limited Companies:*** This dataset of manufacturing sector is compiled by the RBI (henceforth referred to as the RBI dataset). This dataset enables us to get a balanced panel of micro level data at the company level.

iii) ***Inclusion of data on unorganised Sector***: The study uses data available for unorganised manufacturing sector so as to make comparisons between organised and unorganised sectors.

iv) ***Inclusion of more states of India***: In Trivedi (2004), only 10 major states of India (and the three bifurcated states) were included. In this study, 15 major states (and the three bifurcated states) have been included.

v) ***Inclusion of Food, Beverages and Tobacco Industry***: Given the importance of this industry for employment generation and output produced, we have included this industry as well in our analysis in this study. As can be seen from Section 2, this industry accounts for more than 20 per cent of employment and about 13 per cent of gross

[18] The word estimation is used in a rather loose sense. It means estimation of productivity with both parametric and non-parametric methods.

output of India's organised manufacturing sector. Thus, the industry coverage of this study is much wider.

vi) ***Extended Temporal Coverage***: The temporal coverage of the study has been extended to 2003-04 (to 2004-05 in case of RBI dataset). In fact, for the aggregate manufacturing sector for India as a whole, we have extended the coverage of the study up to 2007-08.

vii) ***Use of Input-Output Absorption Matrices for Input Price Index compilation:*** The input-Output absorption matrix 1998-99 has been used to update the input price index series, during 1998-99 to 2003-04, for industry and state level analysis. For the total organised manufacturing sector for all India where we could extend the analysis up to 2007-08, we have also used *Input-Output Absorption Matrices* for 2003-04 and 2006-07 for the compilation of input price indices. More details of the datasets used are given in Tables 4.1 and 4.2.

The study encompasses 18 major states of India, three of which were bifurcated in November 2000. The bifurcated states are: Bihar, Madhya Pradesh and Uttar Pradesh. Three new states, *viz.*, Jharkhand, Chattisgarh and Uttarakhand were carved out of Bihar, Madhya Pradesh and Uttar Pradesh, respectively. To ensure the comparability of pre-bifurcation period with the post-bifurcation period, we have added the data for the newly created state to the respective state from which it was created. We have marked the bifurcated States with '*'. Thus, the states included in this study, arranged in alphabetical order, are: Andhra Pradesh (AP), Bihar* (BIH*), Delhi (DEL), Gujarat (GUJ), Haryana (HAR), Karnataka (KAR), Kerala (KER), Maharashtra (MAH), Madhya Pradesh* (MP*), Orissa (ORI), Punjab (PUN), Rajasthan (RAJ), Tamil Nadu (TN), Uttar Pradesh* (UP*) and West Bengal (WB).

The industry groups chosen for investigation, again arranged in alphabetical order are: (i) Chemical and chemical products (CHEM); (ii) Food, Beverages and Tobacco (FBT); (iii) Leather and leather products (LEATH); (iv) Metal and metal products (METAL); (v) Machinery and

Table 4.1: Datasets and Methodology Used in the Study

Dataset	Temporal Span	Coverage	Characteristics of the Dataset	Methodology Used	Industry Coverage	Spatial Disaggregation
1) ASI	1980-81 to 2003-04	Organised Manufacturing	2-3 digit level industry data and also for the manufacturing sector	Growth Accounting with Translog index used for measurement of Total Factor Productivity	1. Food Products & Beverages 2. Textiles & Textile Products 3. Leather & Leather Products 4. Chemical & Chemical Products 5. Metal & Metal Products 6. Machinery & Transport Equipment, **Total Manufacturing**	1. Andhra Pradesh 2. Bihar* 3. Delhi 4. Gujarat 5. Haryana 6. Karnataka 7. Kerala 8. Madhya Pradesh* 9. Maharashtra 10. Orissa 11. Punjab 12. Rajasthan 13. Tamil Nadu 14. Uttar Pradesh* 15. West Bengal **All India**
2) ASI unit level data	1993-94 to 2003-04 (except 1995-96)	Organised Manufacturing	Unit codes have not been given in a consistent manner across the years and hence, preparation of a panel data not possible	Efficiency measurement for each year with stochastic frontier production function	—"—	**All India**
3) RBI Data from Balance Sheets of Companies	1993-94 to 2004-05	Non-government Public Limited Companies in Manufacturing Sector	Balanced panel data for 6 industries and also for 449 companies	Data Envelopment Analysis, SFPF, calculation of efficiency for each year and also Malmquist index of productivity change	—"— (except leather and Tobacco industries)	**All India**

Table 4.1: Datasets and Methodology Used in the Study *(Concld.)*

Dataset	Temporal Span	Coverage	Characteristics of the Dataset	Methodology Used	Industry Coverage	Spatial Disaggregation
4) Unit level NSSO data	45th Round (1989-90), 51st Round (1994-95) and 56th Round (2000-01)	Unorganised sector	Unit codes have not been given in a consistent manner across for the three rounds and hence, preparation of panel data was not possible. Also compilation of series on real capital stock is problematic due to discontinuous nature of the data.	Estimation of Labour productivity	—"—	**All India**

Table 4.2: No. of Micro Units Covered in the Various Datasets

	No. of Units in ASI Unit Level Dataset					
YEAR	CHEM	FBT	LEATH	METAL	MTE	TEX
1993-94	2777	4613	407	3098	4575	3808
1994-95	3526	7631	608	4840	7048	5311
1996-97	3650	7793	586	5065	7055	5585
1997-98	1480	3065	273	1866	3055	2957
1998-99	1489	2524	356	1845	3064	2715
1999-00	1623	2011	344	1985	3803	2921
2000-01	2219	2674	487	2592	4711	3909
2001-02	2485	2653	562	2605	5024	4072
2002-03	2430	3294	562	2703	5110	4084
2003-04	3222	4947	721	3936	7083	5073
No. of Companies included from The RBI dataset						
Period	CHEM	FBT*	LEATH	METAL	MTE	TEX
1993-94 to 2004-05	78	60	-	47	116	53
No. of Units in NSS Unit Level Dataset						
Year	CHEM	FBT	LEATH	METAL	MTE	TEX
1989-90 (45th Round)	922	22660	2140	4809	1928	15935
1994-95 (51st Round)	1547	22885	2856	6917	2688	42246
2000-01 (56th Round)	1977	32172	2543	9772	4896	50891

Note: * This dataset did not contain any company from Tobacco industry.

transport equipment (MTE); and, (vi) Textiles and textile products (TEX). In addition, we have investigated the performance of overall manufacturing sector (MFG).

Thus, this study is a major revision of the earlier studies, in terms of the spatial coverage, temporal coverage, sectoral coverage and application of alternative methodologies to examine the performance of the Indian manufacturing sector.

The input price index in this study uses input weight for input prices based on the CSO Input-Output tables 1978-79, 1984-85, 1989-90, 1993-94 and 1998-99[19] and hence this index is expected to reflect a more adequately the movement in input prices as compared with the indices

[19] As mentioned earlier, we have also used Input-Output tables 2003-04 and 2006-07 for computing input price index for the Total organised manufacturing sector for India.

which have been used in the other studies. The advantage of using these weights is that these indices also include the prices of 'infrastructure and other services' as well. The extension of time-period in this study has also enabled us to increase the length of the post-reform period in our dataset. For the period of the study, three National Industrial Classification (NIC) codes have been used for data collection by the Annual Survey of Industries (ASI). The details of NIC codes (1970, 1987 and 1998) of the industries covered in this study have been provided in Annexure 4.1. It may also be noted that the necessary adjustment has been made in the data series for period 1980-81 to 1997-98 so as to make it comparable to the ASI data reported after 1997-98 (as these do not include electricity, *etc.*).

4.2 Measurement of Variables

Output: We have used gross output/value of output as the proxy for output, which has been converted in real terms by deflating it by the WPI for the respective industries. For the datasets which begin in 1993-94, we have used WPI with 1993-94 base and for the ASI industry-state level data which begins in 1980-81, the WPI series have been spliced and arithmetically converted to 1981-82 base.

Labour: Total persons engaged/ total employees have been used as a measure of labour input. We did not attempt to adjust for the quality of the labour. It may be pertinent to note that Bosworth, et al (2007) did adjust for the quality of labour and did not find any significant contribution of education to productivity.

Inputs: As mentioned earlier, we have included total inputs which comprise of material, fuel and inputs of other services and we have deflated total inputs by a weighted index of input prices, wherein, the weights of input prices have been assigned in proportion to the value of inputs used to the total inputs used by the respective industry. The weights have been derived from the absorption matrices of the various input-output tables provided by the CSO. The industry codes in the various input-output

matrices which are matched with the various NIC codes are provided in Annexure 4.2.

Capital Stock: As the stock of capital is available at the historic cost, we have converted the same to replacement cost, wherever possible. This has been possible in the case of datasets 1 and 3. For datasets 2 and 4, this conversion was not possible due to the lack of data on the units' capital stock in years prior to 1993-94. Annexure 4.3 details the procedure for compilation of capital stock series for dataset 1 and Annexure 4.4 does so for the dataset 3.

4.3. Methodologies Used

Productivity and efficiency levels/changes can be measured using either parametric or non-parametric methods. In Table 4.3, we outline the main methodologies used in the literature to measure productivity and efficiency levels/changes. We have used some of these methodologies and

Table 4.3: Methodologies Used in the Literature to Measure Productivity and Efficiency Levels/Changes

Estimation Approach	Method	Main Options	Measure
Parametric Estimation	Production function	Cobb-Douglas, Translog, Constant Elesticity of Substitution (CES)	Productivity growth (Descriptive)
	Stochastic Frontier	Cobb-Douglas, Translog, with alternative assumptions about the distribution of random variable (U_i) that capture inefficiency	Efficiency level (Normative)
Non-parametric methods	Index of Productivity	Discrete approximations, based on the various functional forms of production functions, such as, Cobb-Douglas, Translog, *etc.*	Productivity change (Descriptive)
		Malmquist index based on distance functions	Productivity and efficiency change (Descriptive and Normative)
	Data Envelopment Analysis (DEA)	Input or Output orientations, Constant/ Non-constant/Variable Returns to Scale	Efficiency level(Normative)

these are explained in the various sub-sections in the context of the dataset used.

4.3.1 ASI dataset for Industry-State Levels (Organised Manufacturing Sector)

For this dataset, we have used Equation (4.1) to estimate '*annual*' TFPG, which have later been used to construct TFP indices. The trend growth rates of TFP for the entire time-span of the study have been estimated by using the semi-log trend equation as specified in equation (4.2A). Equation (4.2B) has been used for estimating trend rates of growth of TFP for the pre-reform and post-reform periods, respectively.

$$\ln (TFP_t/TFP_{t-1}) = \ln (O_t/O_{t-1}) - [(w_t+w_{t-1})/2] \ln (L_t/L_{t-1}) - [(n_t+n_{t-1})/2] \ln (N_t/N_{t-1}) - [\{(1-(n_t+w_t)) + (1- (n_{t-1}+w_{t-1}))\}/2] \ln (K_t/ K_{t-1}) \quad ...4.1$$

$$\ln Y_t = \alpha_0 + \beta_0 T + \varepsilon_t \quad ...4.2A$$

$$\ln Y_t = \alpha_0 + \beta_0 T + \gamma_0 DPOLICY + \delta_0 DPOLICY * T + \varepsilon_t \quad ...4.2B$$

We have also used the Cobb-Douglas (CD) production function for measurement of TFPG and the inter-state and inter-industry differences in TFP levels and growth rates, as stated in equations 4.3 A and 4.3 B

$$\begin{aligned}\ln O_t = {} & C_1 + \alpha_1 \ln L_t + \beta_1 \ln K_t + \gamma_1 \ln N_t + \delta_1 t + \Pi_1 DPOLICY_t + \lambda_1 DAP + \lambda_2 DBIH^*_t + \\ & \lambda_3 DDEL_t + \lambda_4 GUJ_t + \lambda_5 DHAR_t + \lambda_6 DKAR_t + \lambda_7 DKER_t + + \lambda_8 DMAH_t + \\ & \lambda_9 DMP^*_t + \lambda_{10} DORI_t + \lambda_{11} DPUN_t + \lambda_{12} DRAJ_t + \lambda_{13} DTN_t + \lambda_{14} DUP^*_t + \lambda_{15} DWB_t + \\ & \theta_1 DAP*T_t + \theta_2 DBIH^*T_t + \theta_3 DDEL*T_t + \theta_4 DGUJ*T_t + \theta_5 DHAR*T_t + \theta_6 DKAR*T_t + \\ & \theta_7 DKER*T_t + \theta_8 DMAH*T_t + \theta_9 DMP^*T_t + \theta_{10} DORI*T_t + \theta_{11} DPUN*T_t + \\ & \theta_{12} DRAJ*T_t + \theta_{13} DTN*T_t + \theta_{14} DUP^*T_t + \theta_{15} DWB*T_t + \varepsilon_t \end{aligned} \quad ...4.3A$$

$$\begin{aligned}\ln O_t = {} & C_2 + \alpha_2 \ln L_t + \beta_2 \ln K_t + \gamma_2 \ln N_t + \delta_2 T + \Pi_2 DPOLICY_t + \pi_1 DFBT_t + \pi_2 DCHEM_t + \\ & \pi_3 DLEATH_t + \pi_4 DMETAL_t + \pi_5 DMTE_t + \pi_6 DTEX_t + \Omega_1 DFBT*T_t + \Omega_2 DCHEM*T_t \\ & + \Omega_3 DLEATH*T_t + \Omega_4 DMETAL*T_t + \Omega_5 DMTE*T_t + \Omega_6 DTEX*T_t + \mu_t \end{aligned} \quad ...4.3B$$

The notations used in the above equations are as follows. 'O' and 'N' denote value of output and raw materials at constant (1981-82) prices. 'L' and 'K' denote labour employed and real capital stock, respectively. In equation (4.1), 'w' and 'n' are shares of wages and inputs (excluding factor inputs) respectively, in nominal output. 'ln' indicates natural logarithm, whereas, 't' denotes time. We have used notation 'T', wherever we have used time an explanatory variable. The weight of capital input in equation (4.1) has been obtained as residual, *i.e.*, by subtracting the sum of weights of labour and inputs from unity.

In equation 4.3A and 4.3B, we have used abbreviations for the states and industries[20]. In these equation parameters α_s, β_s and γ_s, measure output (O) elasticities *w.r.t.* L, K, and N, respectively. In equation 4.3A we have included the policy dummy variable, *viz.*, DPOLICY and also the intercept dummies for the states. In equation 4.3B instead of state dummies, we use the industry dummies. Parameters δ and π measure TFPG and the impact of policy regime, respectively. The estimates of coefficients of the dummies, *viz.*, λ_1 to λ_{15}, enable us to compare the differences in the levels of TFP across the states. The estimates of π_1 to π_6 enable us to compare TFP across industries. We have used STATA 8.2 for estimation of this production function. The dummy for the intercept (state) for the benchmark state is dropped by the software. The coefficients λ_i (subscript i denotes the State) provide us with the differences in the TFP level of the respective states as compared to that for the benchmark state for which the dummy is dropped. Similarly, coefficients π_j (subscript j denotes the industry) provide us with the differences in the TFP level of the respective industries as compared to that for the benchmark industry for which the dummy is dropped by the software itself.

We have also included multiplicative or slope dummies in equation 4.3A (4.3B) which have been obtained by multiplying the state (industry)

[20] The abbreviations used for the various states (see the list of abbreviations) by the first three letters of the respective states.

intercept dummies with the time variable. These dummies have been indicted by 'T' and multiplied to the intercept dummies. Needless to mention that one of the states/industries is treated as benchmark state/industry for TFPG and the multiplicative dummy for the benchmark state/industry is dropped by the software. The coefficients of slope dummies capture the differences in TFPG of various states/industries in relation to the benchmark state/industry. Equation 4.3A and 4.3B have been estimated using the panel data. Data for 15 states/6 industries for the above-mentioned variables spanning the time-period 1980-81 to 2003-04 (24 years) constituted the balanced panel for each state/industry group. The benchmark states/industries for intercept dummies and slope dummies are indicated in the empirical results.

Trend rates of TFPG have been estimated for TFP indices obtained by using the TL index for the time-span 1980-81 to 2003-04, and also for the pre-reform and post-reform periods using equations 4.1, 4.2A and 4.2B. In equations 4.2A and 4.2B, ln Y_t indicates the natural log of the variable (*viz.*, TFP indices) for which trend growth rate is to be estimated. Time variable is indicated by 'T'. In equation 4.2B, the dummy variable is denoted by 'DPOLICY'. This variable assumes value equal to '0' in the first pre-reform period, whereas, '1' in the post-reform period. [(Antilog of β_0)-1]*100 gives us trend growth rate for the pre-reform period, whereas, [{Antilog of (β_0+ δ_0)} -1]*100 gives us the trend growth rate for the post-reform[21] period. As there has been a debate over whether the year 1991-92 should be included in the post or pre-reform period, we have estimated productivity with two periodisation of pre and post-reform period. These are periodisation 1 with pre-reform period as (1A): 1980-81 to 1990-91 and post-reform Period (1B): 1991-92 to 2003-04 and are periodisation 2 with pre-reform period as (2A): 1980-81 to 1991-92 and post-reform Period (2B): 1992-93 to 2003-04.

[21] A few researchers do not consider post-reform as the appropriate description of the period of liberalised policy regime. Ideally, it could also be called as the reform period rather than post-reform period. However, in view of the fact that majority of researcher have referred to it as the post-reform period, we also follow this tradion.

As regards the measure of production, gross output[22] has been preferred to value added and hence, total inputs[23] have been included in the set of inputs. Data on value of output, number of employees, value of material inputs and net fixed capital formation, fixed capital, *etc.*, have been drawn from the datasets mentioned above. All these data, barring the number of employees, are in nominal terms. Nominal output has been converted into real output by using the Wholesale Price Index (WPI) for the relevant industry/industry groups. WPI series with base 1970-71, 1981-82 and 1993-94 have been used for the relevant periods. The 1970-71 and 1993-94 WPI series have been arithmetically brought to a common base year, *i.e.*, 1981-82. We have converted the nominal inputs series into real input series by deflating them by the input price index series constructed for each of the industry groups. As mentioned above, five input-output matrices have been used to obtain the weights for inputs used by the selected industries. These are Input-Output (Commodity X Industry) absorption matrices. The industries in the input-output absorption matrices which broadly correspond to the industries selected in this study have been reported in Annexure 4.2.

As both workers and supervisory/managerial staff changes can affect productivity, we have preferred to use the number of employees over the number of workers, as a proxy for labour input. For the period 1998-99 to 2001-02, the data on total persons engaged has been used. The data on emoluments and of total inputs in nominal gross output, used to calculate 'w' and 'n', respectively (see Equation 4.1), have also been drawn from the ASI and used for estimating TFPG for dataset 1.

[22] See justification for this in Trivedi (2004).

[23] Total inputs comprises total value of fuels and materials consumed as well as expenditures such as cost of contract and commission work done by others on materials supplied by the factory, cost of materials consumed for repair and maintenance of factory's fixed assets including cost of repairs and maintenance work done by others to the factory's fixed assets, inward freight and transport charges, rates and taxes (excluding income tax), postage, telephone and telex expenses, insurance charges, banking charges, cost of printing and stationery and purchase value of goods sold in the same condition as purchased.

The National Accounts Statistics (NAS) 1990 provides estimates of net fixed capital stock (NFCS) for the registered manufacturing sector. Using data from NAS and from ASI, we have constructed the capital stock series. Details of compilation of capital stock series have been provided in Annexure 4.3.

4.2.2 ASI dataset at Unit Level (Organised Manufacturing Sector)

As mentioned earlier, this dataset does not enable us to construct either a balanced or unbalanced panel, as it is not possible to assign identification codes for the units surveyed in the sample sector. In view of this, the best we could do is to estimate efficiencies derived from the stochastic frontier production function, for each year and for each industry and report the mean efficiency levels for the same.

For this dataset, at best we could use a Cobb-Douglas and Translog Production Frontier using cross-sectional data and assuming a truncated normal distribution for the non-negative random variable (U_i) that capture inefficiency. The Translog Production Frontier functional form underlying this model is given in Equation (4.4) and the Cobb-Douglas function excludes the square and interaction terms for inputs from this equation.

$$\ln(O_i) = \beta_0 + \beta_1 \ln(K_i) + \beta_2 \ln(L_i) + \beta_3 \ln(N_i) + \beta_4 \ln(K_i)^2 + \beta_5 \ln(L_i)^2 + \beta_6 \ln(L_i)^2 + \beta_7 \ln(K_i) * \ln(L_i) + \beta_8 \ln(K_i) * \ln(N_i) + \beta_9 \ln(L_i) * \ln(N_i) + V_i - U_i \quad \ldots(4.4)$$

Here 'i' indicates the firm and V_i are random error term with a zero mean and constant variance and are identically and independently distributed (iid). The estimates of efficiency have been obtained using Front 4.1 version of the software provided by Tim Coelli[24].

4.2.3 RBI dataset at Unit Level for Non-government Public Limited Companies

This dataset enabled us to construct a balanced panel for industries and for all manufacturing. We have estimated the standard efficiency

[24] See Coelli (1996), http://www.uq.edu.au/economics/cepa/frontier.htm

models within the framework of data envelopment analysis (henceforth, DEA), with the assumptions of CRS (constant returns to scale) and VRS (variable returns to scale) for each of the industries across years and also estimated the output-oriented Malmquist index (MIo) for estimating productivity change. As mentioned by Coelli (1996) DEA drawing upon the works of Debreu (1951) and Koopmans (1951), Farrell (1957) outlined the framework for measurement of *levels of efficiency* in the framework of DEA. DEA method involves construction of a piecewise linear frontier (using the linear programming models) for the decision making units (DMUs) from their observed input-output data. In other words, these combinations of inputs-outputs are based on the actual data and no functional form to the underlying relationship between inputs and outputs is assumed. Thus, the construction of the frontier is parameter free. Efficiency of a DMU is measured in terms of how far it is from the frontier.

DEA can be either input-orientated or output-orientated. The input-orientated (I-O) DEA method defines the frontier by seeking the maximum possible proportional reduction (radial measure) in input usage for a given

Figure 4.1(A). Input Oriented (I-O) Frontier

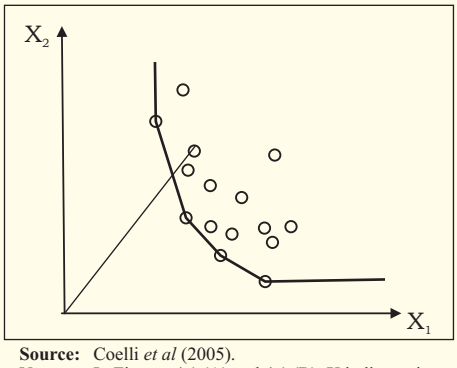
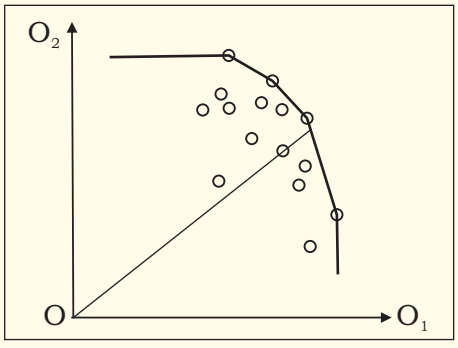


Figure 4.1(B). Output Oriented (O-O) Frontier



Source: Coelli *et al* (2005).
Note: In Figures 4.1 (A) and 4.1 (B), X indicates input and O indicates output. Subscripts '1' and '2' indicate the two inputs in Figure 4.1 (A) and outputs in Figure 4.1(B), respectively.

output for each DMU. This is shown in Figure 4.1 (A). In the case of output orientated (O-O) DEA method, it measures the maximum proportional (radial measure) increase in output production, for the input levels (Figure 4.1 (B)). (In)efficiency of a DMU is measured in terms of how far it is from the frontier. The efficiency is bound between 0 and 1, with DMUs which are on the frontier, the efficiency level will be equal to 1 and those outside (inside) it in the case of I-O (O-O) will have efficiency levels less than 1. The I-O and O-O measures of technical efficiency yield identical results in the case of constant returns to scale (Fare and Lovell, 1978).

The assumption of CRS is valid when all DMUs operate at optimal scale. In the situations of market imperfections and distortions, the companies have to deviate from operating at optimal scale. Adjustments to CRS-DEA model to incorporate VRS were suggested by Fare, Grosskopf and Logan (1983) and Banker, Charnes and Cooper (1984)[25]. Technical efficiency (TE) measured with the assumption of CRS in the event of market imperfections and distortions is confounded by scale efficiencies (SE). In order to remove the effect of SE from TE, the use of VRS models is adhered to. Figure 4.2 and equations 4.5 to 4.8 illustrate how the assumptions regarding the returns to scale can alter the measurement of TE. Figure 4.2 depicts one output and one input case. We measure output quantity (q) on Y axis and input quantity (x) on X axis. CRS and VRS frontiers have been indicated along with the NIRS (non-increasing returns to scale) portion of the VRS frontier.

The input oriented technical and scale efficiencies at point 'P' (Figure 4.2) can be estimated as follows.

$$TE_{CRS} = APc/AP \quad \ldots 4.5$$

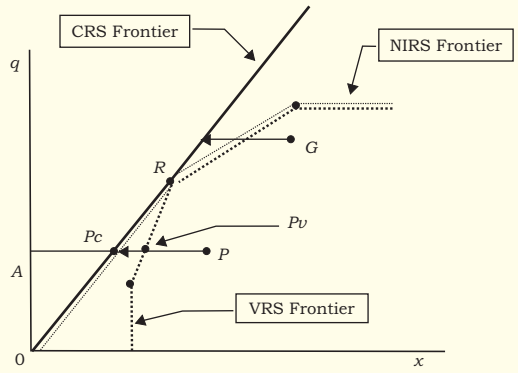
$$TE_{VRS} = APv/AP \quad \ldots 4.6$$

$$SE = APc / APv \quad \ldots 4.7$$

$$TE_{CRS} = TE_{VRS} * SE = (APv/AP) * APc/AP \quad \ldots 4.8$$

[25] See Coelli et al (2005) for more elaboration.

Figure 4.2: Production Frontiers with Alternative Assumptions of Returns to Scale



Source: Coelli *et al* (2005).

In other words, the scale efficiency can be interpreted as the ratio of the average product of the DMU operating at point Pv to the average product at the point of technically optimal scale of production at point R.

We have used DEAP version 2.1 of the software provided by Tim Coelli[26] for measuring efficiency levels of DMUs and have reported only the mean efficiency levels of companies for each industry in the following chapter.

We have used equation 4.4 and also the Cobb-Douglas specification to estimate the efficiency of various industries. The Cobb-Douglas specification excludes the quadratic and multiplicative terms of equation 4.4. Rest of the description of methodology remains the same as specified in section 4.2.2.

Frontiers and technical-efficiency measures can be compared across time by means of the Malmquist index. Malmquist productivity indices were first introduced into the literature by Caves et al[27] (1982) and were empirically applied by Fare *et al* (1994). They demonstrated that the

[26] http://www.uq.edu.au/economics/cepa/deap.htm

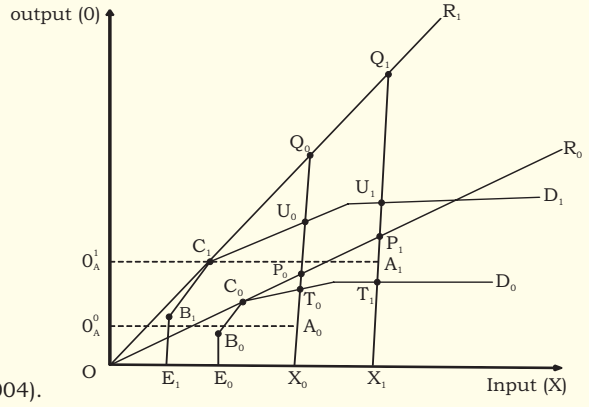
[27] Caves, Christensen, and Diewert (1982), Fare, Grosskopf, Norris and Zhang (1994).

Malmquist output based productivity index can be decomposed in two components: (i) representing the reletive efficiency change index under the constant returns to scale and measures the degree of catching up to the best-practice frontier for each observation between time period t and time period t+1; and (ii) representing the technical change index which measures the shift in the frontier of technology between two time periods evaluated at X_t and X_{t+1}. The Malmquist index output oriented (MIo) index of productivity change is the geometric mean of the two output based Malmquist TFP indices. The former ratio uses the period t technology and the latter ratio uses period t+1 technology. The four distance functions are calculated for MIo.

$$MIo(O_{t+1}, X_{t+1}, O_t, X_t) = \sqrt{\frac{D^t{}_o(X_{t+1}, O_{t+1})}{D^t{}_o(X_t, O_t)} \times \frac{D^{t+1}{}_o(X_{t+1}, O_{t+1})}{D^{t+1}{}_o(X_t, O_t)}} \quad ....4.9$$

A value of MIo > 1 indicates positive TFP growth from period t to period t+1, while a value less than one indicates a TFP growth decline. We elaborate this using Figure 4.3.

Figure 4.3: A Graphical View of the Malmquist Index of Productivity Change



Source: Ray (2004).

In Figure 4.3, Ro and R_1 indicate the CRS frontiers for the two times period 0 and 1, whereas, the piecewise linear frontiers depict the VRS frontiers. The lower frontier is for time period '0' and the upper frontier is for time period 1[28]. To measure the Malmquist index of productivity change, we have used DEAP 2.1 version, provided by Coelli.

4.2.4 Unit level NSSO data

As seen in Section 2, the unorganised manufacturing sector is more important in terms of generation of employment rather than in terms of contribution to the output. There were numerous problems with capital stock series for the unit level data for unorganised sectors and we did not deem it appropriate to use the same. In view of this, instead of solving the huge number of linear programming models and examining the efficiencies of DMUs or industries, we have estimated industry-wise average labour productivity in unorganised sector and compared the same with the organised sector. In other words, we can view the organised sector as providing a benchmark to the unorganised sector or *vice versa*.

[28] For decomposition of Malmquist index, see Annexure 4.5.

5. Productivity and Efficiency of Indian Manufacturing Sector

This chapter details the estimates of TFP levels, TFPG and efficiency of the Indian manufacturing sector. In section 5.1, we present the empirical results pertaining to the organised manufacturing sector (industry and state levels), using the both growth accounting and production function approaches. The estimates presented in section 5.1 are for the period 1980-81 to 2007-08 for aggregate manufacturing sector and for the period 1980-81 to 2003-04 for ASI data at industry and state levels. In section 5.2, we present the efficiency estimates using the Stochastic Frontier Production Function (SFPF) (TL specification) for the ASI unit level data. The estimates presented in section 5.2 are for the period 1993-94 to 2003-04 (barring the year 1995-96, due to the non-availability of data). Section 5.3.provides estimates of efficiency for the Public Ltd. Companies (RBI dataset), using Data Envelopment Analysis (DEA), Stochastic Frontier Production Function with both Cobb-Douglas and Translog specifications and also productivity growth estimates using the Malmquist Index. The estimates of productivity and efficiency provided in this section are for the period 1993-94 to 2004-05. Section 5.4 provides estimates of labour productivity for the unorganised manufacturing sector based on the NSSO unit level data. This dataset is available for 1989-90, 1994-95, 2000-01. A comparison of labour productivity between organised and unorganised sectors has also been provided in section 5.4.

5.1 Total Factor Productivity in India's Organised[29] Manufacturing Sector (MFG)

5.1.1 Growth Accounting Estimates of TFPG: Trends

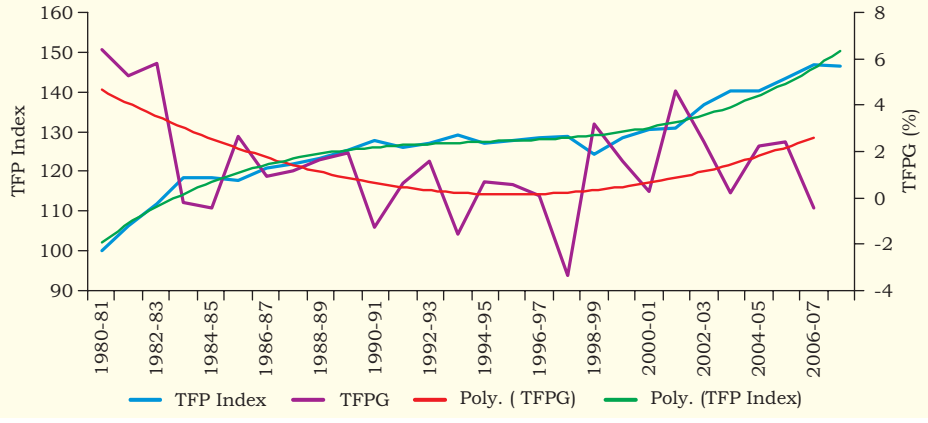
In this sub-section, we first discuss the trend growth rates of TFP obtained using the growth accounting framework (*i.e.*, discrete approximation

[29] As we have discussed only 'organised' manufacturing sector in section 5.1, we will keep referring to it simply as 'manufacturing' sector in this section. In other sections where we compare it with other datasets, we will be more specific.

of the translog production function). As mentioned earlier, opinions have differed over the inclusion of the year 1991-92 as a post or pre-reform year. In view of this, we have estimated productivity with two alternative pre and post reform periods. These are classification 1 with pre-reform period as (1A): 1980-81 to 1990-91 and post-reform Period (1B): 1991-92 to 2003-04 and classification 2 with pre-reform period as (2A): 1980-81 to 1991-92 and post-reform Period (2B): 1992-93 to 2003-04. This is to ensure that the choice of cut-off period does not vitiate the comparison of TFPG during the pre and post reform period. We also highlight the annual variations in TFPG which allow us to view the fluctuations in TFPG over the span of the study.

Figure 5.1 gives a synoptic view of the TFP index and TFPG for the organised manufacturing sector. It can be seen from Figure 5.1 that the TFP index registered a rise in the eighties, though the rate of increase decelerated as we approached the end of the eighties. Despite the fluctuations in TFPG during the eighties, the trend rate of TFPG (refer section 5.1.2 for more details) is about 2 pcpa during the pre-reform period irrespective of which of the two alternative cut-off periods are considered. The deceleration in TFPG during the post-reform period, especially in the nineties, is very much evident.

Figure 5.1: TFP Index and TFP Growth in Manufacturing (All India)



The TFPG estimates for the post-reform period with the two cut-off periods are 0.98 and 1.05.[30] The deceleration in TFPG during the post-reform period is statistically significant. However, one of the redeeming features of the growth of manufacturing sector in India is that in the post-nineties, TFP index seems to be on an ascent, as can be seen from Figure 5.1.

Table 5.1 provides the trend rates of TFPG across the various industries.

It can be seen from Table 5.1 that TFPG for the manufacturing sector for the period 1980-81 to 2007-08 works out to be about 0.99 pcpa. As regards the rate of change of TFP (TFPG) for MFG as a whole, it witnessed deceleration during the post-reform period.

For the period 1980-81 to 2003-04, CHEM and MTE industries witnessed TFPG which were much higher than those witnessed by other industries. As against it, FBT and TEX industries were responsible for pulling down the TFPG of MFG as a whole. TFPG of METAL industry was comparable to that witnessed by the MFG.

Both CHEM and TEX industries witnessed deceleration in TFPG. The only shining industry seems to be the METAL industry during the

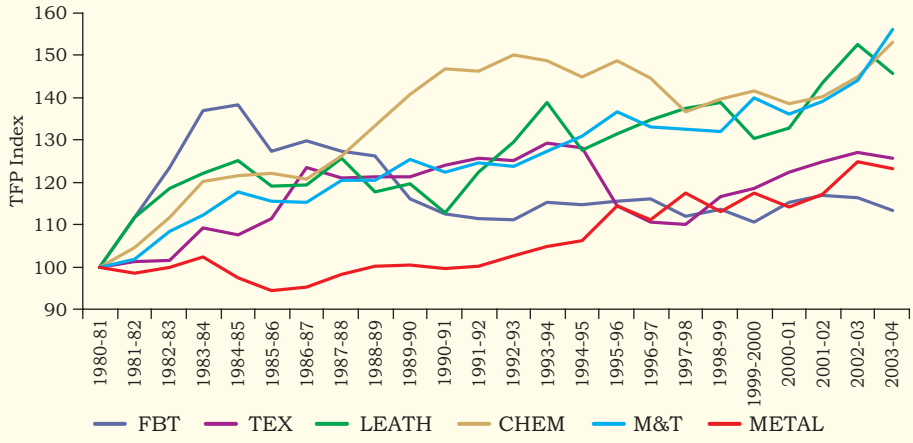
Table 5.1: Trend Rates of Growth of TFPG (pcpa): Industry-wise

State	Entire time-span of the study	Pre-reform		Post-reform		Acceleration (A)/ Deceleration (D) or absence thereof (-) in TFPG	
		Period IA	Period 2A	Period IB	Period 2B	IB over IA	2B over 2A
CHEM***(a)***	1.35	3.45	3.37	-0.23	-0.24	D*	D*
FBT***(a)***	-0.41	0.55	0.07	0.01	-0.06	–	–
LEATH***(a)***	1.17	0.78	0.76	1.18	1.03	–	–
METAL***(a)***	1.08	-0.03	0.04	1.63	1.54	A*	A*
MTE***(a)***	1.47	2.10	1.95	1.46	1.50	–	–
TEX***(a)***	0.69	2.47	2.32	-0.03	0.12	D*	D*
MFG(a)	0.92	2.07	1.88	0.61	0.66	D*	D*
MFG(b)	0.99	2.07	1.88	0.98	1.05	D*	D*

Note: '**', '*' and @ indicate significance at 1 per cent, 5 per cent and 10 per cent levels, respectively. (a) indicates estimates up to 2003-04 and (b) indicates estimates up to 2007-08.

[30] It may be noted that we have extended the post-reform period only for manufacturing sector for period up to 2007-08.

Figure 5.2: Industry-wise TFP Index (All India)



post-reform period, which seems to be confined to the nineties alone. The 7 other industries, *viz.*, FBT, MTE and LEATH did not witness either acceleration or deceleration in TFPG during the post-reform period.

In Figure 5.2, we provide a synoptic view of the yearly movements of TFP index across the selected industries. We can see from Figure 5.2 that during the post-nineties, most of the industries, barring FBT have demonstrated rising TFP levels. In other words, by and large the Indian manufacturing sector productivity performance seems to have improved in the recent years in comparison to that witnessed during the nineties.

Table 5.2 provides the trend rates of growth of TFPG for the manufacturing sector across the various states of India.

It can be seen from Table 5.2 that, the TFPG has decelerated for the total manufacturing sector as well as for most of the states. In the case of AP, MP*, Orissa and Rajasthan neither acceleration nor deceleration in TFPG was witnessed, irrespective of the cut-off year for pre and post-reform period. Incidentally these states, barring AP, are not the major

Table 5.2: Trend Rates of Growth of TFPG (pcpa) in Total MFG: State-wise

State	1980-81 to 2003-04	Pre-reform		Post-reform$		Acceleration (A)/ Deceleration (D) or absence thereof (-) in TFPG	
		Period IA	Period 2A	Period IB	Period 2B	IB over IA	2B over 2A
AP	1.41	1.82	1.67	1.69	1.76	–	–
BIH*	1.55	3.32	3.01	1.55	1.78	D**	D@
DEL	1.04	1.89	1.84	0.93	1.12	D@	D#
GUJ	0.78	1.59	1.41	0.81	0.88	D@	D#
HAR	1.33	1.96	1.83	1.94	2.24	–	A#
KAR	1.05	2.51	2.66	-0.28	-0.13	D*	D*
KER	1.36	2.35	2.33	1.18	1.42	D*	D*
MAH	0.88	1.95	1.67	0.76	0.75	D*	D**
MP*	1.37	1.56	1.39	1.76	1.78	–	–
ORI	1.27	2.16	1.99	1.97	2.36	–	–
PUN	0.79	1.72	1.60	0.59	0.69	D**	D**
RAJ	1.43	2.06	1.87	1.86	2.01	–	–
TN	0.65	1.90	1.73	0.63	0.85	D*	D**
UP*	1.14	2.25	2.12	1.00	1.17	D**	D**
WB	1.05	1.12	0.91	2.07	2.25	A**	A*
All India	0.92	2.07	1.88	0.61	0.66	D*	D*

Note: '*', '**', '@' and '#'as suffixes to A and D indicate significance at 1%, 5%, 10%, and 20% levels, respectively. $ indicates that estimates are up to 2003-04.

contributors to the output of organised manufacturing sector in India. Haryana and West Bengal have demonstrated acceleration in TFPG. Acceleration in TFPG in Haryana is sensitive to cut-off year for the reform period, whereas, for West Bengal, acceleration is more robust. In brief, the TFPG in three major states of India, *viz*, Gujarat, Maharashtra and Tamil Nadu was either below or equal to the TFPG for India as a whole and these states witnessed deceleration in TFPG. Only West Bengal, which ranked high in terms of output in 1980-81, witnessed acceleration in TFPG. However, this is only a partial view of the industrial performance, as will be explained shortly.

In what follows, we present the industry-wise TFPG (Table 5.3 to Table 5.8) for each of the selected states of India. We provide the estimates of TFPG for both pre and post-reform periods. It may also be noted that

TFPG at industry levels in a few states could not be estimated due to data problems in capital stock series[31].

As mentioned earlier, Gujarat and Maharashtra are the two major states which account for more than half of the national output of chemical industry. Both these states witnessed TFPG (see Table 5.3) which was lower than the TFPG for this industry for the country as a whole. Moreover, both these states as well as many other states witnessed deceleration in TFPG in this industry. Kerala, West Bengal and Orissa witnessed neither acceleration nor deceleration in TFPG. However, in the former two states this industry has the least presence, whereas, in West Bengal this industry has a good presence.

As can be seen from Table 5.4, FBT industry witnessed negative trend rate of TFPG over the entire span of the study and did not witness

Table 5.3: Trend Rates of TFPG (pcpa) in Chemicals (CHEM) Industry

State	1980-81 to 2003-04	Pre-reform		Post-reform$		Acceleration (A)/ Deceleration (D) or absence thereof (-) in TFPG	
		Period IA	Period 2A	Period IB	Period 2B	IB over IA	2B over 2A
AP	1.75	3.66	4.10	-0.98	-0.90	D*	D*
BIH*	2.06	5.04	5.74	-1.53	-1.15	D*	D*
DEL	1.12	2.19	2.69	0.23	0.84	D#	D#
GUJ	1.26	3.30	2.98	-0.16	-0.38	D*	D*
HAR	2.06	6.22	5.63	0.98	1.28	D*	D*
KAR	1.56	3.44	3.56	0.22	0.47	D*	D*
KER	0.06	-0.31	0.01	-0.91	-1.02	–	–
MAH	1.15	3.71	3.43	-1.13	-1.47	D*	D*
MP*	2.24	3.77	4.42	-0.33	-0.07	D*	D*
ORI	-0.004	-1.03	-0.69	0.39	0.60	–	–
RAJ	2.05	2.27	2.13	1.93	1.80	D*	–
TN	0.30	1.89	1.83	-0.16	0.14	D*	D*
UP*	0.58	3.99	4.26	-1.82	-1.32	D*	D*
WB	2.50	2.63	2.83	2.96	3.43	–	–
All India	1.35	3.45	3.37	-0.23	-0.24	D*	D*

Note: '*', '**', '@' and '#'as suffixes to A and D indicate significance at 1 %, 5 %, 10 %, and 20 % levels, respectively. $ indicates that estimates are up to 2003-04.

[31] The states excluded are: Punjab (chemical), Rajasthan, Kerala, Gujarat, Bihar* (leather) and Andhra Pradesh (metal).

Table 5.4: Trend Rates of TFPG (pcpa) in Food, Beverages and Tobacco (FBT) Industry

State	1980-81 to 2003-04	Pre-reform		Post-reform$		Acceleration (A)/ Deceleration (D) or absence thereof (-) in TFPG	
		Period IA	Period 2A	Period IB	Period 2B	IB over IA	2B over 2A
AP	0.14	2.14	1.75	-0.55	-0.60	D **	D **
BIH*	0.19	2.44	2.32	-1.02	-0.86	D **	D **
DEL	0.09	1.00	0.40	0.43	0.16	–	–
GUJ	0.36	1.75	1.21	0.65	0.61	D #	–
HAR	-0.13	2.52	1.78	-0.57	-0.70	D *	D **
KAR	0.60	1.88	1.46	0.55	0.47	–	–
KER	0.12	2.76	2.22	-0.40	-0.34	D *	D *
MAH	0.75	4.12	3.11	-0.54	-1.06	D *	D **
MP*	-0.42	2.19	1.62	-1.08	-1.11	D *	D **
ORI	-0.03	1.51	1.03	-0.24	-0.36	D #	D #
PUN	0.82	1.29	0.86	0.85	0.52	D #	–
RAJ	0.51	1.78	1.40	0.47	0.44	D #	–
TN	1.26	3.34	2.80	0.66	0.51	D *	D **
UP*	0.52	2.27	1.57	0.67	0.51	D #	–
WB	0.28	2.06	1.42	0.55	0.52	D #	–
All India	-0.41	0.55	0.07	0.01	-0.06	–	–

Note: '*', '**', '@' and '#'as suffixes to A and D indicate significance at 1 %, 5 per cent, 10 % , and 20 % levels, respectively. $ indicates that estimates are up to 2003-04.

any acceleration or deceleration in TFPG during the post-reform period over the pre-reform period, irrespective of the two cut-off periods chosen. Maharashtra, UP*, AP, Gujarat and Tamil Nadu are the states in which FBT industry has the maximum presence. In other states as well, FBT industry has not witnessed acceleration in TFPG in the post-reform period. It can be recalled that this is one of the industries which accounts for about 21 per cent of employment in organised manufacturing industry. A fall in productivity level in FBT industry coupled with no improvement in growth of productivity in this industry during the post-reform period should certainly be a cause of concern for policy makers.

Tamil Nadu, UP* and West Bengal are the three major states which account for most of leather production in India. The TFPG of this industry is above that witnessed by the manufacturing sector as a whole (Table

5.1). Though the TFPG rates for leather industry (Table 5.5) during the post-reform period are slightly higher than those witnessed in the pre-reform period, the acceleration is not statistically significant. West Bengal did witness acceleration in TFPG over the post-reform period, but this was not the case with other two states. Also TFPG in the two other states was much below that witnessed by West Bengal, if the entire time-span of the study is considered.

TFPG of metal industry was higher than the TFPG for the manufacturing sector as a whole (Table 5.1). Moreover, TFPG for metal industry accelerated during the post-reform period, unlike the other industries. The dominating states in the case of metal industry are: Maharashtra, West Bengal, Bihar* and MP*. Maharashtra displays almost absence of growth of TFP in metal industry. The acceleration/deceleration of TFPG is sensitive to the choice of the cut-off year for reform and is significant only at 20 per cent level. Hence, Maharashtra does not account for acceleration of TFPG of metal industry. Bihar* also did not show either acceleration/deceleration in TFPG in metal industry, though it certainly accounts for better overall performance of TFPG of metal industry. MP*

Table 5.5: Trend Rates of TFPG in Leather (LEATH) Industry

State	1980-81 to 2003-04	Pre-reform		Post-reform$		Acceleration (A)/ Deceleration (D) or absence thereof (-) in TFPG	
		Period IA	Period 2A	Period IB	Period 2B	IB over IA	2B over 2A
AP	1.38	1.13	1.10	1.52	1.46	–	–
DEL	-0.86	-1.23	-0.64	-1.73	-1.50	–	–
HAR	1.55	0.15	0.11	2.81	2.77	A **	A **
KAR	0.46	2.42	1.84	-0.05	-0.26	D #	D #
MAH	0.91	2.39	2.15	0.58	0.67	D #	–
MP*	1.44	1.69	1.39	1.66	1.48	–	–
ORI	-0.004	-1.03	-0.69	0.39	0.60	–	–
TN	1.20	0.72	0.79	0.91	0.72	–	–
UP*	0.71	1.01	0.84	0.51	0.32	–	–
WB	1.68	-0.26	-0.37	2.68	2.27	A **	A **
All India	1.17	0.78	0.76	1.18	1.03	–	–

Note: '*', '**', '@' and '#'as suffixes to A and D indicate significance at 1 %, 5 %, 10 %, and 20 % levels, respectively. $ indicates that estimates are up to 2003-04.

Table 5.6: Trend Rates of TFPG in Metals (METAL) Industry

State	1980-81 to 2003-04	Pre-reform		Post-reform$		Acceleration (A)/ Deceleration (D) or absence thereof (-) in TFPG	
		Period IA	Period 2A	Period IB	Period 2B	IB over IA	2B over 2A
BIH*	1.94	1.92	1.82	2.15	2.11	–	–
DEL	1.04	-0.67	-0.31	1.66	1.74	D *	A *
GUJ	-0.51	0.17	0.83	-1.96	-1.53	D @	D @
HAR	0.47	-0.74	-0.52	0.92	0.94	D *	A *
KAR	0.55	0.79	1.07	-0.51	-0.51	D #	D @
KER	1.51	-0.12	0.40	1.98	2.22	D **	A **
MAH	0.15	-0.33	-0.64	0.39	-0.05	A #	D #
MP*	1.06	-0.74	-1.04	1.80	1.11	A **	A **
ORI	6.52	1.34	1.44	15.70	17.59	A *	A *
PUN	0.83	-0.67	-0.44	1.42	1.42	A *	A *
RAJ	1.23	-0.42	-0.27	2.59	2.71	A *	A *
TN	0.99	0.18	0.52	1.07	1.23	A **	A #
UP*	0.42	0.21	0.46	0.90	1.31	A #	A @
WB	1.00	-1.90	-1.45	2.54	2.67	A *	A *
All India	1.08	-0.03	0.04	1.63	1.54	A *	A *

Note: '*', '**', '@' and '#'as suffixes to A and D indicate significance at 1 %, 5 %, 10 %, and 20 % levels, respectively. $ indicates that estimates are up to 2003-04.

and West Bengal witnessed TFPG in metal industry close to the national rate and also the acceleration of TFPG in these two states in the post-reform period was statistically significant.

MTE industry demonstrated a better performance in terms of TFPG as compared to the other industries (Table 5.1). This industry did not witness any significant acceleration/deceleration in TFPG during the post-reform period. Machinery and transport equipment industry is located mainly in Maharashtra, Tamil Nadu, Haryana, UP*, Karnataka and Gujarat. Maharashtra and UP* have witnessed significant deceleration in TFPG in MTE industry during the post-reform period. In contrast, Haryana has witnessed acceleration in TFPG in MTE industry. Karnataka and Tamil Nadu did not witness either acceleration or deceleration in TFPG of MTE industry. Gujarat also did not witness acceleration in TFPG. In fact it witnessed deceleration in TFPG, if we include the year 1991-92 in the post-reform period.

Table 5.7: Trend Rates of TFPG in Machinery and Transport Equipment (MTE) Industry

State	1980-81 to 2003-04	Pre-reform		Post-reform$		Acceleration (A)/ Deceleration (D) or absence thereof (-) in TFPG	
		Period IA	Period 2A	Period IB	Period 2B	IB over IA	2B over 2A
AP	1.74	1.61	1.43	2.33	2.30	–	–
BIH	1.39	3.30	2.74	1.59	1.66	D@	–
DEL	1.20	1.85	1.70	1.26	1.33	A#	–
GUJ	1.27	1.93	1.75	1.42	1.50	D#	–
HAR	1.26	1.13	1.12	1.92	2.13	A#	A@
KAR	1.34	1.52	1.60	1.35	1.51	–	–
KER	0.55	-0.24	-1.43	2.36	1.35	–	–
MAH	0.98	1.71	1.60	0.26	0.09	D*	D*
MP	1.32	2.96	2.66	1.32	1.53	D**	D#
ORI	0.24	1.15	0.77	0.11	-0.07	D#	D#
PUN	1.38	1.29	1.33	1.54	1.63	–	–
RAJ	1.85	2.04	2.10	1.89	2.04	–	–
TN	1.48	2.00	1.77	1.86	1.92	–	–
UP	1.51	2.89	2.81	0.23	0.10	D*	D*
WB	1.37	2.09	1.94	1.41	1.50	D#	–
All India	1.47	2.10	1.95	1.46	1.50	–	–

Note: '*', '**', '@' and '#'as suffixes to A and D indicate significance at 1 %, 5 %, 10 % , and 20 % levels, respectively. $ indicates that estimates are up to 2003-04.

Textiles industry is one of the major contributors to employment in manufacturing sector. TFPG has been rather low and has also decelerated in this industry (See Table 5.8) during the post-reform period, similar to what has happened to FBT industry. Tamil Nadu, Maharashtra, Gujarat, Punjab and Rajasthan have been the leading states in textiles industry. Except for Rajasthan, TFPG in each of these states has been lower as compared to that witnessed for the country as a whole. Moreover, all these states including Rajasthan have witnessed deceleration in TFPG during the post-reform period.

5.1.2 Growth Accounting Estimates of TFPG: Time-Path and Volatility

We now discuss the time paths of TFP indices, as these enable us to observe the TFPG movements across states and industries in a less rigid framework than in the framework of pre and post-reform period. In Figures

Table 5.8: Trend Rates of TFPG in Textiles (TEX) Industry

State	1980-81 to 2003-04	Pre-reform		Post-reform$		Acceleration (A)/ Deceleration (D) or absence thereof (-) in TFPG	
		Period IA	Period 2A	Period IB	Period 2B	IB over IA	2B over 2A
AP	0.54	2.39	2.14	-0.06	0.04	D *	D *
BIH*	0.62	1.51	1.45	0.33	0.46	–	–
DEL	0.45	3.51	3.37	-1.48	-1.37	D *	D *
GUJ	0.62	1.94	1.69	0.48	0.58	D **	D @
HAR	1.09	0.88	0.95	1.46	1.61	A #	A @
KAR	1.18	2.39	2.59	-0.46	-0.45	D *	D *
KER	0.70	2.47	2.14	0.78	1.04	D *	D @
MAH	0.57	2.81	2.70	-0.41	-0.16	D *	D *
MP*	0.83	1.95	1.97	0.41	0.65	D **	D @
ORI	4.25	3.83	3.48	8.64	9.81	A @	A *
PUN	0.58	2.06	2.16	0.20	0.68	D **	D **
RAJ	0.76	2.00	2.43	-0.59	-0.19	D *	D *
TN	1.02	2.61	2.53	0.47	0.70	D *	D *
UP*	0.60	1.78	1.71	-0.07	-0.01	D *	D *
WB	1.41	2.00	1.92	1.53	1.68	–	–
All India	0.69	2.47	2.32	-0.03	0.12	D *	D *

Note: '*', '**', '@' and '#'as suffixes to A and D indicate significance at 1 %, 5 %, 10 %, and 20 % levels, respectively. $ indicates that estimates are up to 2003-04.

5.3 to 5.17, we present the annual time-path of TFP indices for the 15 selected states of India[32]. The thin black smoothened curve is the fitted trend (of polynomials of not more than 4th order) for the TFP indices. It can be seen from these Figures that in most of the states (barring Kerala, MP* and Rajasthan, wherein trend growth rate of TFP seems to be constant over the entire span of the study), the curvature of the trend curve is sharper in the post-nineties than during the nineties which is indicative of the fact that the TFP has been rising at a higher rate during the recent years as compared with that witnessed during the decade of the nineties.

In Table 5.9A, we provide the average of annual growth rates of TFP for the various time-periods and also the coefficient of variation (CV) as a measure of volatility of TFPG for the various industries.

[32] Various Appendix Figures (Figure A5.1 to A5.15) provide the industry-wise movement of TFP indices for each of the 15 selected states of India.

Figure 5.3: TFP index of Manufacturing (Andhra Pradesh)

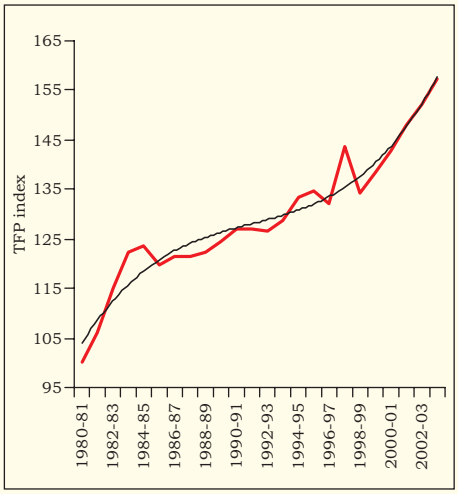


Figure 5.4: TFP index of Manufacturing (Bihar*)

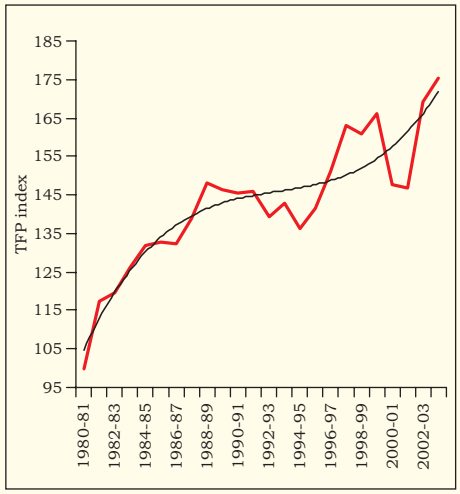


Figure 5.5: TFP index of Manufacturing (Delhi)

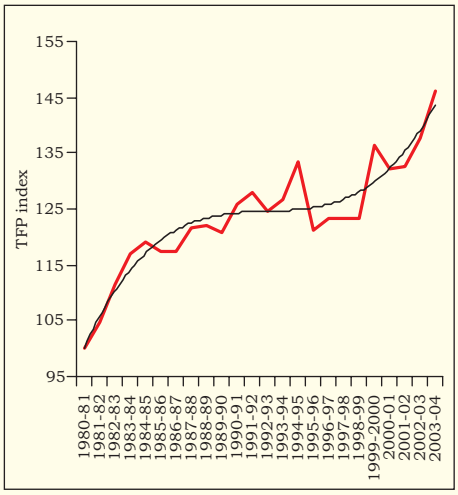


Figure 5.6: TFP index of Manufacturing (Gujarat)

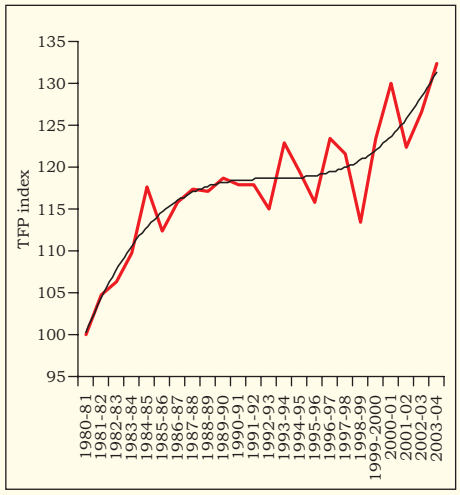


Figure 5.7: TFP index of Manufacturing (Haryana)

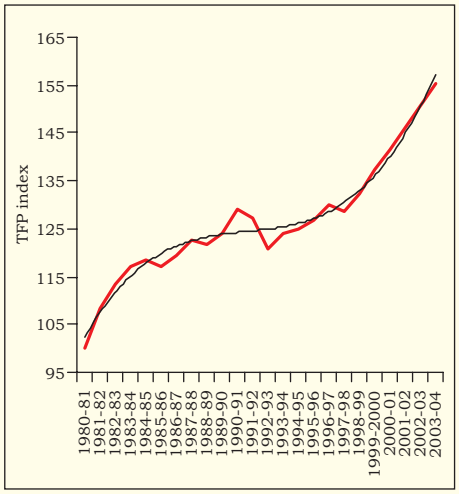


Figure 5.8: TFP index of Manufacturing (Karnataka)

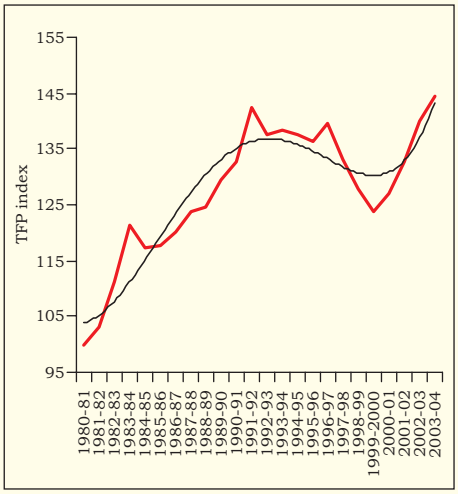


Figure 5.9: TFP index of Manufacturing (Kerala)

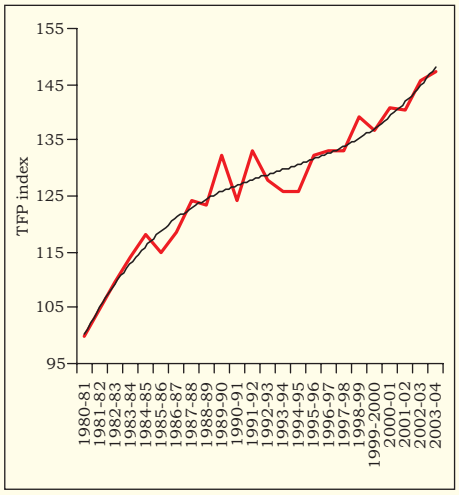


Figure 5.10: TFP index of Manufacturing (Maharashtra)

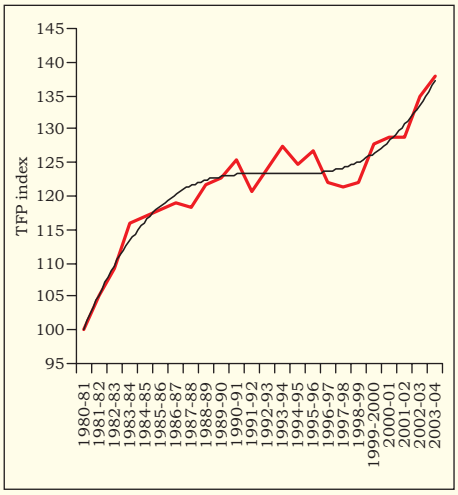


Figure 5.11: TFP index of Manufacturing (Madhya Pradesh*)

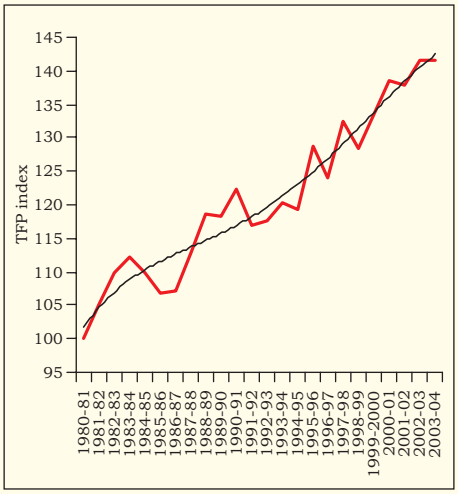


Figure 5.12: TFP index of Manufacturing (Orissa)

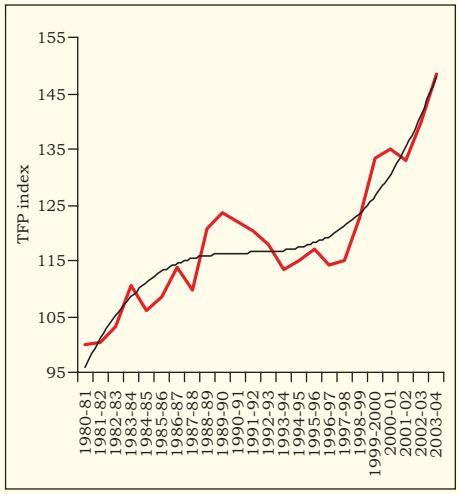


Figure 5.13: TFP index of Manufacturing (Punjab)

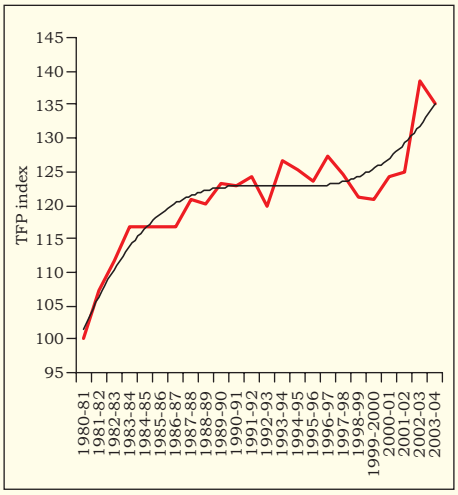


Figure 5.14: TFP index of Manufacturing (Rajasthan)

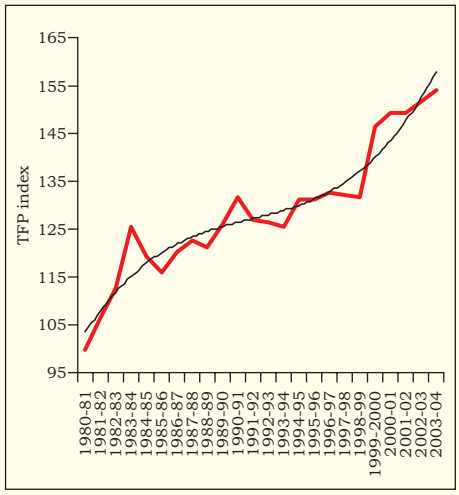


Figure 5.15: TFP index of Manufacturing (Tamil Nadu)

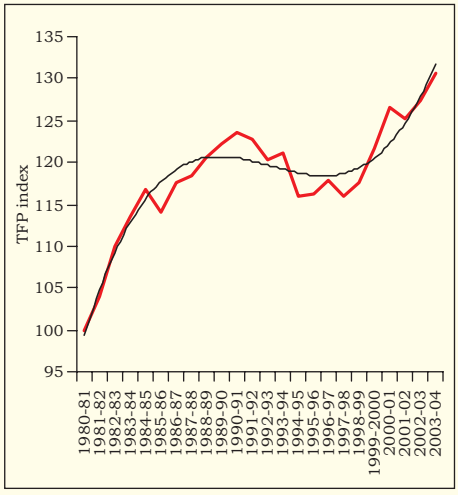


Figure 5.16: TFP index of Manufacturing (Uttar Pradesh*)

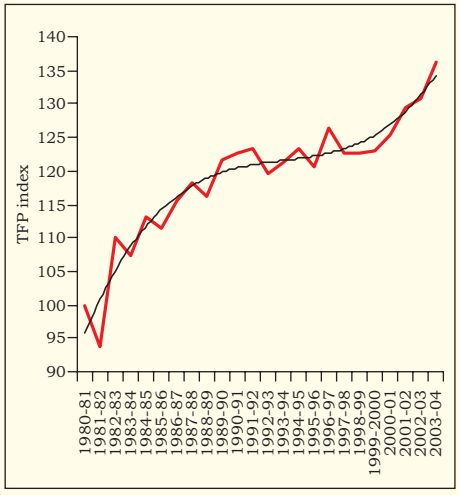


Figure 5.17: TFP index of Manufacturing (West Bengal)

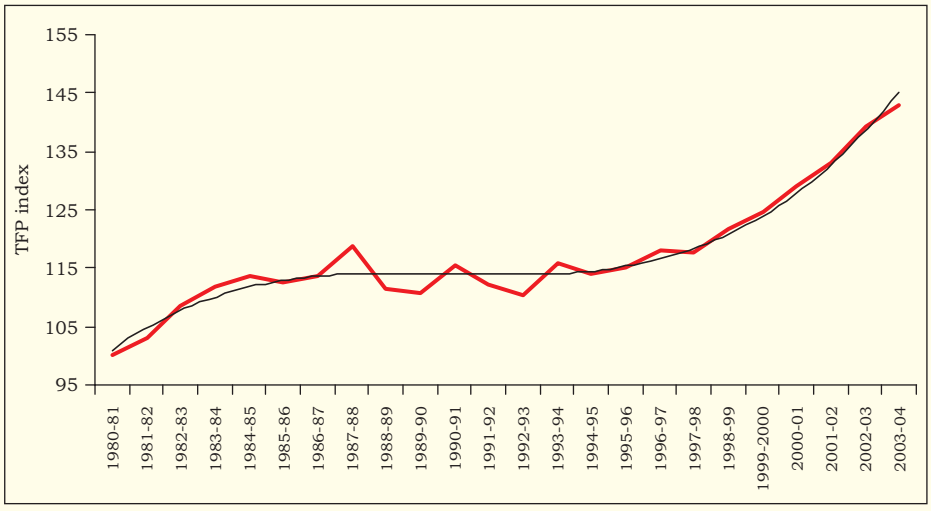


Table 5.9A: Quinquennial Average TFPG and Volatility in TFPG: Industry-wise

Period	Industries						
	CHEM	FBT	LEATH	METAL	MTE	TEX	MFG
1981-82 to 1984-85	5.04	8.53	5.85	-0.63	4.20	1.92	4.32
1985-86 to 1989-90	2.99	-3.37	-0.83	0.67	1.27	2.52	1.19
1990-91 to 1994-95	0.64	-0.18	1.57	1.10	0.92	1.11	0.27
1995-96 to 1999-2000	-0.44	-0.97	0.48	2.15	1.40	-1.40	0.24
2000-01 to 2003-04	2.03	0.64	2.94	1.29	2.82	1.53	2.21
AVG ANNUAL TFPG$	1.92	0.61	1.79	0.97	2.00	1.09	1.50
TREND TFPG$	1.35	-0.41	1.17	1.08	1.47	0.69	0.92
CV for ANNUAL *TFPG$*	*1.80*	*8.34*	*3.03*	*3.40*	*1.55*	*3.80*	*1.58*

Notes: (i) $ indicates that estimates are up to 2003-04.
(ii) TFPG is measured in terms of pcpa.

It can be seen from Table 5.9A that except for metal industry, all the component industries, as well as the manufacturing sector have witnessed a revival of TFPG in the present decade. This is a welcome feature of the Indian manufacturing sector, though much more is needed

Table 5.9B: Quinquennial Average TFPG and Volatility in TFPG: State-wise

States/ Country	1981-82 to 1984-85	1985-86 to 1989-90	1990-91 to 1994-95	1995-96 to 1999-2000	2000-01 to 2003-04	AVG ANNUAL TFPG$	TREND TFPG$	CV for ANNUAL TFPG$
AP	5.51	0.15	1.38	0.90	3.24	2.05	1.41	1.70
BIH*	7.33	2.17	-1.38	4.10	1.75	2.64	1.55	1.32
DEL	4.46	0.28	2.12	0.62	1.77	1.74	1.04	1.38
GUJ	4.18	0.20	0.20	0.81	1.86	1.32	0.78	3.15
HAR	4.37	0.88	0.23	1.92	3.14	1.97	1.33	2.30
KAR	4.15	2.03	1.30	-2.08	3.96	1.68	1.05	2.08
KER	4.28	2.32	-0.87	1.69	1.87	1.75	1.36	1.52
MAH	4.00	0.96	0.40	0.50	1.95	1.44	0.88	2.82
MP*	2.40	1.54	0.22	2.40	1.47	1.58	1.37	2.23
ORI	1.52	3.22	-1.37	3.06	2.76	1.81	1.27	2.40
PUN	4.01	1.09	0.37	-0.74	3.00	1.38	0.79	1.91
RAJ	4.70	1.10	0.92	2.25	1.29	1.97	1.43	1.92
TN	3.96	0.90	-1.01	0.99	1.84	1.20	0.65	5.11
UP*	3.52	1.53	0.23	0.40	2.37	1.49	1.14	2.77
WB	3.21	-0.39	0.63	1.81	3.46	1.60	1.05	1.79
All India	4.32	1.19	0.27	0.24	2.21	1.50	0.92	1.58

Notes: (i) $ indicates that estimates are up to 2003-04.
(ii) TFPG is measured in terms of pcpa.

in terms of its overall performance. As can be seen from Table 5.9, FBT and TEX are the industries with maximum fluctuations in TFPG, besides being the lowest TFPG performers.

A perusal of Table 5.9B also indicates the revival of TFPG during 2000-01 to 2003-04 for all India as well as for most of the states barring Bihar*, MP*, Orissa and Rajasthan.

5.1.3 Production Function Estimates of TFP and TFPG: 1980-81 to 2003-04

We have also used the Cobb-Douglas (CD) production function approach for measurement of TFPG and the inter-state differences in TFP levels and growth rates (see section 4.2.1 for methodological details). These results have been presented in Tables 5.10 to 5.16. The empirical results pertaining to contribution of inputs (L, K and N), productivity (captured by the coefficient of time variable), inter-state differences in TFP levels and TFPG have been provided in these tables. The estimates of TFPG across states and the TFPG over the reform period are given in Table 5.17.

The main observations that emerge from the scrutiny of Table 5.10 to 5.17 are as follows:

- Output growth in the Indian manufacturing sector has been resource intensive, as can be seen from the coefficients of N, across industries and also for the manufacturing sector as well.
- The policy environment, *per se*, does not emerge as enabling factor leading to a shift to a higher growth path for the organised manufacuturing sector. Contribution of inputs seems to be the main causal factor behind manufacturing exapansion. However, for METAL and LEATH industries, the coefficient of policy dummy is positive and statistically significant, whereas, for CHEM, FBT and TEX, this coefficient is statistically not significant and hence, its sign and magnitude do not matter.

Table 5.10 Production Function Estimates for MFG$

lnQ	Coefficient	t-statistic	Significance level
Constant	1.0730	3.06	0.00
ln L	0.0560	1.91	0.06
ln K	0.0303	2.95	0.00
ln N	0.8565	43.33	0.00
t	0.0181	11.44	0.00
Dpolicy	-0.0513	-6.04	0.00
DAP	-0.1683	-5.39	0.00
DBIH*	-0.1042	-2.95	0.00
DDEL	-0.1964	-3.23	0.00
DGUJ	-0.1216	-4.69	0.00
DHAR	-0.1600	-3.01	0.00
DKAR	-0.1000	-2.42	0.02
DKER	-0.1555	-3.22	0.00
DMAH	(dropped)		
DMP*	-0.1157	-2.81	0.01
DORI	-0.2124	-3.43	0.00
DPUN	-0.1559	-3.25	0.00
DRAJ	-0.1864	-3.39	0.00
DTN	-0.0705	-2.82	0.01
DUP*	-0.1558	-5.76	0.00
DWB	-0.0823	-3.27	0.00
DAPT	0.0008	0.53	0.60
DBIH*T	0.0001	0.07	0.94
DDELT	(dropped)		
DGUJT	0.0011	0.77	0.44
DHART	0.0007	0.43	0.67
DKART	-0.0011	-0.70	0.48
DKERT	-0.0028	-1.89	0.06
DMAHT	-0.0016	-1.16	0.25
DMP*T	-0.0015	-1.02	0.31
DORIT	0.0000	0.01	0.99
DPUNT	-0.0018	-1.13	0.26
DRAJT	0.0006	0.42	0.68
DTNT	-0.0026	-1.70	0.09
DUP*T	0.0001	0.07	0.94
DWBT	-0.0055	-3.67	0.00

Note: $ indicates that estimates are up to 2003-04.

Table 5.11 Production Function Estimates for CHEM[$]

lnQ	Coefficient	t-statistic	Significance level
Constant	0.5432	1.16	0.25
ln L	0.0793	1.11	0.27
ln K	-0.1543	-6.60	0.00
ln N	1.0079	21.38	0.00
t	0.0187	3.54	0.00
Dpolicy	0.0156	0.52	0.60
DAP	0.3152	2.65	0.01
DBIH*	0.5570	4.77	0.00
DDEL	(dropped)		
DGUJ	0.5048	3.18	0.00
DHAR	0.4476	4.64	0.00
DKAR	0.2953	3.05	0.00
DKER	0.2489	2.60	0.01
DMAH	0.4305	2.36	0.02
DMP*	0.2437	2.50	0.01
DORI	0.0578	0.69	0.49
DRAJ	0.1480	1.72	0.09
DTN	0.2618	1.70	0.09
DUP*	0.2580	2.22	0.03
DWB	0.3453	2.49	0.01
DAPT	(dropped)		
DBIH*T	-0.0512	-7.43	0.00
DDELT	-0.0076	-1.35	0.18
DGUJT	-0.0013	-0.24	0.81
DHART	-0.0200	-3.53	0.00
DKART	-0.0050	-0.91	0.36
DKERT	-0.0177	-3.15	0.00
DMAHT	-0.0027	-0.47	0.64
DMP*T	-0.0035	-0.64	0.52
DORIT	-0.0110	-1.96	0.05
DRAJT	0.0073	1.30	0.20
DTNT	0.0004	0.06	0.95
DUP*T	0.0054	0.97	0.33
DWBT	-0.0113	-1.83	0.07

Note: $ indicates that estimates are up to 2003-04.

Table 5.12 Production Function Estimates for FBT[$]

lnQ	Coefficient	t-statistic	Significance level
Constant	2.6829	8.84	0.00
ln L	0.0143	0.74	0.46
ln K	-0.0321	-1.68	0.09
ln N	0.7183	21.39	0.00
t	0.0162	5.01	0.00
Dpolicy	-0.0117	-0.59	0.56
DAP	0.9315	7.46	0.00
DBIH*	0.4188	6.03	0.00
DDEL	0.4211	5.61	0.00
DGUJ	0.8055	7.15	0.00
DHAR	0.4071	5.78	0.00
DKAR	0.6665	7.03	0.00
DKER	0.5204	6.34	0.00
DMAH	1.0896	8.38	0.00
DMP*	0.4600	5.79	0.00
DORI	(dropped)		
DPUN	0.7389	7.11	0.00
DRAJ	0.3999	4.38	0.00
DTN	0.9130	6.93	0.00
DUP*	0.9395	7.54	0.00
DWB	0.6604	6.84	0.00
DAPT	-0.0003	-0.07	0.95
DBIH*T	0.0037	1.02	0.31
DDELT	(dropped)		
DGUJT	0.0045	1.19	0.23
DHART	0.0108	2.75	0.01
DKART	0.0117	3.08	0.00
DKERT	0.0068	1.78	0.08
DMAHT	0.0074	1.95	0.05
DMP*T	0.0201	4.37	0.00
DORIT	0.0143	3.33	0.00
DPUNT	0.0045	1.17	0.24
DRAJT	0.0108	2.52	0.01
DTNT	0.0011	0.27	0.79
DUP*T	0.0071	1.88	0.06
DWBT	0.0004	0.10	0.92

Note: $ indicates that estimates are up to 2003-04.

Table 5.13 Production Function Estimates for LEATH[$]

lnQ	Coefficient	t-statistic	Significance level
Constant	0.2590	2.54	0.01
ln L	0.1218	4.74	0.00
ln K	0.0078	0.38	0.70
ln N	0.8608	36.26	0.00
t	0.0097	3.00	0.00
Dpolicy	0.0648	2.63	0.01
DAP	-0.1142	-1.32	0.19
DDEL	(dropped)		
DHAR	0.0116	0.20	0.84
DKAR	-0.0319	-0.47	0.64
DMAH	-0.0051	-0.06	0.95
DMP*	-0.0484	-0.55	0.58
DTN	-0.0409	-0.31	0.76
DUP*	-0.1208	-1.13	0.26
DWB	-0.0349	-0.32	0.75
DAPT	-0.0017	-0.45	0.66
DDELT	0.0021	0.34	0.73
DHART	0.0010	0.19	0.85
DKART	-0.0015	-0.32	0.75
DMAHT	0.0010	0.28	0.78
DMP*T	0.0039	1.08	0.28
DTNT	-0.0008	-0.21	0.83
DUP*T	0.0049	1.19	0.23
DWBT	(dropped)		

Note: $ indicates that estimates are up to 2003-04.

Table 5.14 Production Function Estimates for METAL[$]

lnQ	Coefficient	t-statistic	Significance level
Constant	0.4757	1.67	0.10
ln L	0.0670	2.04	0.04
ln K	0.0634	5.52	0.00
ln N	0.8455	33.86	0.00
t	0.0167	6.98	0.00
Dpolicy	0.0506	3.25	0.00
DBIH*	0.0426	0.40	0.69
DDEL	-0.0444	-0.95	0.34
DGUJ	0.0194	0.28	0.78
DHAR	0.0209	0.37	0.71
DKAR	-0.0141	-0.23	0.82
DKER	(dropped)		
DMAH	0.1307	1.31	0.19
DMP*	0.0937	1.08	0.28
DORI	-0.0218	-0.30	0.77
DPUN	0.0250	0.38	0.71
DRAJ	-0.0257	-0.50	0.62
DTN	-0.0081	-0.12	0.91
DUP*	0.0310	0.43	0.67
DWB	0.0021	0.02	0.98
DBIH*T	(dropped)		
DDELT	-0.0096	-3.52	0.00
DGUJT	-0.0083	-2.53	0.01
DHART	-0.0108	-3.71	0.00
DKART	-0.0066	-2.15	0.03
DKERT	-0.0090	-3.16	0.00
DMAHT	-0.0131	-4.55	0.00
DMP*T	-0.0090	-3.14	0.00
DORIT	-0.0021	-0.73	0.47
DPUNT	-0.0088	-3.15	0.00
DRAJT	-0.0077	-2.67	0.01
DTNT	-0.0087	-2.91	0.00
DUP*T	-0.0080	-2.68	0.01
DWBT	-0.0117	-4.28	0.00

Note: $ indicates that estimates are up to 2003-04.

Table 5.15 Production Function Estimates for MTE[$]

lnQ	Coefficient	t-statistic	Significance level
Constant	0.6942	2.3800	0.02
ln L	0.1378	4.5000	0.00
ln K	0.0584	2.6000	0.01
ln N	0.7589	28.0100	0.00
t	0.0189	7.0400	0.00
Dpolicy	-0.0237	-1.5500	0.12
DAP	0.1340	1.3100	0.19
DBIH*	0.1596	1.4200	0.16
DDEL	0.0451	0.6400	0.52
DGUJ	0.0665	0.6800	0.50
DHAR	0.0489	0.5700	0.57
DKAR	0.1832	1.8300	0.07
DKER	-0.1537	-2.1200	0.04
DMAH	0.2533	1.7200	0.09
DMP*	0.1427	1.8600	0.06
DORI	(dropped)		
DPUN	0.0299	0.36	0.72
DRAJ	0.0534	0.76	0.45
DTN	0.1390	1.11	0.27
DUP*	0.0746	0.69	0.49
DWB	0.1766	1.40	0.16
DAPT	0.0005	0.18	0.86
DBIH*T	-0.0040	-1.17	0.24
DDELT	(dropped)		
DGUJT	0.0020	0.68	0.50
DHART	0.0065	1.81	0.07
DKART	0.0004	0.11	0.91
DKERT	0.0083	2.44	0.02
DMAHT	-0.0010	-0.36	0.72
DMP*T	-0.0011	-0.38	0.70
DORIT	-0.0046	-1.62	0.11
DPUNT	0.0024	0.83	0.41
DRAJT	0.0022	0.75	0.46
DTNT	0.0029	1.00	0.32
DUP*T	0.0050	1.56	0.12
DWBT	-0.0057	-1.80	0.07

Note: $ indicates that estimates are up to 2003-04.

Table 5.16 Production Function Estimates for TEX[$]

lnQ	Coefficient	t-statistic	Significance level
Constant	3.5742	9.18	0.000
ln L	0.0111	0.26	0.796
ln K	0.0342	1.70	0.089
ln N	0.6866	25.67	0.000
t	0.0305	8.77	0.000
Dpolicy	-0.0199	-1.02	0.308
DAP	-0.5512	-7.42	0.000
DBIH*	-1.0788	-9.09	0.000
DDEL	-0.6440	-6.07	0.000
DGUJ	-0.0778	-1.56	0.120
DHAR	-0.8195	-7.96	0.000
DKAR	-0.6622	-7.92	0.000
DKER	-0.7148	-7.48	0.000
DMAH	(dropped)		
DMP*	-0.5659	-7.48	0.000
DORI	-1.2171	-11.19	0.000
DPUN	-0.4581	-5.79	0.000
DRAJ	-0.5241	-6.80	0.000
DTN	-0.2836	-5.13	0.000
DUP*	-0.4117	-6.41	0.000
DWB	-0.2042	-3.57	0.000
DAPT	-0.0116	-3.26	0.001
DBIH*T	-0.0335	-7.76	0.000
DDELT	(dropped)		
DGUJT	-0.0175	-4.61	0.000
DHART	-0.0026	-0.71	0.479
DKART	0.0026	0.67	0.502
DKERT	-0.0154	-4.03	0.000
DMAHT	-0.0199	-5.15	0.000
DMP*T	-0.0070	-1.85	0.066
DORIT	0.0092	1.57	0.118
DPUNT	-0.0069	-1.95	0.052
DRAJT	-0.0039	-1.07	0.286
DTNT	0.0002	0.05	0.961
DUP*T	-0.0152	-4.14	0.000
DWBT	-0.0187	-4.55	0.000

Note: $ indicates that estimates are up to 2003-04.

Table 5.17: State wise TFPG across Policy Regime: 19801-81 to 2003-04

State	TFPG (pcpa) obtained by PFA	Policy Regime
AP	1.84	NIL
BIH*	-0.52	NIL
DEL	1.09	NIL
GUJ	1.45	NIL
HAR	0.86	NIL
KAR	1.98	NIL
KER	1.89	NIL
MAH	2.44	POSITIVE
MP*	1.65	NIL
ORI	1.20	NIL
PUN	1.41	NIL
RAJ	1.93	NIL
TN	2.11	NIL
UP*	1.44	NIL
WB	1.12	NIL

For MTE industry, it is negative, but statistically significant at 12 per cent level. In other words, the TFPG performance of various industries has varied across the policy regimes.

- The inter-state differences in TFP levels are by and large, statistically significant across industries, except for METAL, MTE and LEATH industries. The inter-state differences in productivity levels are rather stark in the case of TEX industry. This observation is based on the statistical significance of coefficients of state dummies.
- As regards the inter-state differences in TFPG, these are more pronounced in FBT and TEX, which are traditional and labour intensive industries. This observation is based on the statistical significance of coefficients of multiplicative dummies for states and time.
- TFPG across states though differs from the highest for Maharashtra (2.44 per cent pcpa) to almost zero for Bihar* (the negative coefficient of 't' for Bihar* is not statistically significant), it is only Maharashtra that seems to have witnessed a higher

productivity during the post-reform period, as it is only in this case the coefficient of Dpolicy dummy is positive and statistically significant (though only at 10 per cent level). For all other states, this coefficient turns out to be statistically insignifiant.

In Tables 5.18A and 5.18B, we provide the summary of empirical results obtained for the organised manufacturing sector based on the ASI industry-state level data. In the former table, we provide ranks of the various states for both TFP and TFPG. TFPG ranks are derived by applying the two alternative methodologies, *viz.*, PFA and GAA. In the latter Table (5.18B), we highlight the consistency or otherwise of the TFPG ranks of three best/worst states. The states highlighted in blue color are the states

Table 5.18A: Inter-State Comparison of TFP levels and TFPG$

Industry'	CHEM	FBT	LEATH	METAL	MTE	TEX	MFG
TFP Level Ranking: Production Function Approach							
Best Performers	BIH* GUJ HAR	MAH UP* AP	HAR DEL MAH	MAH MP* BIH*	MAH KAR WB	MAH GUJ WB	MAH TN WB
Worst Performers	DEL ORI RAJ	ORI RAJ HAR	UP* AP MP*	DEL RAJ ORI	KER ORI PUN	ORI BIH* HAR	ORI DEL RAJ
TFPG Ranking: Production Function Approach							
Best Performers	RAJ UP* TN	MP* ORI KAR	UP* MP* DEL	BIH* ORI KAR	KER HAR UP*	ORI KAR TN	GUJ AP HAR
Worst Performers	BIH* HAR KER	AP DEL WB	AP KAR TN	MAH WB HAR	WB ORI BIH*	BIH* MAH WB	WB KER TN
TFPG Ranking: Growth Accounting Approach							
Best Performers	BIH* WB ORI	TN PUN MAH	WB HAR MP*	ORI AP BIH*	RAJ AP UP*	ORI WB KAR	BIH* RAJ AP
Worst Performers	TN UP* KER	MP* AP HAR	DEL KAR UP*	GUJ MAH UP*	KER HAR DEL	DEL AP MAH	TN GUJ PUN

Note: $ indicates that estimates are up to 2003-04.

Table 5.18B: Consistency/Inconsistency of TFPG Ranking with GA and PFA$

Consistency/Inconsistency of Ranks with PFA & GAA	CHEM	FBT	LEATH	METAL	MTE	TEX	MFG
Consistent	KER	AP	KAR MP*	BIH* MAH ORI	UP*	KAR ORI MAH	AP TN
Inconsistent	BIH* TN UP*	MP*	UP* DEL		KER	WB	GUJ

Note: $ indicates that estimates are up to 2003-04.

in which an industry contributes significantly to the output of organised manufacturing of the respective state. Thus, mainly it is the consistency/ inconsistency of TFPG ranks for these states that is of prime concern to us. Gujarat emerges as the best performer according to the PFA and worst performer according to GAA. As mentioned earlier, leather industry constitutes a rather insignificant proportion of the total organised manufacturing. The ranking of UP* (for leather industry) which is one of the three major states that specializes in leather industry also gets inconsistent ranking with the two alternative methodologies. However, for most of the states, the ranking of best performing and worst performing states in major states seems to be consistent, as can be seen from Table 5.18B.

5.2 ASI Unit Level Data: 1993-94 to 2003-04

As mentioned in section 4 of this study, ASI has also been providing unit level data, since 1993-94 (barring 1995-96). Unfortunately, we are unable to compile a panel data set from this database. This is partly due to the fact that the ASI does not provide the identification codes for the census sector. For the sample sector, in any case it cannot be done. In view of this, we have estimated year-wise mean efficiency scores of the units belonging to the six industry groups. These estimates have been presented in Table 5.19A and 5.19B. We have used SFPF both CD and TL specifications. The methodology has been outlined in Section 4.2.2 for

Table 5.19A: Mean Efficiency Obtained by Using SFPF (CD Specification)

Year	CHEM	FBT	LEATH	METAL	MTE	TEX
1993-94	0.9995	0.9993	0.9987	0.9998	0.9980	0.9994
1994-95	0.9967	0.7128	0.5787	0.9931	0.9929	0.5913
1996-97	0.5889	0.5074	0.4874	0.5206	0.5650	0.4437
1997-98	0.9959	0.9921	0.9976	0.9956	0.9966	0.9941
1998-99	0.9994	0.9988	0.9993	0.9994	0.9994	0.9993
1999-00	0.9993	0.9987	0.9992	0.9995	0.9995	0.9992
2000-01	0.9994	0.9992	0.9993	0.9996	0.9994	0.9994
2001-02	0.9993	0.9987	0.9993	0.9995	0.9993	0.9993
2002-03	0.9994	0.9989	0.9995	0.9996	0.9994	0.9989
2003-04	0.9994	0.9990	0.9997	0.9996	0.9995	0.9993

estimating the mean efficiency levels for the ASI unit level dataset, for each of the years spanning from 1993-94 to 2003-04 (barring 1995-96). These estimates reveal that though in most of the years, a majority of firms were operating close to the frontier (since the mean efficiency score is very close to unity), in 1994-95 FBT and LEATH industries show inefficiencies with CD specification, but only FBT shows inefficiency with TL specifications. In 1996-97 all industry groups indicate efficiency levels ranging between 0.44 and 0.59 with CD specification and between 0.49 and 0.88 with translog specification. In 2002-03 and 2003-04, FBT industry displays inefficiency levels ranging from 10 to 16 percent. It can also be seen that TFP indices obtained by growth accounting estimates at industry levels (Figure 5.2) in these years are rather low as compared to those in observed for other years. However, we are not very comfortable

Table 5.19B: Mean Efficiency Obtained by Using SFPF (TL Specification)

Year	CHEM	FBT	LEATH	METAL	MTE	TEX
1993-94	1.000	0.999	0.947	0.999	0.999	0.955
1994-95	0.997	0.690	0.908	0.995	0.994	0.917
1996-97	0.593	0.508	0.489	0.517	0.566	0.884
1997-98	0.996	0.833	0.879	0.871	0.887	0.914
1998-99	0.999	0.999	0.966	0.999	0.955	0.948
1999-00	0.956	0.949	0.961	1.000	0.959	0.956
2000-01	0.960	0.999	0.887	0.966	0.962	0.963
2001-02	0.958	0.999	0.999	0.968	0.962	0.966
2002-03	0.963	0.897	0.999	0.969	0.964	0.958
2003-04	0.962	0.842	0.822	0.969	0.999	0.954

with these estimates for two reasons: (i) the data base is too large and the detection of outliers is a difficult proposition; and, (ii) we believe that there is problem in measurement of input, particularly that of capital. In view of this, we can treat these results as rather tentative. However, these results can be treated as indicators of problems associated with the database.

5.3 *Technical Efficiency and Productivity for Public Limited (Non-Government) Manufacturing Companies: 1993-94 to 2004-05*

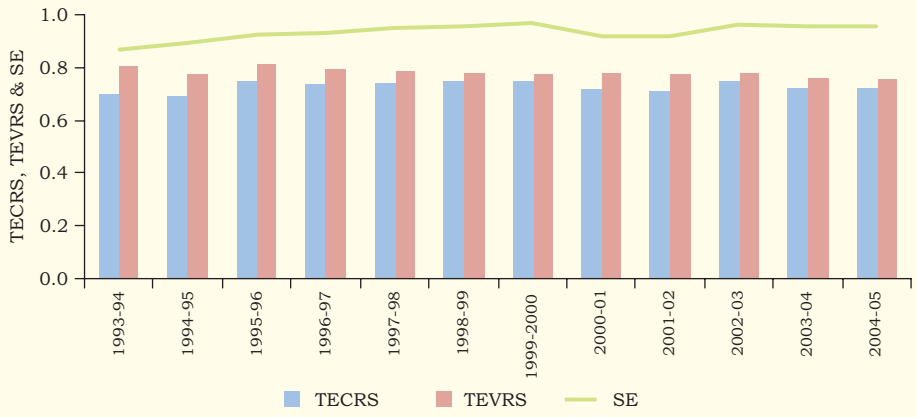
We have also used Public Limited (Non-Government non-financial) Manufacturing Companies database that is compiled by the Reserve Bank of India. This database spans over the period 1993-94 to 2004-05. For this database, we could construct a balanced panel dataset and have applied the Data Envelopment Approach (DEA) outlined in Section 4.2.3 in order to estimate the mean levels of technical efficiency and the scale efficiency. Besides, we have estimated TFPG with the help of Malmquist productivity index. These calculations have been done by using DEAP[33]. The sample firms in leather and tobacco industries were too few in number and hence, we could not include these industries in analysis conducted in this section. The analysis is not carried out at state level due to the small number of companies in the sample.

5.3.1 *Industry-wise Technical Efficiency using DEA (Multi-Stage): 1993-94 to 2004-05*

It can be seen from Figure 5.18 that scale efficiency (SE) is very close to unity and hence, the assumption of constant returns to scale (CRS) for the manufacturing sector as such seems to be justified. Technical efficiency (TE) has ranged between 0.69 and 0.75 (under the assumption of CRS). In Figure 5.19, we present the technical efficiency scores of the five selected industries under both CRS (TECRS) and VRS (TEVRS) assumptions. It can be seen that with the CRS assumption, the efficiency of food and beverages (FB) industry is the lowest and that of metal industry is the highest.

[33] DEAP Version 2.1 provided by Tim Coelli at http://www.uq.edu.au/economics/cepa/deap.htm

Figure 5.18: Technical Efficiency and Scale Efficiency: All 449 Companies



Yearly movements in technical efficiency for various industries are given in Tables 5.20 to 5.25.

Figure 5.19: Mean Technical Efficiency Scores in Selected Industries 1993-94 to 2004-05

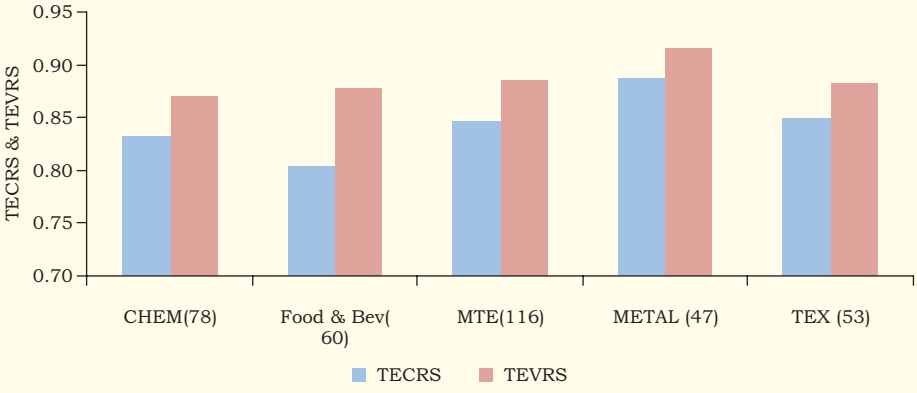


Table 5.20: Chemical Industry (78 firms)

Year	Technical Efficiency from CRS DEA (CRSTE)	Technical Efficiency from VRS DEA (VRSTE)	Scale Efficiency (scale) = CRSTE/VRSTE
1993-94	0.823	0.895	0.920
1994-95	0.843	0.890	0.946
1995-96	0.821	0.873	0.941
1996-97	0.845	0.877	0.964
1997-98	0.818	0.848	0.967
1998-99	0.826	0.866	0.955
1999-2000	0.813	0.865	0.941
2000-01	0.832	0.870	0.960
2001-02	0.835	0.866	0.965
2002-03	0.849	0.866	0.980
2003-04	0.832	0.852	0.976
2004-05	0.845	0.869	0.972

Table 5.21: Food & Beverages (60 firms)

Year	Technical Efficiency from CRS DEA (CRSTE)	Technical Efficiency from VRS DEA (VRSTE)	Scale Efficiency (scale) = CRSTE/VRSTE
1993-94	0.697	0.865	0.804
1994-95	0.622	0.756	0.821
1995-96	0.766	0.869	0.885
1996-97	0.761	0.860	0.889
1997-98	0.841	0.907	0.928
1998-99	0.859	0.907	0.948
1999-2000	0.856	0.897	0.956
2000-01	0.854	0.883	0.968
2001-02	0.865	0.905	0.957
2002-03	0.900	0.922	0.976
2003-04	0.807	0.871	0.927
2004-05	0.817	0.889	0.923

Table 5.22: Metals and Metal Products (METAL) (47 firms)

Year	Technical Efficiency from CRS DEA (CRSTE)	Technical Efficiency from VRS DEA (VRSTE)	Scale Efficiency (scale) = CRSTE/VRSTE
1993-94	0.895	0.938	0.954
1994-95	0.911	0.946	0.963
1995-96	0.902	0.936	0.965
1996-97	0.897	0.935	0.960
1997-98	0.885	0.909	0.974
1998-99	0.878	0.902	0.975
1999-2000	0.869	0.888	0.979
2000-01	0.896	0.914	0.980
2001-02	0.863	0.886	0.974
2002-03	0.884	0.906	0.976
2003-04	0.887	0.912	0.974
2004-05	0.873	0.908	0.964

Table 5.23: Machinery and Transport Equipment (MTE) (116 firms)

Year	Technical Efficiency from CRS DEA (CRSTE)	Technical Efficiency from VRS DEA (VRSTE)	Scale Efficiency (scale) = CRSTE/VRSTE
1993-94	0.869	0.905	0.961
1994-95	0.869	0.902	0.965
1995-96	0.860	0.901	0.955
1996-97	0.851	0.895	0.952
1997-98	0.853	0.887	0.962
1998-99	0.840	0.878	0.956
1999-2000	0.860	0.899	0.957
2000-01	0.806	0.867	0.931
2001-02	0.803	0.863	0.929
2002-03	0.848	0.874	0.970
2003-04	0.832	0.859	0.970
2004-05	0.865	0.890	0.972

Table 5.24: Textiles and Textile Products (TEX) (53 firms)

Year	Technical Efficiency from CRS DEA (CRSTE)	Technical Efficiency from VRS DEA (VRSTE)	Scale Efficiency (scale) = CRSTE/VRSTE
1993-94	0.868	0.915	0.950
1994-95	0.826	0.880	0.941
1995-96	0.834	0.878	0.952
1996-97	0.861	0.899	0.958
1997-98	0.888	0.912	0.975
1998-99	0.848	0.884	0.961
1999-2000	0.832	0.862	0.967
2000-01	0.836	0.859	0.975
2001-02	0.861	0.882	0.977
2002-03	0.848	0.880	0.967
2003-04	0.840	0.868	0.970
2004-05	0.845	0.863	0.980

Table 5.25: All Companies (449 firms)

Year	Technical Efficiency from CRS DEA (CRSTE)	Technical Efficiency from VRS DEA (VRSTE)	Scale Efficiency (scale) = CRSTE/VRSTE
1993-94	0.698	0.804	0.871
1994-95	0.690	0.774	0.891
1995-96	0.751	0.811	0.927
1996-97	0.738	0.793	0.931
1997-98	0.744	0.785	0.949
1998-99	0.748	0.782	0.956
1999-2000	0.748	0.775	0.966
2000-01	0.715	0.782	0.916
2001-02	0.712	0.774	0.921
2002-03	0.748	0.777	0.963
2003-04	0.725	0.761	0.954
2004-05	0.724	0.756	0.957

5.3.2 Total Factor Productivity Growth (Measured Using the Malmquist Index)

In Table 5.26, we present the TFPG across industries using the Malmquist Index.

It can be seen from Table 5.26 that the average TFPG of manufacturing sector is about 1.50 pcpa for the entire period. TFPG of Food and Beverages is lowest followed by the TEX industry. MTE and METAL industries have recorded the highest TFPG which is almost double of that for the CHEM industry.

The empirical results of estimates of efficiency obtained by application of various methodologies which have been applied to the RBI dataset on Public Ltd. Companies belonging to the manufacturing sector have been compared in Table 5.27.

The empirical results of efficiency estimates derived from DEA, SFPF (both Cobb-Douglas and Translog specifications) and productivity estimates derived by using Malmquist Index indicate that the efficiency and productivity of Food and Beverages industry is the lowest. The latter two approaches also indicate that the next worst performer is the TEX industry. According to SFPF estimates, CHEM industry is the best performer in

Table 5.26: Total Factor Productivity Growth (Measured Using the Malmquist Index)

Year	CHEM	FB	MTE	METAL	TEX	MFG
1994-95	0.50	0.90	1.40	3.70	0.20	**2.90**
1995-96	5.20	0.40	4.40	7.70	-5.30	**4.00**
1996-97	4.00	-7.50	1.90	-2.60	-2.50	**-0.40**
1997-98	-1.60	13.50	0.30	-2.90	2.00	**0.70**
1998-99	-1.50	-9.50	0.50	5.20	6.60	**-0.60**
1999-2000	-9.30	-2.40	7.20	4.30	4.80	**1.60**
2000-01	10.50	-5.90	-1.50	-1.00	0.80	**1.50**
2001-02	2.20	5.10	1.70	4.00	1.80	**3.80**
2002-03	0.70	2.60	2.60	4.90	0.40	**2.70**
2003-04	4.10	1.90	7.70	-2.30	4.70	**3.70**
2004-05	-1.70	-13.10	1.00	4.30	-6.90	**-3.50**
Average	1.10	-1.50	2.40	2.20	0.50	**1.50**

Table 5.27: Efficiency and Productivity of Selected Public Ltd. Companies: 1993-94 to 2004-05

Industry (Number of firms included)	Mean Efficiency Estimates				Mean TFPG (pcpa)
	Data Envelopment Analysis (DEA)		Stochastic Frontier Production Function (SFPF)		Using Malmquist Index
	TECRS	TEVRS	Cobb-Douglas Function	Translog Function	
CHEM (78)	0.832	0.870	0.9245	0.9256	1.1
Food & Beverages (60)	0.804	0.878	0.6462	0.6267	-1.5
MTE (116)	0.846	0.885	0.8021	0.8030	2.4
METAL(47)	0.887	0.915	0.8170	0.8121	2.2
TEX (53)	0.849	0.882	0.7131	0.7268	0.5
All Companies (449)	0.728	0.781	0.6586	0.6688	1.5

terms of efficiency. As per the Malmquist index, MTE and METAL industries are the best performers as regards TFPG.

5.4 *Labour Productivity: A Comparison of Organised and Unorganised Sector*

The NSSO has been conducting enterprises surveys relating to various activities in its periodical rounds. The enterprises surveys on unorganised manufacturing sector were introduced since 33rd round of NSS (1978-79). Thereafter, the unorganised manufacturing sector has been covered in the 40th, 45th, 51st, 56th and 62nd rounds and the consolidated results were published by the NSSO accordingly. We have obtained the unit level raw data for 45th, 51st and 56th rounds from the NSSO, which were processed at our end. These unit level data were compiled state-wise and industry-wise for the estimation of labour productivity. The industrial classification used for unit level data in the ASI dataset has been adopted for this analysis.

We now present the levels of labour productivity in organised and unorganised manufacturing sectors in Table 5.28. From Table 5.28, we can see that labour productivity in both organised and unorganised sector has increased over time. Labour productivity in various organised manufacturing industries ranged between 1.6 to 2.2 times in 2000-01 as

Table 5.28: Average Labour Productivity (in ₹ at constant 1981-82 prices)

Industry	Organised Manufacturing Sector			Unorganised Manufacturing Sector		
	1989-90	1994-95	2000-01	1989-90	1994-95	2000-01
CHEM	370829	435405	608237	40214	39637	67136
FBT	131511	146965	291494	11594	14959	24782
LEATH	117840	162685	208403	9953	19850	27800
METAL	201258	261629	360641	13774	23138	34954
MTE	187704	245622	400788	27192	41890	54120
TEX	109609	151414	201862	9645	9979	18072
MFG	168007	208557	336726	12452	14949	22794

compared to the respective figures in 1989-90. This range for the unorganised sector was 1.7 to 2.8 times. However the disparity in the levels of labour productivity between organised and unorganised sectors are rather sharp and have perpetuated. Organised manufacturing sector had labour productivity which was 13 times, 14 times and 15 times higher than its unorganised counterpart in years 1989-90, 1994-95 and 2000-01, respectively.

Table A5.1: TFP Indices for Chemical Industry (ASI data, State level Data using GAA)

Year	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	RAJ	TN	UP*	WB	**INDIA**
1980-81	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	**100.0**
1981-82	105.2	112.7	99.1	105.5	109.6	108.2	107.4	101.0	105.7	100.7	111.5	107.7	94.0	100.4	**104.5**
1982-83	115.5	116.1	115.4	116.8	141.7	109.6	121.6	103.4	101.7	81.6	111.0	114.5	113.7	105.9	**111.7**
1983-84	140.7	123.5	124.8	115.9	159.0	121.9	128.5	117.7	106.3	90.7	123.1	116.7	122.9	112.7	**120.3**
1984-85	123.3	147.4	125.3	125.8	171.6	113.0	123.9	114.0	113.1	105.0	115.7	117.2	123.0	113.1	**121.6**
1985-86	124.2	153.5	141.7	126.2	185.4	119.0	106.2	114.3	116.9	103.9	115.9	113.4	122.5	114.1	**122.2**
1986-87	126.0	157.3	106.2	124.4	157.8	122.9	101.9	116.3	116.3	102.4	105.9	106.3	113.0	118.4	**120.7**
1987-88	127.9	159.6	114.8	131.4	186.6	115.8	104.0	119.0	121.7	100.3	124.8	111.3	136.1	115.9	**126.2**
1988-89	146.1	139.5	115.6	144.3	201.8	125.0	106.8	126.3	130.1	75.3	123.5	125.2	128.8	121.7	**133.4**
1989-90	147.1	161.7	131.6	135.2	181.2	141.7	111.0	143.7	129.7	100.4	132.9	121.6	147.3	118.5	**140.7**
1990-91	151.4	176.3	137.0	140.5	194.8	157.5	111.1	147.9	155.8	80.9	135.1	134.8	149.5	139.6	**146.9**
1991-92	175.7	221.5	153.3	138.6	197.4	152.2	118.4	136.3	171.5	96.7	130.1	126.6	164.5	140.4	**146.2**
1992-93	173.2	206.6	134.1	156.5	186.8	140.4	129.2	147.5	164.1	86.2	128.7	116.2	158.5	133.6	**150.0**
1993-94	168.7	192.6	123.5	147.1	185.1	140.6	118.0	151.8	155.2	95.9	121.0	114.6	155.1	138.2	**148.9**
1994-95	169.5	176.5	130.4	154.7	197.6	162.4	122.4	134.8	165.3	96.6	153.3	118.9	122.8	136.9	**145.0**
1995-96	189.0	182.8	134.2	145.3	191.8	137.3	120.6	153.4	151.5	99.2	164.1	119.7	123.9	145.8	**148.7**
1996-97	157.3	228.7	132.5	143.1	189.5	155.0	107.6	142.6	158.6	88.3	172.2	115.8	129.4	144.7	**144.7**
1997-98	139.6	153.7	131.3	131.1	182.2	135.9	104.8	142.8	165.1	92.9	146.2	109.3	118.3	143.4	**136.7**
1998-99	155.2	200.6	123.1	142.5	192.6	134.3	112.6	138.6	148.3	86.6	142.1	112.9	123.1	141.5	**140.0**
1999-2000	161.8	176.6	174.4	140.7	200.4	139.9	120.8	130.3	151.1	92.9	155.0	127.7	122.7	138.1	**141.4**
2000-01	146.1	152.4	121.6	139.4	204.0	145.3	113.9	124.8	160.2	95.6	174.6	118.3	118.5	155.0	**138.4**
2001-02	163.6	171.9	136.0	138.4	194.5	139.2	109.5	125.8	155.4	117.7	154.1	118.3	123.9	162.3	**140.1**
2002-03	160.1	171.7	144.0	143.5	199.6	161.5	110.1	127.1	157.4	92.3	155.5	113.2	130.0	186.3	**144.8**
2003-04	161.8	194.0	139.6	157.7	235.1	156.8	110.9	136.8	165.0	92.4	166.7	119.2	132.6	222.2	**153.0**

Table A5.2: TFP Indices for FBT Industry (ASI data, State level Data using GAA)

Year	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	**INDIA**
1980-81	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	**100.0**
1981-82	113.4	114.4	112.4	113.2	113.0	114.1	112.5	120.3	116.5	114.3	115.0	114.0	115.8	114.8	116.8	**111.7**
1982-83	127.7	120.0	126.7	125.8	128.6	129.1	128.2	149.9	132.0	128.6	128.0	125.3	132.2	130.7	128.9	**123.4**
1983-84	138.9	164.6	137.3	142.0	150.8	181.4	150.6	160.6	143.0	146.0	141.9	136.4	152.1	146.5	147.1	**137.0**
1984-85	142.6	136.4	153.5	139.6	149.6	155.0	164.5	162.7	146.8	151.6	149.3	146.1	158.1	151.7	155.4	**138.2**
1985-86	136.8	133.1	133.3	132.0	138.1	149.5	139.9	163.7	135.5	136.9	136.1	130.0	147.3	144.4	142.6	**127.2**
1986-87	140.3	145.9	135.6	135.9	144.9	147.3	152.1	170.0	145.8	138.7	137.2	137.6	155.7	150.1	149.1	**129.9**
1987-88	140.1	138.3	139.9	137.0	145.5	144.1	151.0	168.1	146.0	146.1	136.8	134.8	152.8	150.6	142.5	**127.4**
1988-89	138.0	176.7	128.7	135.4	149.1	142.0	149.2	176.1	148.5	139.2	135.7	139.4	159.0	147.1	142.9	**126.2**
1989-90	133.4	127.7	118.3	131.0	139.1	140.7	141.7	173.3	138.0	124.7	123.7	128.7	154.6	137.3	136.3	**116.0**
1990-91	133.6	130.6	120.5	127.0	136.7	133.4	140.2	160.3	130.0	125.7	124.6	127.7	146.6	131.1	132.9	**112.4**
1991-92	134.2	150.0	115.3	124.2	129.6	138.5	141.4	151.2	131.9	126.8	125.0	129.5	150.6	129.9	129.5	**111.5**
1992-93	132.8	134.4	121.8	124.2	128.7	138.0	131.6	161.7	131.9	128.1	130.7	129.8	149.6	133.5	132.0	**111.2**
1993-94	134.4	144.7	125.4	128.9	138.5	145.1	139.1	150.3	136.0	138.7	146.3	131.4	159.5	140.5	136.7	**115.3**
1994-95	139.0	131.8	126.3	128.2	131.2	143.4	134.4	174.1	133.3	126.4	148.3	136.0	161.9	138.0	130.6	**114.8**
1995-96	134.4	144.0	128.7	133.1	136.9	143.5	140.3	176.4	138.9	133.8	143.1	132.3	164.3	141.3	135.1	**115.6**
1996-97	135.3	135.5	131.0	132.7	127.0	148.9	147.5	169.7	116.8	138.6	136.4	134.3	170.0	144.9	137.8	**116.0**
1997-98	136.1	147.8	127.5	128.9	120.4	148.8	139.0	215.8	109.0	122.5	139.7	139.6	166.0	138.1	125.0	**111.9**
1998-99	109.1	137.9	129.9	127.5	126.2	150.8	134.6	177.8	118.5	118.0	145.2	131.6	164.0	140.4	136.8	**112.3**
1999-2000	118.4	132.0	118.3	127.1	132.5	144.8	128.5	151.7	116.2	120.9	138.0	127.9	155.6	135.0	130.9	**109.2**
2000-01	153.5	129.0	122.7	133.2	134.6	146.8	135.2	181.2	121.6	128.7	143.8	134.3	168.4	145.8	138.3	**113.9**
2001-02	140.1	132.2	128.2	134.4	131.3	150.1	134.6	141.2	126.4	129.1	151.9	136.1	167.6	146.2	140.2	**115.5**
2002-03	117.8	130.2	134.0	138.5	129.3	150.3	132.8	179.9	123.0	131.1	146.2	141.4	165.9	146.1	141.6	**115.0**
2003-04	125.7	124.2	125.0	134.8	112.6	146.6	132.3	125.4	117.0	127.7	146.1	138.6	163.7	142.8	139.6	**111.9**

Table A5.3: TFP Indices for Leather Industry
(ASI data, State level Data using GAA)

Year	AP	DEL	HAR	KAR	MAH	MP*	ORI	TN	UP*	WB	**INDIA**
1980-81	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	**100.0**
1981-82	101.7	98.9	124.7	112.9	112.6	133.0	100.7	111.0	115.2	111.9	**111.8**
1982-83	106.4	109.8	135.8	120.5	114.6	130.3	81.6	117.9	122.2	117.4	**118.7**
1983-84	125.7	120.4	124.9	175.9	132.0	135.3	90.7	124.2	109.9	121.8	**122.1**
1984-85	119.0	107.5	121.4	168.4	132.0	129.7	105.0	123.6	122.4	133.1	**125.2**
1985-86	97.1	110.1	126.2	149.8	141.1	139.1	103.9	118.6	117.2	116.9	**119.2**
1986-87	116.0	99.7	123.9	140.1	107.8	139.1	102.4	119.5	115.7	125.1	**119.4**
1987-88	125.1	109.4	123.2	144.2	138.8	142.7	100.3	124.5	123.6	129.9	**125.6**
1988-89	113.8	89.6	122.9	146.3	133.9	138.4	75.3	118.1	123.7	101.4	**117.8**
1989-90	116.4	94.6	105.8	147.2	143.4	136.9	100.4	118.1	119.5	115.3	**119.6**
1990-91	111.1	94.0	125.2	136.7	128.6	131.5	80.9	111.8	116.2	99.3	**112.7**
1991-92	118.5	111.4	120.9	138.0	135.6	135.1	96.7	124.3	118.5	110.3	**122.3**
1992-93	130.7	106.8	139.8	146.2	135.2	159.8	86.2	131.0	122.8	119.8	**129.6**
1993-94	114.2	132.0	131.8	148.2	132.1	129.0	95.9	144.9	140.6	127.5	**138.8**
1994-95	122.2	105.9	118.9	145.8	122.4	134.0	96.6	129.2	124.5	130.3	**127.7**
1995-96	132.8	79.1	126.5	148.0	148.7	139.7	99.2	133.9	128.5	135.4	**131.6**
1996-97	141.6	83.8	146.8	160.9	131.2	186.6	88.3	137.9	128.5	129.1	**134.8**
1997-98	120.9	82.0	153.7	150.8	148.7	161.1	92.9	137.9	131.3	177.8	**137.4**
1998-99	148.6	86.2	152.7	131.0	155.9	186.8	86.6	134.3	119.0	166.0	**138.8**
1999-2000	114.3	90.3	138.7	124.8	133.5	162.1	92.9	135.6	109.4	137.2	**130.4**
2000-01	147.7	88.8	133.9	138.5	113.1	126.8	95.6	131.9	120.3	151.2	**132.8**
2001-02	140.6	91.9	174.7	126.5	135.7	163.8	117.7	142.4	134.3	163.9	**143.6**

Table A5.4: TFP Indices for Metal Industry (ASI data, State level Data using GAA)

Year	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	**INDIA**
1980-81	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	**100.0**
1981-82	114.8	95.8	97.4	96.6	93.9	100.3	95.3	105.0	89.1	97.5	94.5	89.0	96.6	97.8	**98.5**
1982-83	114.2	99.6	97.2	97.2	93.9	108.4	96.3	102.8	89.6	98.2	96.3	92.3	101.6	101.6	**99.8**
1983-84	120.2	102.0	100.9	98.7	86.7	95.2	99.7	104.2	96.4	98.3	105.6	95.3	110.2	97.4	**102.4**
1984-85	121.9	94.5	95.1	94.5	85.0	95.7	97.5	90.2	84.5	98.8	96.8	92.1	102.8	93.3	**97.3**
1985-86	117.9	93.2	93.0	90.9	85.8	95.9	93.4	87.1	84.6	90.0	88.0	89.7	98.5	94.3	**94.3**
1986-87	115.1	93.7	95.2	96.9	91.0	103.8	97.9	84.3	94.3	95.8	100.5	94.6	100.4	84.0	**95.3**
1987-88	119.8	96.4	102.7	94.8	94.3	100.3	100.5	92.7	89.7	93.1	96.5	94.8	102.3	89.0	**98.2**
1988-89	132.7	92.2	99.0	91.0	94.6	100.2	98.2	96.3	105.0	93.3	92.0	98.8	100.0	84.8	**100.0**
1989-90	129.3	92.9	100.1	93.0	105.2	104.1	94.4	96.1	108.6	93.8	98.2	94.9	105.8	82.9	**100.5**
1990-91	127.9	94.7	99.5	92.2	102.9	95.5	92.2	100.5	104.7	94.3	93.6	94.4	101.8	88.2	**99.7**
1991-92	130.1	101.1	117.6	96.3	105.6	113.4	87.3	84.9	105.4	97.6	97.7	104.1	109.9	92.2	**100.2**
1992-93	128.4	102.2	104.4	95.8	106.0	105.8	99.9	100.3	106.3	96.8	105.2	99.6	100.0	89.6	**102.8**
1993-94	138.8	101.3	96.2	99.0	107.6	100.4	100.5	104.8	98.8	94.8	92.5	102.4	95.0	94.7	**104.9**
1994-95	132.8	97.8	92.0	96.5	102.1	114.9	102.3	101.7	101.2	99.8	97.3	101.5	105.5	99.4	**106.1**
1995-96	139.4	105.7	94.4	101.6	114.5	119.1	105.3	124.3	105.5	101.3	104.9	104.0	107.3	106.0	**114.3**
1996-97	146.4	105.3	99.5	102.2	113.1	131.1	98.2	110.6	98.3	109.4	105.7	101.8	100.3	96.3	**111.2**
1997-98	168.3	119.1	93.1	100.4	93.9	118.1	97.3	128.2	96.2	127.6	101.3	109.4	100.7	97.1	**117.4**
1998-99	170.7	112.4	88.8	96.8	91.9	112.4	95.1	117.6	114.6	107.1	124.2	107.8	106.3	100.3	**113.0**
1999-2000	173.8	112.1	95.3	105.0	92.0	134.1	91.3	104.1	145.0	106.9	119.9	112.1	106.3	112.9	**117.5**
2000-01	144.0	116.2	99.0	109.7	93.1	140.6	101.7	105.1	161.2	112.2	131.0	112.2	109.0	111.8	**114.2**
2001-02	136.9	119.7	95.9	99.2	97.9	136.5	99.5	111.5	149.9	110.8	124.0	116.1	112.8	120.0	**117.3**
2002-03	173.8	120.2	105.6	110.3	108.6	132.4	104.6	120.1	164.3	116.8	123.3	112.9	115.0	120.4	**124.8**
2003-04	169.1	115.8	101.0	105.6	110.3	123.7	100.8	124.5	212.7	107.4	122.7	109.4	111.9	121.0	**123.3**

Table A5.5: TFP Indices for MTE Industry (ASI data, State level Data using GAA)

Year	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	INDIA
1980-81	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	**100.0**
1981-82	108.6	120.2	100.2	100.7	103.1	95.9	118.9	100.1	101.0	100.7	100.9	99.5	103.8	92.6	100.2	**101.9**
1982-83	113.6	117.1	104.2	103.3	108.4	111.0	150.6	104.8	115.4	97.0	103.4	108.7	108.7	106.7	109.7	**108.3**
1983-84	129.0	125.9	111.8	105.9	109.8	116.1	139.7	109.3	115.7	96.4	102.1	109.4	109.4	105.2	112.3	**112.1**
1984-85	146.8	138.4	112.3	110.9	108.6	112.8	125.5	114.6	131.9	97.5	102.2	123.3	113.7	113.4	116.0	**117.8**
1985-86	120.7	137.0	114.8	114.5	105.7	115.1	101.2	111.2	120.0	114.7	106.7	116.3	117.6	109.6	109.6	**115.6**
1986-87	114.8	135.2	111.1	112.0	108.3	109.8	138.2	109.9	121.5	109.0	105.5	127.0	117.2	112.2	116.8	**115.1**
1987-88	120.7	140.4	117.9	117.3	113.3	119.1	148.2	114.9	130.5	103.9	108.4	129.6	118.1	120.6	121.8	**120.4**
1988-89	124.9	141.9	120.6	117.5	114.0	116.3	102.3	116.2	143.5	107.1	109.6	117.3	115.7	119.3	119.3	**120.6**
1989-90	128.0	162.2	118.4	120.3	116.8	117.5	88.8	119.3	136.4	110.0	115.4	121.1	124.1	130.5	121.5	**125.3**
1990-91	127.1	137.8	117.7	116.9	111.0	114.7	144.6	117.1	126.8	107.1	111.6	118.2	124.4	126.2	124.2	**122.5**
1991-92	126.7	138.5	119.9	118.5	116.2	124.5	87.8	118.9	133.8	100.8	115.6	131.8	120.8	130.1	123.5	**124.6**
1992-93	125.7	133.9	119.6	116.7	112.8	121.5	129.4	118.1	129.9	104.5	113.4	124.1	124.6	138.5	119.7	**123.6**
1993-94	136.7	139.3	120.5	126.2	110.0	117.9	167.9	124.3	134.0	113.2	117.7	127.9	123.1	134.5	120.3	**127.2**
1994-95	138.4	135.5	130.6	121.3	114.5	125.1	103.1	127.2	131.4	106.6	116.8	141.0	126.3	149.4	123.2	**131.0**
1995-96	141.8	154.6	118.1	125.3	117.0	131.3	105.4	135.1	138.6	109.2	121.1	142.0	134.4	138.2	132.4	**136.7**
1996-97	148.4	162.7	122.7	119.1	128.0	131.6	135.9	127.1	134.5	106.3	117.0	151.0	129.5	128.2	135.1	**133.0**
1997-98	145.3	168.6	123.6	123.3	134.9	127.2	82.8	124.3	129.7	110.9	125.0	146.1	124.7	131.1	131.4	**132.5**
1998-99	152.1	144.3	126.6	125.2	135.5	142.1	143.2	119.9	128.0	97.2	136.2	132.3	130.6	125.8	139.0	**132.1**
1999-2000	149.7	146.9	132.9	134.7	113.7	126.2	148.4	135.4	147.2	97.7	129.8	144.7	136.3	132.9	136.5	**140.1**
2000-01	155.4	136.0	128.7	127.8	129.5	125.4	138.2	125.9	141.6	102.7	125.2	140.2	139.8	131.5	144.0	**136.2**
2001-02	156.3	148.4	135.5	134.3	128.3	133.3	137.0	126.3	148.8	101.9	135.0	151.6	139.9	132.7	131.7	**139.2**
2002-03	158.5	159.2	137.2	135.5	138.3	138.4	138.8	113.9	149.5	108.6	130.5	157.1	147.4	141.5	137.8	**144.1**
2003-04	177.1	192.3	139.2	145.5	148.3	154.6	146.9	133.1	157.5	116.1	137.2	173.7	159.6	149.5	144.2	**156.1**

Table A5.6: TFP Indices for TEX Industry (ASI data, State level Data using GAA)

Year	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	**INDIA**
1980-81	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	**100.0**
1981-82	97.8	93.6	102.9	103.3	97.8	99.4	99.0	105.6	100.8	88.1	93.9	102.0	105.4	101.0	96.1	**101.3**
1982-83	100.8	93.8	106.6	103.5	107.1	100.7	99.7	99.4	98.8	142.6	97.8	106.0	101.5	105.7	96.4	**101.5**
1983-84	110.4	93.7	117.9	112.3	107.3	113.7	109.0	108.5	109.2	120.4	100.3	109.4	106.6	115.9	99.0	**109.3**
1984-85	109.2	92.6	113.1	108.2	106.5	114.9	111.2	109.2	105.5	121.7	103.0	117.3	107.7	112.9	105.0	**107.7**
1985-86	109.2	80.4	116.9	112.9	102.7	99.4	117.3	116.5	100.5	129.9	105.3	111.0	112.2	113.3	104.1	**111.3**
1986-87	122.5	100.6	133.3	124.2	108.0	115.8	126.2	128.6	117.1	134.3	116.5	124.0	125.0	125.6	119.7	**123.4**
1987-88	124.3	102.3	136.2	119.9	108.2	123.3	121.9	121.4	116.6	131.6	113.3	119.8	125.0	117.4	113.5	**121.0**
1988-89	120.4	113.0	141.3	118.4	108.2	122.6	120.5	126.3	118.4	137.1	115.1	118.5	126.1	112.9	115.2	**121.2**
1989-90	118.7	103.7	129.7	116.4	106.7	118.5	119.9	123.4	109.5	144.6	108.9	111.5	121.0	119.0	111.8	**121.4**
1990-91	120.6	108.7	136.7	121.2	111.8	125.6	122.0	130.0	122.6	148.8	117.2	128.4	126.1	121.1	113.7	**124.1**
1991-92	120.7	105.7	143.0	118.5	113.6	135.4	120.4	131.8	122.7	144.6	123.3	142.2	130.2	123.3	117.3	**125.6**
1992-93	123.8	103.2	136.5	118.7	110.1	133.1	110.0	129.4	120.1	143.2	119.7	129.9	127.7	125.5	118.6	**125.0**
1993-94	129.0	127.5	138.4	122.8	108.1	159.5	114.4	135.8	110.9	143.8	110.2	134.1	129.1	128.6	121.3	**129.2**
1994-95	119.8	102.5	163.6	124.2	116.5	138.9	126.5	128.7	122.0	154.5	114.2	133.7	131.4	128.2	123.1	**128.2**
1995-96	112.4	96.8	122.4	115.7	118.5	120.1	116.2	112.7	119.6	127.2	104.7	123.7	122.6	113.7	109.2	**114.3**
1996-97	106.1	93.6	113.4	110.6	116.4	115.3	109.0	108.8	115.2	130.1	98.5	116.4	112.6	112.9	114.0	**110.7**
1997-98	108.8	90.8	108.6	106.1	123.4	132.0	113.6	105.5	124.7	125.8	102.8	109.3	116.2	110.1	123.6	**110.0**
1998-99	114.6	97.9	126.8	118.3	119.4	129.9	121.1	118.0	101.5	251.9	107.1	118.2	125.1	120.5	122.7	**116.8**
1999-2000	112.1	105.2	125.0	115.2	115.1	124.0	116.8	120.3	115.1	204.6	105.8	119.9	125.9	121.4	130.4	**118.5**
2000-01	115.5	108.8	121.2	121.1	129.9	126.2	126.7	125.0	125.1	197.7	120.6	124.0	131.4	120.6	129.4	**122.3**
2001-02	121.5	119.5	124.0	127.1	130.8	134.2	126.0	119.2	121.3	291.6	119.2	130.0	131.2	122.3	137.2	**124.8**
2002-03	122.6	112.7	123.3	125.9	127.6	137.6	127.5	126.2	129.0	368.7	118.9	130.0	133.9	127.4	139.0	**127.1**
2003-04	125.1	106.3	120.4	127.9	130.6	130.9	124.0	127.1	126.0	342.4	119.6	126.7	131.6	122.8	136.5	**125.8**

Table A5.7: TFP Indices for Organised Manufacturing Sector (ASI data, State level Data using GAA)

Year	AP	BIH*	DEL	GUJ	HAR	KAR	KER	MAH	MP*	ORI	PUN	RAJ	TN	UP*	WB	**INDIA**
1980-81	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	**100.0**
1981-82	106.3	117.5	104.6	104.7	108.4	103.3	104.6	105.3	105.3	100.3	107.3	106.2	104.1	93.8	103.1	**106.4**
1982-83	114.9	119.7	111.4	106.4	113.5	111.3	109.6	109.2	109.7	103.3	111.8	112.4	110.0	110.0	108.5	**112.0**
1983-84	122.5	126.2	117.0	109.8	116.9	121.3	113.9	116.1	112.2	110.6	116.9	125.7	113.5	107.2	111.8	**118.5**
1984-85	123.8	131.9	119.0	117.7	118.5	117.2	118.2	116.9	109.8	105.9	116.9	119.3	116.8	113.1	113.5	**118.3**
1985-86	119.6	132.8	117.3	112.4	117.0	117.8	114.8	118.0	106.9	108.6	116.7	115.8	114.1	111.3	112.5	**117.8**
1986-87	121.6	132.3	117.2	115.7	119.5	120.3	118.7	119.1	107.1	113.6	116.7	120.4	117.5	115.5	113.5	**120.9**
1987-88	121.3	139.0	121.7	117.3	122.7	123.7	124.1	118.4	113.0	109.5	120.8	122.4	118.5	118.1	118.8	**122.0**
1988-89	122.3	148.3	122.2	117.2	121.8	124.6	123.5	121.8	118.5	120.6	120.1	121.4	120.7	116.2	111.6	**123.4**
1989-90	124.6	146.5	120.6	118.7	123.8	129.5	132.2	122.6	118.2	123.5	123.3	125.8	122.1	121.8	110.9	**125.4**
1990-91	127.1	145.4	125.8	117.8	129.3	132.8	124.3	125.5	122.5	122.1	123.0	131.7	123.7	122.8	115.6	**127.8**
1991-92	126.8	146.0	128.1	117.9	127.3	142.3	133.0	120.6	116.9	120.4	124.1	127.0	122.8	123.2	112.3	**126.2**
1992-93	126.7	139.2	124.6	115.1	121.0	137.4	127.8	123.9	117.8	117.9	120.0	126.3	120.4	119.6	110.2	**127.0**
1993-94	128.8	143.0	126.5	122.8	124.2	138.5	125.9	127.5	120.4	113.5	126.7	125.4	121.2	121.2	115.8	**129.0**
1994-95	133.4	136.4	133.6	119.6	124.9	137.7	125.9	124.8	119.3	115.2	125.4	131.4	115.9	123.2	114.1	**127.0**
1995-96	134.8	141.5	121.4	115.7	126.8	136.5	132.2	126.6	128.7	117.0	123.5	131.4	116.1	120.7	115.0	**127.9**
1996-97	132.2	151.0	123.4	123.4	130.0	139.5	133.3	122.0	124.1	114.2	127.2	132.6	117.9	126.5	117.9	**128.6**
1997-98	143.7	162.9	123.3	121.6	128.5	133.0	133.1	121.2	132.5	115.0	124.5	132.3	115.9	122.8	117.6	**128.7**
1998-99	134.2	160.9	123.5	113.4	132.3	127.9	139.3	122.0	128.4	122.9	121.3	131.7	117.7	122.8	121.7	**124.4**
1999-2000	138.6	166.3	136.5	123.4	137.3	123.8	136.7	127.7	133.5	133.4	120.7	146.2	121.6	123.0	124.8	**128.4**
2000-01	142.8	147.9	132.1	130.1	141.4	127.2	140.7	128.8	138.6	135.0	124.3	149.1	126.6	125.4	129.0	**130.4**
2001-02	148.0	146.7	132.6	122.5	146.2	132.6	140.3	128.7	137.9	132.9	125.1	149.2	125.1	129.3	133.1	**130.8**
2002-03	152.3	169.1	137.8	126.7	150.8	139.9	145.7	134.8	141.6	139.9	138.7	151.8	127.4	130.8	139.2	**136.8**
2003-04	157.4	175.2	146.0	132.3	155.3	144.6	147.1	137.9	141.5	148.5	135.2	153.9	130.7	136.3	142.9	**140.1**
2004-05																**140.4**
2005-06																**143.5**
2006-07																**147.0**
2007-08																**146.4**

Figure A5.1: Industry-wise Trend in TFP Index (Andhra Pradesh)

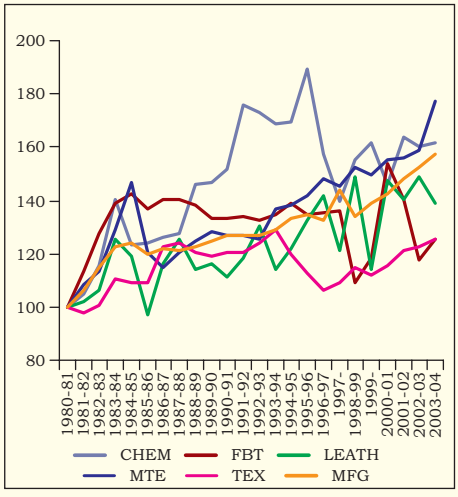


Figure A5.2: Industry-wise Trend in TFP Index (Bihar*)

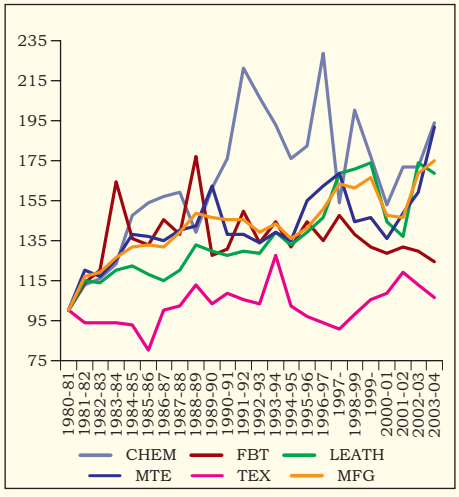


Figure A5.3: Industry-wise Trend in TFP Index (Delhi)

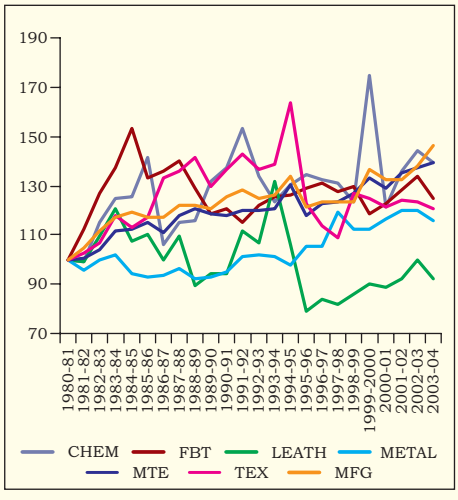


Figure A5.4: Industry-wise Trend in TFP Index (Gujarat)

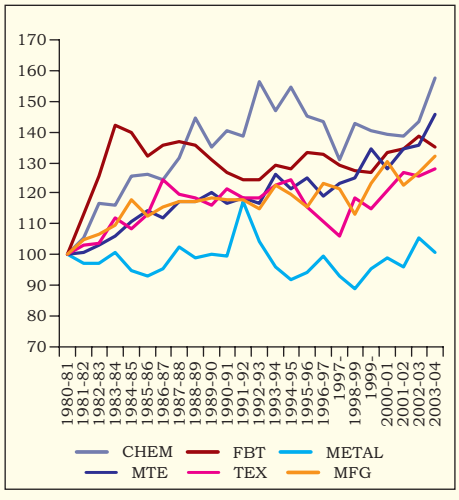


Figure A5.5: Industry-wise Trend in TFP Index (Haryana)

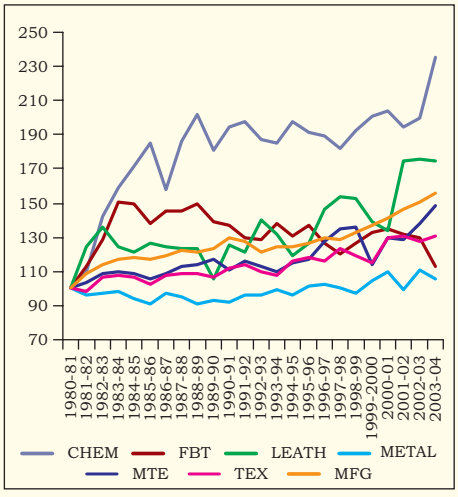


Figure A5.6: Industry-wise Trend in TFP Index (Karnataka)

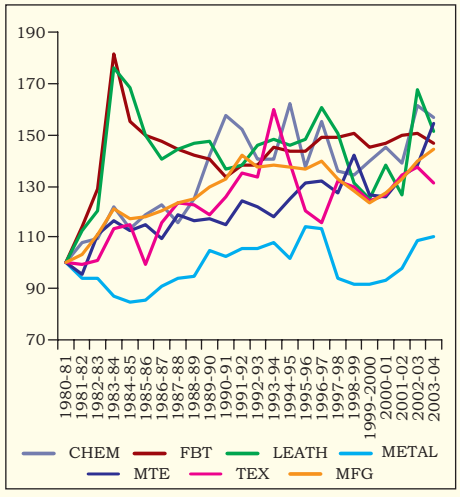


Figure A5.7: Industry-wise Trend in TFP Index (Kerala)

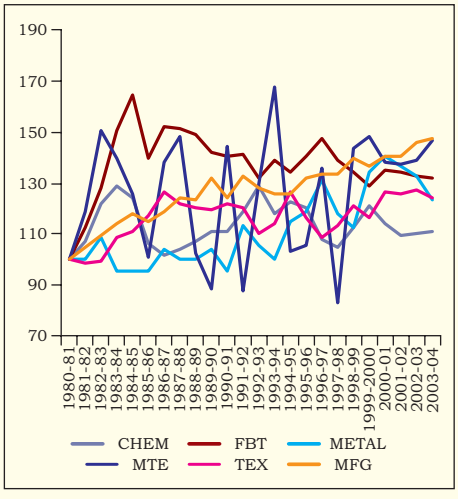


Figure A5.8: Industry-wise Trend in TFP Index (Maharashtra)

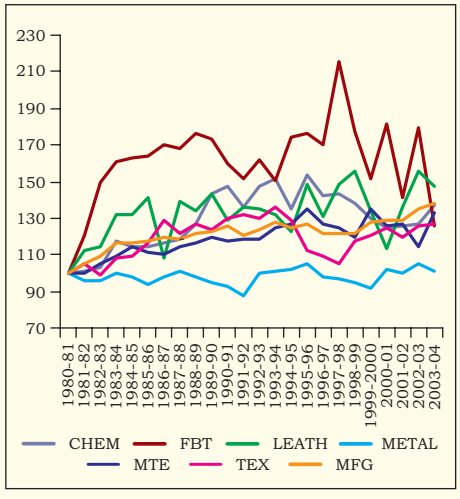


Figure A5.9: Industry-wise Trend in TFP Index (Madhya Pradesh*)

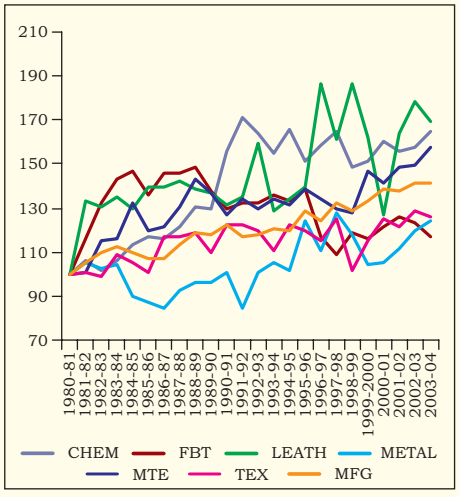


Figure A5.10: Industry-wise Trend in TFP Index (Orissa)

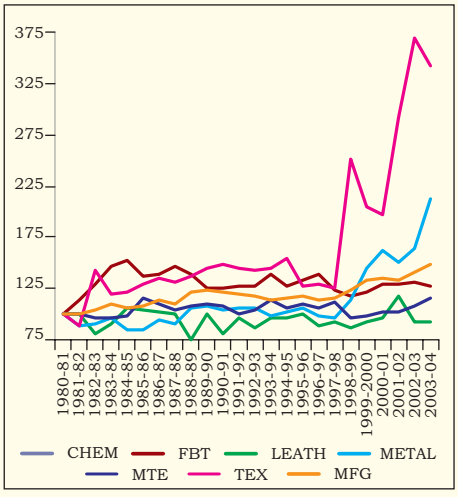


Figure A5.11: Industry-wise Trend in TFP Index (Punjab)

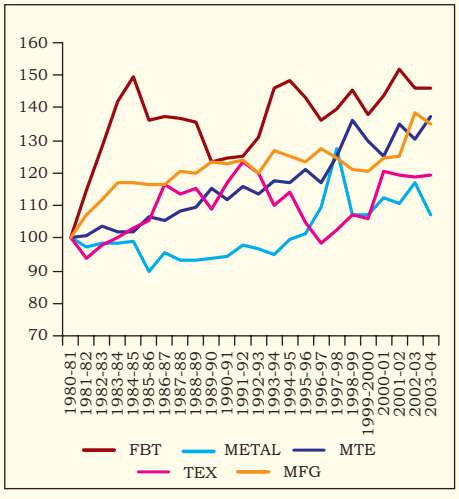


Figure A5.12: Industry-wise Trend in TFP Index (Rajasthan)

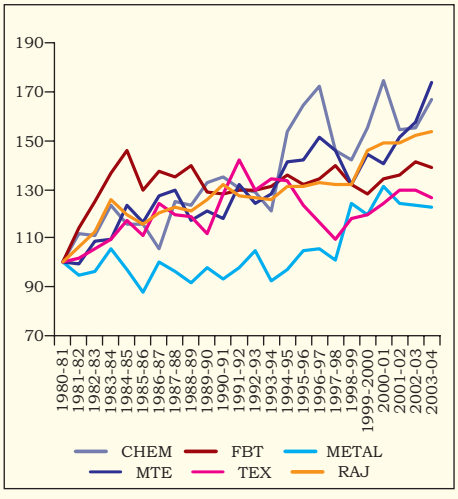


Figure A5.13: Industry-wise Trend in TFP Index (Tamil Nadu)

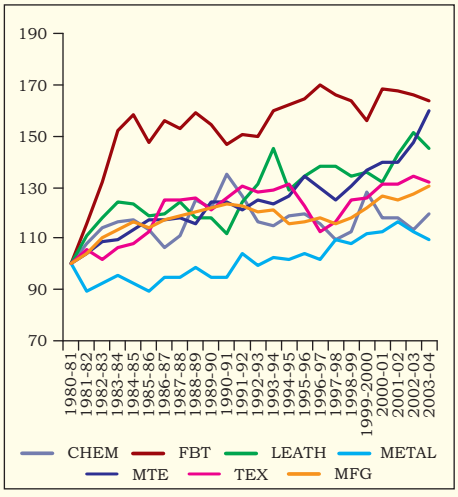


Figure A5.14: Industry-wise Trend in TFP Index (Uttar Pradesh*)

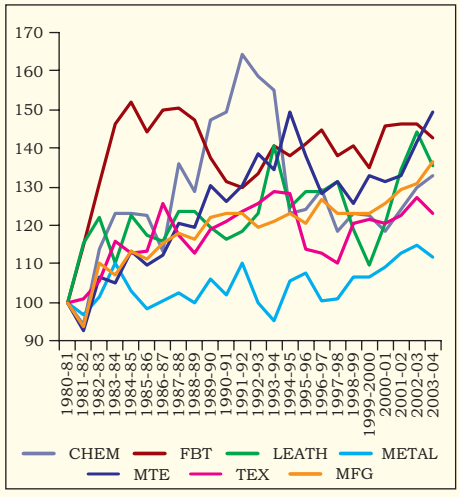
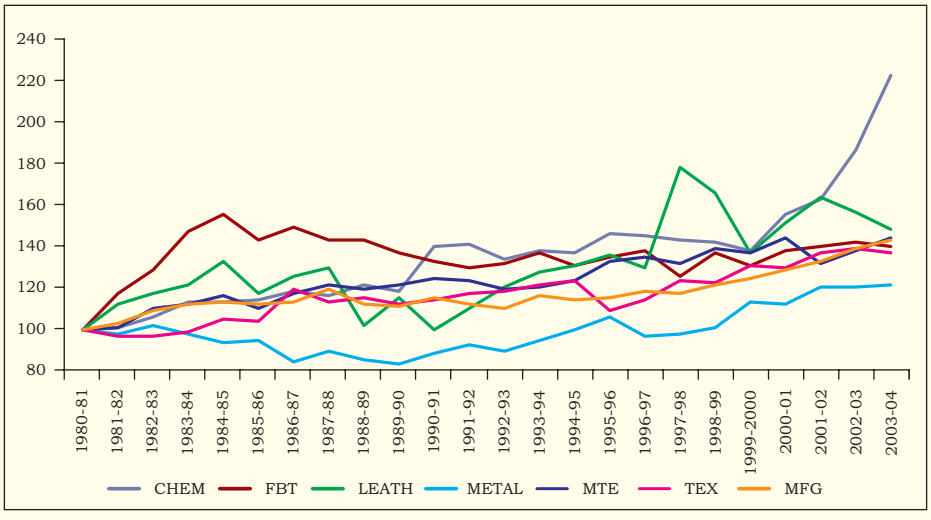


Figure A5.15: Industry-wise Trend in TFP Index (West Bengal)



6. Performance of Manufacturing Sector in India: Output, Employment and Productivity Growth

The earlier sections of this study have provided estimates of productivity and efficiency for the various datasets. In this section, we take an overall view of the performance of India's manufacturing sector, as productivity growth ought to be combined with growing output and employment for it to make a positive impact on the standard of living of people.

6.1. Organised Manufacturing Sector

The performance of a state/industry needs to viewed in various dimensions, such as, growth of output (Og), growth of employment (Lg), the level of TFP and the growth of TFPG. In this section, we try to take a holistic view of each state/industry as regards these criteria. We first discuss the levels of TFP and productivity growth rates along with the employment growth rates. Needless to mention that we will focus on the performance of states in which a particular industry has some presence (see section 5.1.2 and Table 5.18B). Annexures 6.1A, 6.1B, 6.2A and 6.2B provide the trend growth rates of output and employment.

In Figure 6.1A, we provide the trend rates of growth of employment (Lg) and productivity TFPG (obtained with GAA and PFA methodologies, TFPG (GAA) and TFPG (PFA), respectively) for the organised manufacturing sector for the period 1980-81 to 2003-04. In Figure 6.1B and 6.1C, TFPG (GAA) estimates for the pre-reform and post-reform periods (classification 2, in which post-reform period starts from 1992-93 onwards) along with Og and Lg have also been provided.

6.1.1 State-wise Analysis of Performance of Organised Manufacturing Sector

In Chapter 5 we have seen that MAH, TN and WB emerge as the best performers in terms of TFP levels in the manufacturing sector. Out of these, TN and WB feature in the list of worst performers in terms of TFPG.

The worst performers in terms of TFP levels are ORI, DEL and RAJ. Out of these, RAJ is one of the states with best performance in terms of TFPG. Thus, one can say that convergence of TFP is working favorably for RAJ and adversely for TN and WB. HAR, KAR, RAJ, AP and MP* are the states that have done well in terms of output growth, employment growth as well as in terms of TFPG[34]. BIH* and WB have performed very poorly in terms of growth of output and there have been severe job losses in these states. In the case of these states, productivity performance (as obtained from GAA) gets inflated due to job losses. Hence, these cases need to be interpreted with utmost caution, as this is not the desirable situation from a developmental perspective. MAH tops in the list of states in terms of TFP levels. However, over the years, its position has been deteriorating, as it features in the list of states in which output growth and employment growth has been lower than those witnessed at all India level. In the case of Maharashtra, the TFPG measured with GAA is much lower than that measured by the PFA (Table 6.1, Figure 6.1A). As against it, TFPG for Bihar* is negative if measured by PFA and highest, if measured by GAA. It appears that the estimates of TFPG obtained by the two methodologies differ for states demonstrating the polar situations. For the organised MFG, TFPG measured by GAA is lower and almost half of that measured by the PFA approach. In brief, TFPG estimates are sensitive to the application of alternative methodologies. Bihar* and West Bengal are the states with the lowest rate of growth of output and also with falling employment levels. UP* too witnessed fall in employment, but it growth rate has been fairly comparable to the national average. Haryana, which demonstrated highest rate of growth of output, yields a rather low TFPG as measured by PFA. Though the estimates of TFPG obtained by GAA seem to be convincing, as low growth rate of output coupled with fall in employment can give inflated estimates of TFPG, the estimates obtained by PFA seem to be helpful in

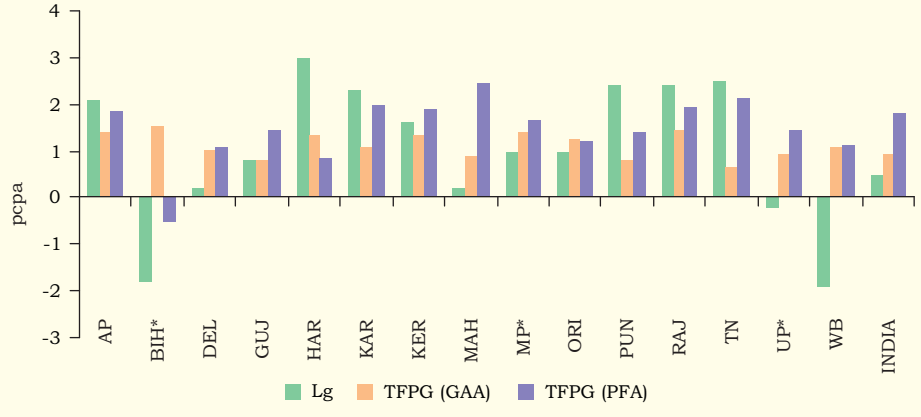
[34] Some of the studies such as, Das (2008), have found the convergence of overall technical efficiency across states during 1979-80 to 2003-04. Kumar, (2004) concludes that there was a tendency of convergence in TFPG among Indian states during the post-reform period, but only for the states that were technically efficient at the beginning of the reform.

Table 6.1: State-wise Performance of Manufacturing Sector in India: 1980-81 to 2003-04

STATE	Og	Lg	TFPG (GAA)	TFPG (PFA)	TFPG (GAA)/Og	TFPG (PFA)/Og
AP	8.80	2.10	1.41	1.84	16.02	20.96
BIH*	3.70	-1.80	1.55	-0.52	41.89	-13.98
DEL	6.20	0.20	1.04	1.09	16.77	17.57
GUJ	8.60	0.80	0.78	1.45	9.07	16.85
HAR	9.90	3.00	1.33	0.86	13.43	8.66
KAR	9.50	2.30	1.05	1.98	11.05	20.85
KER	6.80	1.60	1.36	1.89	20.00	27.87
MAH	6.90	0.20	0.88	2.44	12.75	35.30
MP*	8.80	1.00	1.37	1.65	15.57	18.71
ORI	6.50	1.00	1.27	1.20	19.54	18.49
PUN	6.00	2.40	0.79	1.41	13.17	23.54
RAJ	9.00	2.40	1.43	1.93	15.89	21.43
TN	8.00	2.50	0.65	2.11	8.13	26.40
UP*	7.40	-0.20	0.94	1.44	12.70	19.50
WB	3.40	-1.90	1.05	1.12	30.88	33.03
INDIA	7.30	0.50	0.92	1.81	12.60	24.79

the consistency check. The estimates of contribution of productivity growth to growth of output of manufacturing sector range from about 13 to 25 per cent, as a result of application of alternative methodologies.

Figure 6.1A: Trend Growth Rates of Employment (Lg) and Productivity (TFPG): 1980-81 to 2003-04



It can be seen from Figure 6.1B and Figure 6.1C, GUJ, HAR, KAR, KER and WB witnessed increase in growth rates of output during the post-reform period. However, WB saw increase in output growth from an extremely low rate that it witnessed during the pre-reform period. It had witnessed the lowest growth rate of output among all the states. Rest of the states witnessed either lower or same growth rates of output during the post-reform period. In other words, though the second bout of reforms in the nineties did not result in acceleration of growth of output of the manufacturing sector for India as a whole, it did accelerate growth rates of output of states like GUJ, HAR, KAR and KER. Besides these states, all other states witnessed either stagnant employment or deceleration in employment. Except for HAR, no other state witnessed acceleration in TFPG (GAA). AP, MP*, ORI, RAJ and WB did not see any acceleration/deceleration in TFPG (GAA), whereas, all the remaining states witnessed deceleration in TFPG (GAA) during the post-reforms period. However, there is an improvement of productivity growth at the aggregate level during 2000-04 period. Policy reforms may delay end results for a number of reasons like economic/political uncertainties, external crisis, *etc.*, Understanably, the better placed states such as Gujarat would reap the benifits earlier than

Figure 6.1B: Trend Growth Rates of Output (Og), Employment (Lg) and Productivity (TFPG): 1980-81 to 1991-92

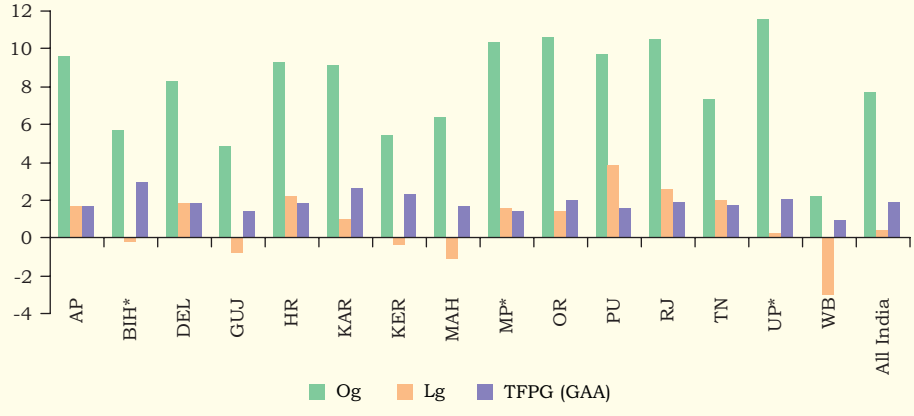
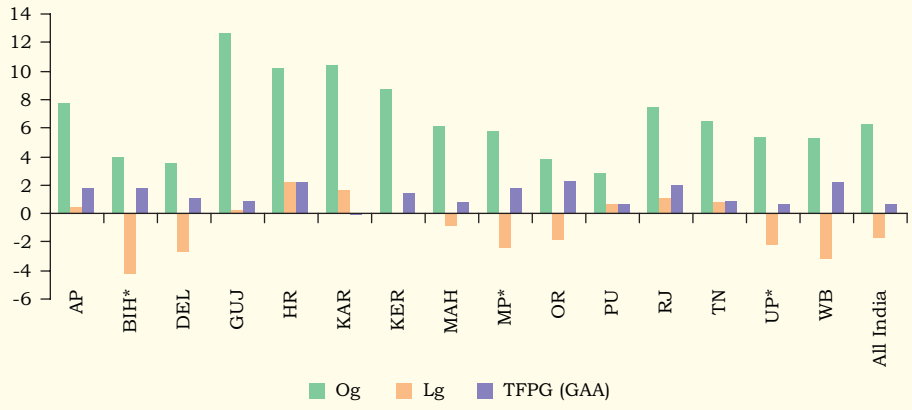


Figure 6.1C: Trend Growth Rates of Output (Og), Employment (Lg) and Productivity (TFPG): 1992-93 to 2003-04



the backward states. Of late, many backward states are growing at a higher rate.

6.1.2: Industry-wise Analysis of Performance of Manufacturing Sector

In Table 6.2, we provide a synoptic view of the Industry-wise performance of India's manufacturing during 1980-81 to 2003-04. It can be seen from this Table that the industries that pulled up the growth rate of output of manufacturing sector were primarily, CHEM and MTE industries. Though leather industry recorded the highest growth rate of output, it has rather low weightage in the manufacturing output. FBT, TEX and METAL recorded lowest rates of growth of output and of these, FBT witnessed falling employment and TEX witnessed the lowest rate of growth of employment. TFPG measured by GAA is negative for the former. For the latter it is positive, but lowest among the remaining industries. Similar positioning of these industries can be seen in terms of the contribution of TFPG (GAA) to growth of output (Og). The estimates of TFPG from PFA seem to be rather high for TEX industry and hence also its contribution to growth of output is the highest across industries.

Table 6.2: Industry-wise Performance Manufacturing Sector in India: 1980-81 to 2003-04

INDUSTRY	Og	Lg	TFPG (GAA)	TFPG (PFA)	TFPG (GAA)/Og	TFPG (PFA)/Og
CHEM	8.40	2.40	1.35	1.87	16.07	22.26
FBT	6.70	-0.50	-0.41	1.62	-6.12	24.18
LEATH	9.10	4.40	1.17	0.97	12.86	10.66
METAL	6.50	0.50	1.08	1.67	16.62	25.69
MTE	8.20	0.50	1.47	1.89	17.93	23.05
TEX	6.30	0.10	0.69	3.05	10.95	48.41
MFG	7.30	0.50	0.92	1.81	12.60	24.79

A cross-check provided to the above results is from the empirical analysis of efficiency estimates obtained for the private limited manufacturing companies carried out in Chapter 5. The mean efficiency estimates of Food and Beverages industry obtained by both Cobb-Douglas specification and Translog specifications of SFPF and also the TFPG obtained by using Malmquist index (see Table 5.27) are the lowest across industries. In view of this, there seems to be confirmation of the fact that this industry is the worst performing industry as regards both TFPG and also in terms of growth of employment generation.

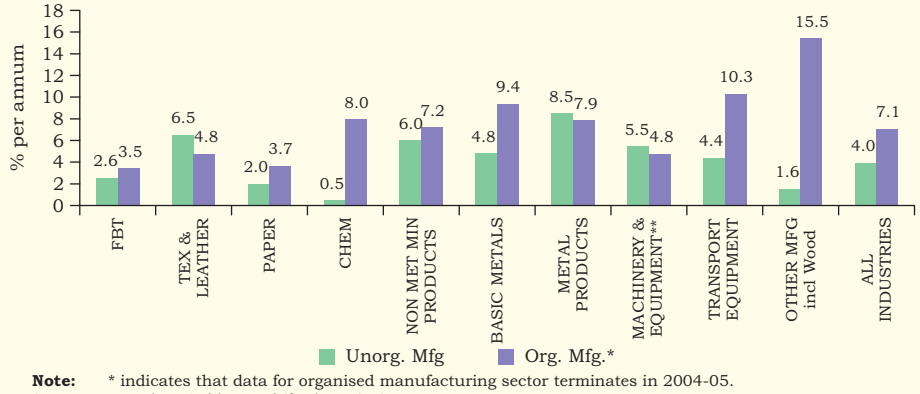
6.2 Unorganised versus Organised Manufacturing Sector

Given the problem of compilation of capital stock for the unorganised manufacturing sector, we do not overambitiously estimate TFPG, but have rather confined ourselves to examining the broad trends in labour productivity, as is also done by Goldar et al (forthcoming). In this section we provide a comparison of findings of our results which are based on the unit level data for unorganised manufacturing sector with those of Goldar et al (forthcoming), which also includes the 2005-06 data for unorganised manufacturing sector and 2004-05 data for organised manufacturing. One of the differences in estimation of labour productivity between our study and that of Goldar et al (forthcoming) is that the latter uses RVASD as a proxy for output.

We have already noted in section 5.4 of this study that labour productivity in both organised and unorganised sector has increased over time. Labour productivity in various industries of organised manufacturing sector ranged between 1.6 to 2.2 times in 2000-01 as compared to that in 1989-90. The respective range for the unorganised sector was 1.7 to 2.8 times. In other words, as regards growth of labour productivity in the unorganised sector, it has increased more or less in tandem with that in the organised sector. However, the disparity in the level of labour productivity between the organised and unorganised sectors seems to have somewhat widened in 2000-01. As indicated earlier, the ratio of labour productivity of various industries in organised manufacturing sector to their counterparts in unorganised manufacturing sector ranged between 6.9 to 13.5 times in 1989-90 and this range widened to 7.5 to 14.8 in 2000-01.

Figure 6.2A, 6.2B and 6.2C provide a comparison between unorganised and organised sectors during the period 1989-90 to 2004-05/2005-06 (organised/unorganised) manufactuing sector.

Figure 6.2A: Growth Rate of Real Value Added in Indian Manufacturing Sector: 1989-90 to 2005-06



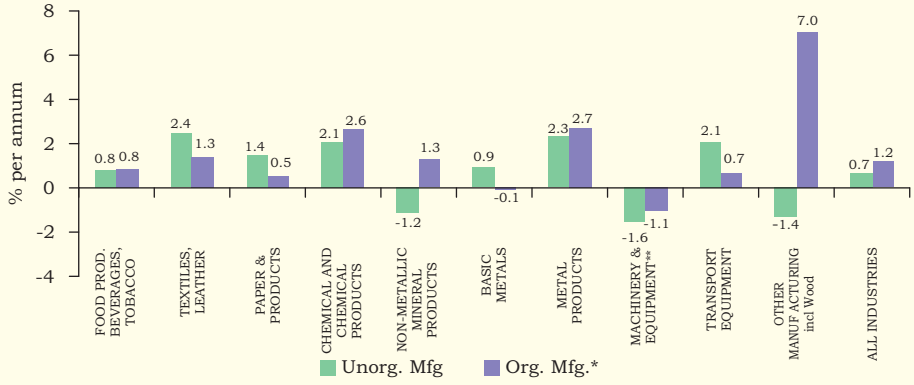
Note: * indicates that data for organised manufacturing sector terminates in 2004-05.
Source: Based on Goldar et al (forthcoming).

As regards textiles and leather, metal products and machinery and equipments, real value added in unorganised sector has increased faster than in the organised manufacturing sector (Figure 6.2A). In all other industries, real value added has grown at a faster rate in the organised sector. However, at aggregate level, the real value added has increased at a slower rate in unorganised manufacturing sector (4.0 pcpa) *vis-à-vis* organised manufacuring sector (7.1 pcpa).

As regards the employment growth in organised and unorganised sector, we observe that it has been higher in the former than in the latter (Figure 6.2B). However, this is not true across industries. Textiles and leather, paper, basic metals and transport equipment industries witnessed highter growth rates of employment as compared to the organised sector. In most of the remaining industries, organised manufacturing performs better than the unorganised sector.

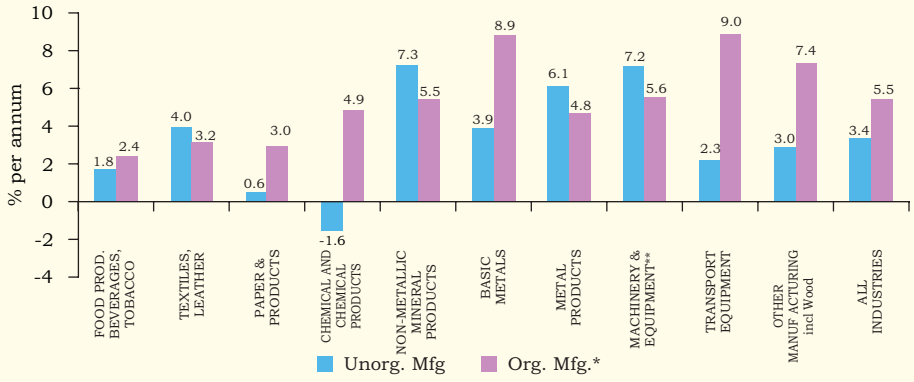
As regards labour productivity growth rate, organised manufacturing sector faired better than unorganised sector, as can be seen from (Figure 6.2C). Again, in Textiles and leather, non-metallic mineral products, metal

Figure 6.2B: Growth Rate of Employment in Indian Manufacturing Sector: 1989-90 to 2005-06



Note: * indicates that data for organised manufacturing sector terminates in 2004-05.
Source: Based on Goldar et al (forthcoming).

Figure 6.2C: Growth Rate of Labour Productivity in Indian Manufacturing Sector: 1989-90 to 2005-06



Note: * indicates that data for organised manufacturing sector terminates in 2004-05.
Source: Based on Goldar et al (forthcoming).

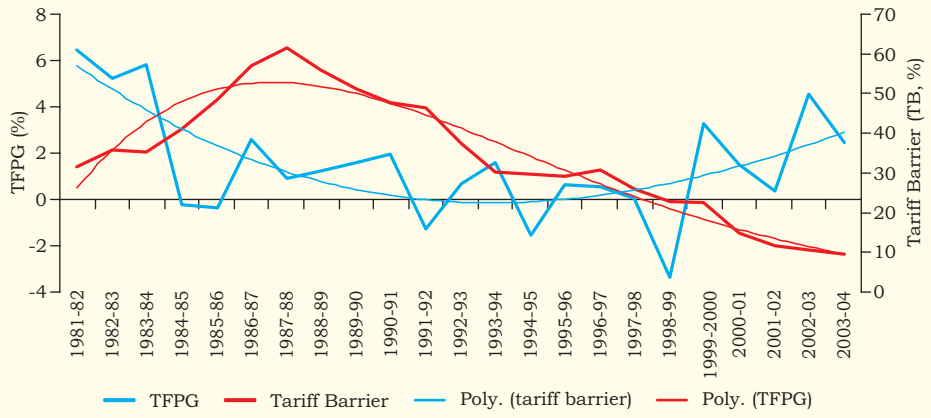
products and machinery and equipments industries, labour productivity growth has been higher in the unorganised manufacturing sector than in the organised manufacturing sector. In other sectors, the performance of organised sector has been better. Our findings about the ranking of the industries according to labour productivity growth rates also broadly coincide with that of Goldar et al (forthcoming).

6.3: Determinants of TFPG in the Organised Manufacturing Sector

In this section, we have used the estimates of productivity growth obtained from GAA[35] and tried to relate them to some of the determinants of TFPG as discussed in the literature review in Section 3. These are: tariff liberalization, export orientation, investment, availability of infrastructure constraint (proxied by growth rate of electricity consumption) and agricultural growth (demand). The time-path of these variables has been

[35] We get a single estimate of TFPG with the production function approach and hence, in order to capture the year to year variation in TFP and relate it to its determinants, we have used TFPG obtained by applying GAA methodology for the organised manufacturing sector. As mentioned earlier, we have not estimated TFPG for the unorganised manufacturing sector due to problem of non-availability of the required data for obtaining reliable estimates of TFPG.

Figure 6.3A : TFPG in Organised Manufacturing Sector and Tariff Liberalisation



shown in Figures 6.3A to 6.3D. We also regress TFPG on its various determinants so as to take an overall view of the same.

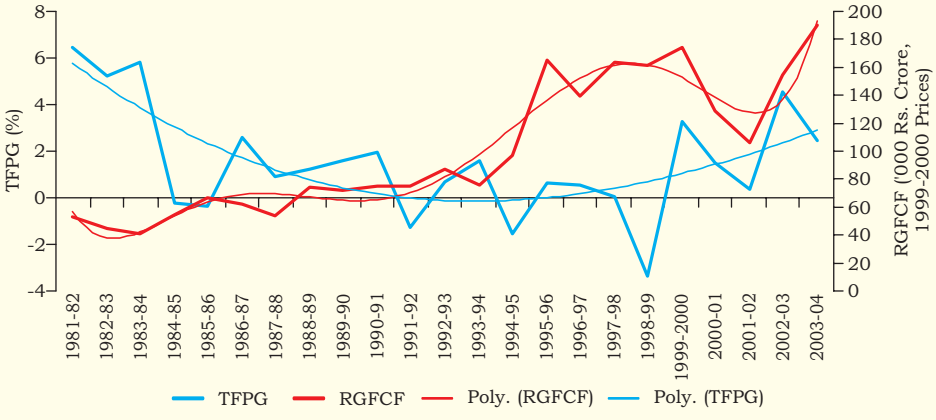
As can be seen from Figure 6.3A, TFPG (GAA) witnessed large fluctuations with steep decline until the mid-eighties and thereafter reversed. During this period, the protectionism as measured by tariff barriers (TB), ratio of import duties to import payments (in percentage terms) was on the rise, almost until 1987-88. Thereafter, there has been consistent decline in protectionism, but the TFPG has risen since the end of the nineties. Thus, if we view the entire span of the study, trade barriers do not seem to be a determinant of TFPG. It is, therefore, not surprising that the various studies come up with different conclusions regarding impact of trade reforms on productivity, depending on the time-period under consideration.

Investment adds to capital stock and various studies, including Utchikawa (2006) have shown that during the periods of high investment, there is lower capacity utilisation. Though higher investment may be beneficial for higher growth, its does not get reflected in higher TFPG due

to lower capacity utilisation. Also the concern of Krugman (2004) and Young (1995) that increasing investment may result in diminishing returns and hence intensification of capital may not lead to sustainable growth and TFPG, seems to be valid under the Indian context. In view of this, we examine the role of real capital formation on productivity in manufacturing sector (Figure 6.3B). We see that until the 1993-94, capital formation in manufacturing sector increased steadily and slowly. There was a spurt in the mid-nineties after which it stabilised and thereafter again wide fluctuations can be seen in capital formation. Though, we do not see any contemporaneous relationship between annual TFPG and capital formation in manufacturing sector, we have examined the effect of lagged investment on TFPG later in this section.

Inadequate growth of infrastructure is often viewed as one of the main constraints on productivity growth. In view of this, we use the rate of growth of electricity conusmption as the proxy for availability of infrastrucutre. We also presume that the rate of growth of electricity used for manufacturing sector would be in the same direction as the use of

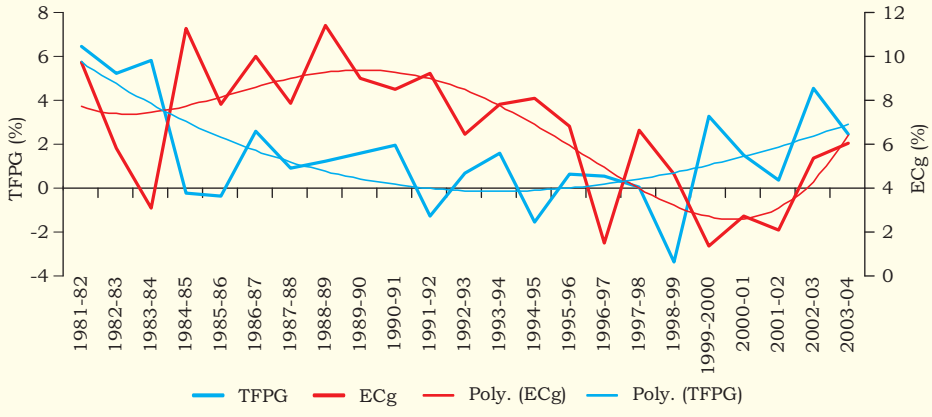
Figure 6.3B: TFPG in Organised Manufacturing Sector and Real Gross Fixed Capital Formation (RGFCF) in Mfg Sector



electricity for all other purposes. In Figure 6.3C, we present the time-path of the TFPG and yearly growth rate of electricity consumption (ECg). From this Figure, it is difficult to infer that higher (lower) growth rate of electricity consumption is associated with higher (lower) TFPG of organised manufacturing sector.

One of the determinants of TFPG is said to be the demand factor. Earlier studies, such as, Ahluwalia (1991) have examined the agricultural growth constraint on the manufacturing sector. The logic underlying this argument is that unless the agriculutral sector feeds raw material inputs to the manufacturing sector and absorbs the output of manufacturing sector both in terms of intermediate products and final consumer goods. Low rate of growth of agriculture can cause unutilised capacities in manufacturing sector and will have a negative impact on TFPG of the manufacturing sector. Moreover, since agriculture employs a large proportion of working force, unless the growth rate of agricultural sector improves, it will not be possible to have a sizeable positive impact on demand for manufacturing goods. In view of this the growth of agricultural sector or generation of purchasing power in agricultural sector could hold

Figure 6.3C: TFGP in Organised Manufacturing Sector and Growth Rate of Electricity Consumption (ECg)



the key to increase in TFPG of manufacturing sector. However, it is also possible to argue that it is not the proportion of population in agriculture, but the income generated in agricultural sector, that is consequential to demand and in boosting growth of manufacturing sector. In view of the fact that agricultural sector's share in national income has declined over the years, manufacturing sector is more likely to find its buyers from services and manufacturing sectors rather than from agricultural sector.

In Figure 6.3D, we present the time-path of agricultural growth rate (Ag) and that of TFPG in organised manufacturing sector. Here as well, a discernible correlation between the two variable seems to be elusive.

It is very often hypothesised that increasing compulsions to compete in the global market could provide an impetus to improvement in productivity. In view of this, one may find a positive correlation between exports growth (EXg) and TFPG. Given the predominance of manufactured exports in India's merchandise exports, we provide a synoptic view of the relationship between TFPG and EXg (measured as per cent change over the previous year in exports in million US $) in Figure 6.3E.

Figure 6.3D: Agricultural Growth Rate (Ag) and TFPG in Organised Manufacturing Sector

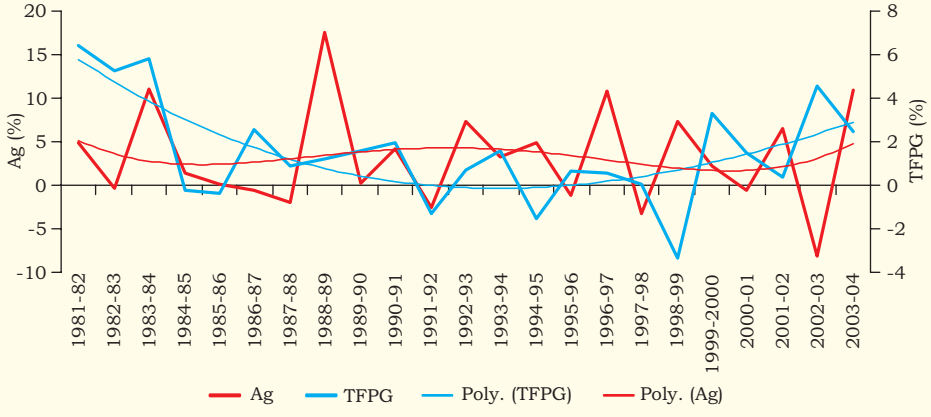
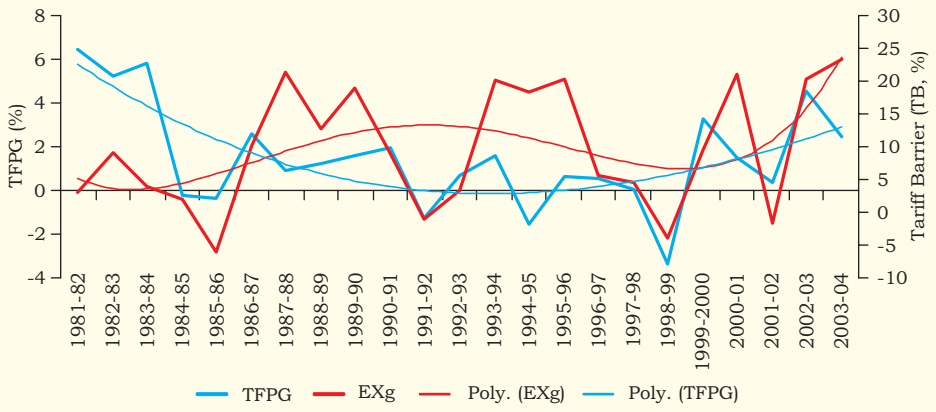


Figure 6.3E: TFPG in Organised Manufacturing Sector and Growth Rate of Exports(EXg)



In order to examine the impact of above-mentioned factors on TFPG, we have regressed the annual TFPG of the organised manufacturing sector on growth rate of agriculture (Ag), growth rate of electricity consumption (ECg). Trade Barriers (TB), rate of growth of exports (EXg) and real gross capital formation (RGCF,t-t3, average of current and the previous three years, so as to allow for gestation period). We also attempted several combinations of the explanatory variables and we report the empirical estimates of the best regression equation (with robust standard errors) in Table 6.3.

Table 6.3: Determinants of TFPG of Organised Manufacturing Sector (1980-81 to 2003-04)

Explanatory Variable	Coefficient	Std. Error	t-statistics	Level of Significance
TB	-0.11486	0.04185	-2.74	0.013
RGCF,t-t3	-0.00005	0.00002	-2.50	0.022
EXg	0.07223	0.04153	1.74	0.098
Constant	9.19478	3.17709	2.89	0.009

Number of observations = 23 R-squared =0. 0.3757
Durbin-Watson d-statistic(4, 23) = 1.71
F(3, 19)= 2.83 Prob > F = 0.0660
Root MSE = 2.011

It can be seen from Table 6.3 that TFPG of manufacturing sector is negatively related to the trade barriers which implies that declining trade barriers have had a positive impact on TFPG. The coefficient of RGCF,t-t3 is negative and statistically significant. The impact of investment is rather difficult to model due to the problem of identification of appropriate lags. As regards the growth of agricultural income (Ag), it does not emerge as a significant explanatory variable for TFPG of organised manufacturing sector. This should not be interpreted as though it does not matter for the growth of total manufacturing sector. It may be kept in mind that due to data limitations, we have excluded unorganised manufacturing sector from the analysis on determinants of TFPG. Moreover, even if Ag is not very crucial for increasing TFPG of manufacturing sector, its role in providing demand for manufacturing sector cannot be denied, as it holds the key to growth with equity. As regards electricity consumption growth and its relationship with TFPG, we find that it is highly correlated with the real gross capital formation and hence, we retained the RGCF, t-t3 variable and dropped ECg in the final regression result.

6.4: Competitiveness and Productivity: An Inter-State Perspective

The recent data on the components of competitiveness that are available state-wise have been reported in Table 6.4. Competitiveness of a state is suppose to depend upon the various characteristics, such as, Factor conditions (FC), Demand conditions (DC), Strategic context (SC), Supporting conditions (SP) and their components. We use the overall score for the state and try to examine if there is any systematic relationship between the competitiveness of a state and the productivity of its organised manufacturing sector.

In Table 6.5 we provide an overview of the empirical results of TFPG, Competitivenss Scores (CS) and the various charactersitics of states identified in the literature, including the investment climate (IC) rank and category.

Table 6.4: Competitiveness of Various States of India

State	State	Factor conditions (FC)					Demand conditions (DC)					Strategic context (SC)			Supporting conditions (SP)		
	Overall Score	FC Score	Financial	Physical	Communication	Administrative	DC Score	Human capacity	Innovation	Demographics	Income & consumption	SC Score	CI & diversity firms	Business incentives	SP Score	Supplier sophistication	Institutional support
AP	52.70	45.82	61.63	55.43	61.40	-25.40	57.86	64.05	48.53	72.35	54.23	49.73	65.25	26.45	61.25	64.44	59.12
BIH*	45.14	40.38	51.92	50.77	46.97	-22.32	52.20	58.91	46.41	64.30	49.17	38.40	51.42	18.88	51.37	51.00	51.61
DEL	56.96	56.00	50.95	83.64	104.40	-9.59	77.27	49.40	50.18	53.78	83.14	43.86	53.90	28.81	46.33	51.01	43.21
GUJ	55.01	47.94	58.27	59.01	64.38	-15.42	61.02	62.56	50.30	62.91	60.55	51.98	70.89	23.60	62.90	72.17	56.72
HAR	52.23	44.93	61.70	58.77	61.00	-31.76	59.81	59.69	50.62	51.82	61.81	48.56	63.31	26.44	59.20	65.63	54.92
KAR	53.04	46.05	56.98	56.34	68.14	-22.87	59.71	59.59	50.19	63.84	58.68	49.74	62.82	30.12	60.21	66.59	55.95
KER	50.20	45.61	60.97	50.89	75.23	-20.81	55.86	49.03	55.44	56.73	55.64	46.85	62.20	23.82	54.52	58.04	52.18
MAH	58.38	48.55	59.91	59.91	68.27	-24.73	69.49	66.42	51.77	79.62	64.46	56.32	69.94	35.89	66.24	68.41	64.79
MP*	47.68	43.05	55.62	52.65	52.47	-26.11	54.72	63.18	50.55	60.97	53.16	39.60	52.87	19.69	55.04	52.64	56.64
ORI	46.69	44.28	54.49	53.43	50.67	-19.46	51.37	65.95	50.30	57.73	49.78	38.85	51.49	19.88	52.93	51.88	53.62
PUN	53.82	48.47	58.26	65.65	73.67	-19.84	60.18	54.72	50.55	53.27	61.90	52.68	68.89	28.36	56.40	62.37	52.42
RAJ	49.11	44.57	53.65	52.53	56.67	-22.96	58.68	67.95	49.16	63.57	57.45	40.59	54.20	20.17	53.60	53.78	53.47
TN	57.16	48.81	61.93	59.66	70.38	-19.39	59.36	61.06	51.53	68.42	57.10	59.36	76.24	34.43	66.65	76.15	60.31
UP*	50.57	45.74	52.96	53.69	51.10	-27.67	62.44	82.04	47.56	95.42	54.18	40.20	53.60	20.10	54.56	54.18	54.82
WB	49.09	44.10	56.03	54.16	53.49	-20.67	57.91	62.69	49.35	73.60	53.99	41.45	54.92	21.23	54.45	55.20	53.95

Source: http://www.competitiveness.org/article/articleview/1020/1/10/

Table 6.5:Competitiveness and Productivity: An Inter-State Perspective

State	CS	TFPG (GAA)	TFPG (PFA)	Geographical Characteristic	Labour Regime	IC Rank and Category		
						Rank		Category
						2009	2002	
AP	52.70	1.41	1.84	C	EF	4	4	G
BIH*	45.14	1.55	-0.52	L	N	13	14	NC
DEL	56.96	1.04	1.09	L	–	8	2	B
GUJ	55.01	0.78	1.45	C	WF	3	3	G
HAR	52.23	1.33	0.86	L	N	5	8	G
KAR	53.04	1.05	1.98	C	EF	1	5	G
KER	50.20	1.36	1.89	C	EF	2	10	P
MAH	58.38	0.88	2.44	C	WF	7	1	B
MP*	47.68	1.37	1.65	L	EF	13	9	P
ORI	46.69	1.27	1.2	C	WF	12	17	NC
PUN	53.82	0.79	1.41	L	N	10	6	G
RAJ	49.11	1.43	1.93	L	EF	16	16	NC
TN	57.16	0.65	2.11	C	EF	9	7	G
UP*	50.57	0.94	1.44	L	N	15	12	P
WB	49.09	1.05	1.12	C	WF	6	11	P

Note: Sources mentioned in Table 3.5.

It can be seen from Table 6.5 that Maharashtra and Tamil Nadu top the list of CS and Bihar is at the bottom of this list. This correlates better with the TFPG obtained by PFA approach rather than by GAA approach. Maharashtra and TN are coastal state with best and good investment climate, respectively and Bihar* is a land-locked state. Maharashtra and TN had a worker friendly environment. Correlation between competitivenss score and TFPG obtained by PFA is about 0.55. The correlation between TFPG obtained by the GAA and competitivness score is about -0.73. In other words, we could not find a neat relationship between competitivenss scores of states and TFPG, as the latter themselves are sensitive to the methodology used in its estimation.

6.5 *Conclusions and Implications for Policy*

The study notes that the estimates of productivity are sensitive to the methodology used, even if the dataset used reamains the same. In view of this, the alternative methodologies can provide the range within which the estimates of productivity could be expected to lie. In this study, we obtained the range of TFPG (1980-81 to 2003-04) for organised manufacturing sector as a whole, between 0.92 and 1.81 pcpa, from GAA and PFA methods respectively, yielding the contribution of TFPG to output growth ranging from about 13 per cent to 25 per cent.

We also note that it is not only the TFPG differentials across states that are starking, but also growth performance of states have been quite varied. State like Bihar* and West Bengal have shown very poor performance in terms of both growth of output and employment in the organised maufacturing sector. Given the fact that economically poorer states have a larger proportion of unorganised labour in their manufacturing sector and that the labor productivity in the unorganised manufactuing sector in 2000-01 was about 1/14th of that in the organised manufacturing sector, regionally balanced development is the need of the hour. This is particularly needed for manufacturing sector, as it can generate employment for skilled, semi-skilled and non-skilled workers.

As regards industries, FBT and Textiles industries have displayed a poorer performance in terms of growth, productivity and also employment generation. The major problems faced by the agro-processing units are[36]: (a) low capacity utilisation; (b) poor recovery of the finished product from the raw materials; (c) problems of inadequate working capital and its management; (d) low product quality; and, (e) unreliable assured power supply. The Ministry of Food Processing Industries, Government of India[37] is also aware of the problems facing this sector, which are identified as

[36] It may be mentioned here that the food processing industry is closely linked to the food manufacturing. For the problems faced by the agro-processing industries, see Kachru (undated).

[37] Reported at http://mospi.nic.in/ContentPage.aspx?CategoryId=122

follows: (i) poor infrastructure in terms of cold storage, warehousing, *etc.*; (ii) inadequate quality control and testing infrastructure; (iii) inefficient supply chain and involvement of middlemen; (iv) high transportation and inventory carrying cost; (v) affordability, cultural and regional preference of fresh food; (vi) high taxation; and, (vii) high packaging cost.

As regards the bottlenecks to better performance of textiles industry identified[38] are: i) structural weaknesses in weaving and processing; ii) fragmented and technologically backward textile processing sector; iii) fragmented garment industry; iv) rigid labour laws; v) inadequate capacity of the domestic textile machinery manufacturing sector; vi) inadequate training facilities in textile sector; and, vii) infrastructural bottlenecks in terms of power, utility, road transport, *etc.*

The problems confronted by the Chemical industry in India are[39]: (a) high prices of basic feed stock; (b) SSI reservation/fragmented nature of industry; (c) low R&D levels; (d) low level of infrastructure; (e) low level of ICT interface; (f) environmental regulations; (g) low level of brand development; and (h) dumping/import competition.

As against these industries, metal industry has performed rather well. Some of the reasons for this are that in the post-reform period, this industry seems to have benefitted due to the backward linkages it has with other industries/sectors. Booming automobile industry in India has provided the metal industry the demand linkage and growing interest of global players in automobile industry is also related to the better performance of metal industry. Besides this, the growth of infrastructure and construction sector in India in the recent years seemed to have provided the metal industry the much needed impetus for its growth. Privatization and globalization of metal industry also seems to be related to its better performance in the post-reform era.

[38] Government of India (2006), Report of the Working Group on Textiles & Jute Industry, Ministry of Textiles.

[39] Export-Import Bank of India (2007).

As regards the TFPG in the organised manufacturing is concerned, we do find the post-reform period has witnessed deceleration in TFPG in all the industries (except metal) in many states. However, the post 1990s decade does present evidence of rising TFP indices and revival of TFPG, except metal industry. Hashim et al (2009) interprete it as an evidence of 'J-curve' effect' of the reforms. We also wish to state that though TFPG has not increased during the post-reform period, it does not mean that reforms have caused this. Certainly, the dynamics of the global and domestic markets have played a crucial role in influencing the industry and regional performance. We also have 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. Further,we cannot rule out the impact of other determinants of TFPG at industry and state levels even if we are unable to link them at aggregate levels. Though reforms may have provided the broad liberalised policy framework, the reforms dealing with micro-foundations for each industry are yet to be formulated and implemented.

Regarding the sustainability of growth of manufacturing sector, two factors seem to be the causes for concern. First is the high resource intensity mantufacturing sector and the second is the intra-sectoral disparity, between organised and unorganised segments of the manufacturing sector, that seems to be getting more widened. On the whole, it is the supply constraint, in the form of technological upgradation, organisational and institutional constraints that seems to be the problem with the Indian manufacturing sector rather than the demand constraint emanating from low growth of agricultural sector, especially for organised manufacturing sector. Atomistic markets, such as, food industry, leather, chemical and textiles are in need of institutional mechanisms, which will provide them with key inputs including technology for their improved performance.

As regards the empirical evidence emerging from the use of micro level data, we would like to exercise much caution in interpretation of the

results emanating from the ASI unit level data, due to the problems associated with compilation of series on capital stock for each of these units. The empirical results, therefore, need to be interpreted with much caution in light of data and methodlogical limitations. However, the RBI company level data provides us with rather convincing results. The mean efficiency levels estimated by SFPF display more variation across industries as compared to those computed by using the DEA. Food & Beverages and Textiles industry show the maximum inefficiency which is also corroborated with the TFPG estimates obtained by the growth accounting estimates for the organised segment of this industry and also measured by the Malmquist index. These are the industries where unorganised sector predominates in terms of employment. Thus, if the welfare of the masses is to be improved, it is necessary to make these industries globally competitive and this may also take care of the unbalanced regional development of the states.

Annexure 4.1: Selected Industries and their National Industrial Classification (NIC) Codes

Industry (Code as per NIC-1970)	Industry (Code as per NIC-1987)	Industry (Code as per NIC-1998)
1. Chemical and chemical products a) Manufacture of Chemical and Chemical Products, except Products of Petroleum and Coal (31)	**1. Chemical and chemical products** a) Manufacture of Basic Chemical and Chemical Products, except Products of Petroleum and Coal (30)	**1. Chemical and chemical products** a) Manufacture of basic chemical (241) b) Manufacture of other chemical product (242)
2. Food, Beverages and Tobacco a) Manufacture of Food Products (20-21) b) Manufacture of Beverages, Tobacco and Tobacco Products (22)	**2. Food, Beverages and Tobacco** a) Manufacture of food products (20) b) Manufacture of other food products (21) c) Manufacture of beverages, tobacco and related Products(22)	**2. Food, Beverages and Tobacco** a) Manufacture of food products and beverages (15) b) Manufacture of tobacco products (16)
3. Leather and leather products a) Manufacture of Leather and Leather and Fur Products, except repair (29)	**3. Leather and leather products** a) Manufacture of Leather and Products of Leather, Fur & Substitutes of Leather (29)	**3. Leather and leather products** a) Tanning and dressing of leather, manufacture of luggage handbags, saddlery & harness (191) b) Manufacture of footwear (192)
4. Metal and metal products a) Basic Metal and Alloys Industries (33) b) Manufacture of Metal Products and Parts except Machinery and Transport Equipment (34)	**4. Metal and metal products** a) Basic Metal and Alloys Industries (33) b) Manufacture of Metal Products and Parts except Machinery and Transport Equipment (34)	**4. Metal and metal products** a) Manufacture of basic iron and metal (271)b) Manufacture of basic precious and non-ferrous metals (272) c) Casting of metals (273) d) Manufacture of structural metal products, tanks, reservoirs and steam generators (281) d) Manufacture of other fabricated metal products; metal working service activities (289)

Annexure 4.1: Selected Industries and their National Industrial Classification (NIC) Codes *(contd.)*

Industry (Code as per NIC-1970)	Industry (Code as per NIC-1987)	Industry (Code as per NIC-1998)
5. Machinery and transport equipment	**5. Machinery and transport equipment**	**5. Machinery and transport equipment**
a) Manufacture of Machinery, Machine Tools and Parts, except Electrical Machinery (35)	a) Manufacture of Machinery and Equipment Other Than Transport Equipment (35-36)	a) Manufacture of general purpose machinery (291)
b) Manufacture of Electrical Machinery, Apparatus, Appliances and Supplies and Parts (36)	b) Manufacture of Transport Equipment and Parts (37)	b) Manufacture of special purpose machinery (292)
c) Manufacture of Transport Equipment and Parts (37)		c) Manufacture of domestic appliances, n.e.c.(293)
		d) Manufacture of office, accounting and computing machinery (300)
		e) Manufacture of electric motors, generators and transformer (311)
		f) Manufacture of electricity distribution and control apparatus, *etc.* (312)
		g) Manufacture of insulated wire and cable, *etc.* (313)
		h) Manufacture of accumulators, primary cells and primary batterie (314)
		i) Manufacture of electric lamps and lighting equipment (315)
		j) Manufacture of other electrical equipment n.e.c (319)
		k) Manufacture of electronic valves and tubes and other electronic component (321)
		l) Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy (322)
		m) Manufacture of television and radio receivers, sound or video recording or reproducing apparatus, and associated good (323)
		n) Manufacture of medical appliances and instruments and appliances for measuring, checking, testing, navigating and other purposes except optical instruments (331)
		o) Manufacture of optical instruments and photographic equipment (332)

Annexure 4.1: Selected Industries and their National Industrial Classification (NIC) Codes *(concld.)*

Industry (Code as per NIC-1970)	Industry (Code as per NIC-1987)	Industry (Code as per NIC-1998)
		p) Manufacture of watches and clock (333) q) Manufacture of motor vehicle (341) r) Manufacture of bodies (coach work) for motor vehicles; manufacture of trailers and semi-trailer (342) s) Manufacture of parts and accessories for motor vehicles and their engines , *etc.* (343) t) Building and repair of ships & boat (351) u) Manufacture of railway and tramway locomotives and rolling stock (352) v) Manufacture of aircraft and spacecraft (353) w) Manufacture of transport equipment n.e.c. (359)
6. Textiles and textile products a) Manufacture of Cotton Textiles (23) b) Manufacture of Wool, Silk and Synthetic Fibres (24) c) Manufacture of Jute, Hemp and Mesta textiles (25) d) Manufacture of Textile Products (26)	**6. Textiles and textile products** a) Manufacture of Cotton Textiles (23) b) Manufacture of Wool, Silk and Man-made Fibre Textiles (24) c) Manufacture of Jute and Other Vegetable Fibre Textiles, Except Cotton (25) d) Manufacture of Textile Products (26)	**6. Textiles and textile products** a) Spinning, weaving and finishing of textiles (171) b) Manufacture of other textiles (172) c) Manufacture of knitted and crocheted fabrics and articles (173) d) Manufacture of wearing apparel except fur apparel (181)

Source: Annual Survey of Industries, various issues.

Annexure 4.2: Commodity/ Industry Codes as Specified in Input-Output (I-O) Tables

Industry/Industry Group	Commodity/Industry Code in I-O Absorption Matrix		
	1978-79 and 1983-84	1989-90, 1993-94 and 1998-99	2003-04 and 2006-07
1. Chemicals and chemical products	28-32	60-68	66 - 73
2. Food, Beverages and Tobacco	12-15	18, 20, 33-40	38 - 45
3. Leather and leather products	24	54-55	59-60
4. Metal and metal products	35-37	72-77	77- 80
5. Machinery and transport equipment	38-43	78-96	81-105
6. Textile and textile products	16-19	41-49	46- 54
Manufacturing	12-44	18, 20, 33-98	38-106

Source: Central Statistical Office, Ministry of Statistics and Programme Implementation, Government of India.

Annexure 4.3: Estimation of Capital Stock Series for ASI Industry-State Level Data

The measurement of capital stock has been a controversial issue both in theoretical and in empirical literature. There is no universally accepted method for its measurement and several methodologies are used in estimation of capital stock. We have used the Perpetual Inventory Accumulation Method (PIAM) for generating the series on capital stock. The PIAM requires the estimates of capital stock for a benchmark year and investment in the subsequent years. This method has been followed by other researchers as well ((Ahluwalia [1991] and Balakrishnan and Pushpangadan [1994]) The time-series on capital stock at current prices has been generated by using equations (A.1).

$$K_t = K_0 + \sum_{i=1}^{t} I_i \qquad \text{(A4.1)}$$

Notations used in these equations are as follows. I is the net fixed capital formation. K is the stock of capital at current prices. Subscript't' has been used to denote time. Data on fixed capital stock available in ASI is the historical data on book value and it is inappropriate to use this data as it does not reflect the replacement cost. In order to circumvent this problem, we have used the data on capital stock for 1980-81 (from CSO, 1990). The proportion of capital stock for each state has been obtained from the ASI fixed capital and then these proportions have been applied to the CSO data on capital stock. The assumption of proportionality was further extended for apportioning the state level capital stock estimates to the industry level capital stock. Though we recognise that this involves the assumption of proportionality which is not easy to check with the reality, any other method of constructing capital stock series at disaggregated industry levels for each state would have also involved some rules of thumb in the absence of appropriate data.

Capital stock for each of the industry in the subsequent years has been arrived at by adding the net fixed capital formation figures to the stock of capital of the previous year (using equation A4.1). In a few cases, such as metal industry in Andhra Pradesh, leather industry in Gujarat and Rajasthan, we had to use gross fixed capital formation/gross capital formation, as the data on negative figures on net fixed capital formation were so high that even after adding them to the stock of capital of the previous years, these yielded negative signs for the stock of capital. As it is not possible to obtain the logarithm of negative numbers, we could not use the data on net fixed capital formation in these cases and hence, gross investment figures have been used only for the above-mentioned cases.

The stock of nominal capital series so obtained has then been deflated by the investment deflator series. Investment deflator series has been obtained by deflating the series on gross capital formation at current prices by the gross capital formation at 1993-94 prices which is published by the CSO. The base of this series has then been shifted arithmetically to 1981-82. This was to retain the consistency of a single base year for all the price indices.

Annexure 4.4: RBI Data on Company Finances

The disaggregated annual data is culled out from the audited annual accounts of non-Government non-financial public limited companies by the Reserve Bank of India to study the finances of these companies form the base data. For the purpose of this study, data on companies engaged in manufacturing activity have been selected. A balanced panel data of 449 companies for 12 years period starting from 1993-94 to 2004-05 have been taken for the purpose of the present study. To have comparable data for all the years, the data on companies, which have undergone mergers and acquisitions during the period under study have been excluded from the sample. Six industries are selected for the purpose of the industry-wise study. A company is classified into a particular industry, if it has earned more than 51 per cent income from that particular activity in 2004-05. The industries (with number of companies) selected for the purpose of the industry-wise study are Machinery and transport equipments (116 companies), Chemicals and chemical products (78 companies), Food and Beverages (60 companies), Textiles and textile products (53 companies) and Metals and metal products (47 companies).

Variables used

Inputs: The input cost is measured as the material input (including raw material and components consumed, stores and spares consumed, power and fuel and other manufacturing expenses) and the cost of non-industrial services (like royalty, technical know-how, selling commission, small repairing work of buildings and machinery, advertisement expenses, insurance expenses, auditor's remuneration and other expenses). However, the cost of machinery (i.e., depreciation provision), cost of borrowing (i.e., interest payments), dividend payments, rent and tax payments have been excluded. Indices for inputs specific to selected industry were derived using the input-output table for the purpose of calculating real input.

Output: Output is measured as the value of the output of the industry during the year. For calculating real output, WPI indices (Base 1993-94 = 100) were used for the specific industries.

Labour Cost (Wages): Wages comprises remuneration paid to the employees in the form of salaries/ wages, bonus, provident fund, employees' welfare expenses and managerial remunerations.

Number of employees: The number of employees is estimated using the ASI data. The per capita remuneration in each industry was derived from the ASI data and applied to this dataset for want of any other better proxy for the same.

Capital Stock (at replacement cost) in the base year: It may be noted that the capital stock reported in the annual accounts are generally at book value at historic costs. While there may be cases where the capital stocks are reported in the books after proper valuation, not all the assets are re-valued by the companies in each year. Thus, base year capital stock needs to be adjusted to get it at the replacement cost. We have adopted the method given by Srivastava (2000). It is assumed that no firm has any capital in the base year (1993-94) of the vintage earlier than 1980-81. For companies incorporated after 1980-81, it is assumed that the earliest vintage of capital in their capital mix dates to the year of incorporation. Further, it is assumed that the price of capital has changed at a constant rate and the investment has increased at a constant rate for all companies from 1980-81 or the date of incorporation of the firm (whichever is later) up to 1993-94 (initial year in the study). National Accounts data series on gross fixed capital formation at current prices and at constant prices (Base year 1999-2000) are used for calculating this constant rate of growth in prices and investments. The annual growth rates of prices are obtained from the price deflators for gross fixed capital formation and the annual growth rates for

Annexure 4.4: RBI Data on Company Finances *(Concld.)*

investment are obtained from the gross fixed capital formation at constant prices series. The constant rate of growth is calculated as the averages of annual growth rates for the period 1980-81 to 1993-94 for companies having year of incorporation 1980 or before. For companies incorporated after 1980-81, the average growth rate from the year of incorporation to 1993-94 are used as the constant growth rate for all such companies. If average annual growth in investment and prices for a firm are denoted by GI and GPR, then the capital stock in the base year at replacement cost is calculated as [((1+GI)*(1+GPR)-1)/(GI*(1+GPR))]*[Capital stock at book value at historic cost].

Average Depreciation Rate: The average depreciation rate (DELTA) has been calculated separately for each of the selected industry using the information contained in the data. It is assumed that all firm's capital stock has useful life (Lt) at the time t, companies use straight line depreciation and depreciation rate is 2/Lt (Salinger and Summers, 1981). The useful life Lt at time t is calculated as (Total gross fixed asset (stock) at time t)/ (Accumulated Depreciation up to time t – Accumulated depreciation till time t-1). As our data starts from 1993-94 onwards, useful life of gross fixed assets (stock) was obtained for the period from 1994-95 to 2004-05. The arithmetic average of Lt (for t from 1994-95 to 2004-05) (say L) was used to calculate the average depreciation rate DELTA (=2/L). It is assumed that this depreciation rate was same for all the companies in the industry and it remained constant for the whole period under study.

Gross Fixed Capital Formation: The gross fixed capital formation in a particular year is calculated as the increase in capital stock during the year at book value, adjusted for revaluation/ devaluation of asset during the year, if any.

Capital Stock in the current year (subsequent to base year) is obtained as [(Capital stock in the previous year)*(1-DELTA)*(Change in the price during the year) + (Gross Fixed Capital Formation during the year)].

Annexure 4.5: Decomposition of Malmquist Index of Productivity Change

The following elaboration is based on Figure 4.3. It show how π_A Δ can be decomposed as follows, *i.e.*, TFP Δ = Technical Efficiency Δ (Catching up Effect) × Technical Δ (Frontier Effect). The efficiency Δ component is equivalent to the ratio of the Farrell technical efficiency in period '1' to the Farrell technical efficiency in period '0', under the constant returns to scale. This efficiency Δ component can be separated into a scale efficiency and pure technical efficiency Δ. The pure technical efficiency is obtained by re-computing efficiency change under the variable returns to scale. The scale efficiency therefore is the ratio of efficiency under the constant returns to scale and the same efficiency under variable returns to scale.

$$\pi_A = \frac{\frac{A_1X_1}{P_1X_1}}{\frac{A_0X_0}{P_0X_0}} = \frac{D_C^1(X_1, O_A^1)}{D_C^0(X_0, O_A^0)} \qquad \text{(A4.5.1)}$$

$$\pi_A = \frac{\frac{A_1X_1}{T_1X_1}\frac{T_1X_1}{P_1X_1}}{\frac{A_0X_0}{T_0X_0}\frac{T_0X_0}{P_0X_0}} = \frac{\frac{A_1X_1}{U_1X_1}\frac{U_1X_1}{T_1X_1}\frac{T_1X_1}{P_1X_1}}{\frac{A_0X_0}{T_0X_0}\frac{T_0X_0}{P_0X_0}} \qquad \text{(A4.5.2)}$$

$$\pi_A = \frac{\frac{A_1X_1}{U_1X_1}\frac{U_1X_1}{Q_1X_1}}{\frac{A_0X_0}{U_0X_0}\frac{U_0X_0}{Q_0X_0}} = \frac{\frac{A_1X_1}{U_1X_1}\frac{U_1X_1}{Q_1X_1}}{\frac{A_0X_0}{T_0X_0}\frac{T_0X_0}{U_0X_0}\frac{U_0X_0}{Q_0X_0}} \qquad \text{(A4.5.3)}$$

$\sqrt{\pi_A \times \pi_A} = \pi_A$ i.e. geometric mean of (A4.5.2) and (A4.5.3) which yields (A4.5.4).

$$\pi_A = \sqrt{\left[\frac{\frac{A_1X_1}{U_1X_1}}{\frac{A_0X_0}{T_0X_0}}\right]\cdot\left[\frac{U_1X_1}{T_1X_1}\cdot\frac{U_0X_0}{T_0X_0}\right]\cdot\left[\frac{\frac{T_1X_1}{P_1X_1}}{\frac{T_0X_0}{P_0X_0}}\times\frac{\frac{U_1X_1}{Q_1X_1}}{\frac{U_0X_0}{Q_0X_0}}\right]} \qquad \text{(A4.5.4)}$$

The components of equation A4.5.4 signify the following.

$$\text{Technical Efficiency } \Delta = \left[\frac{\frac{A_1X_1}{U_1X_1}}{\frac{A_0X_0}{T_0X_0}}\right] = \frac{D^1(X_1, O_A^1)}{D^0(X_0, O_A^0)}$$

$$\text{Technical } \Delta \text{ in relation to VRS} = \left[\frac{U_1X_1}{T_1X_1}\cdot\frac{U_0X_0}{T_0X_0}\right] = \frac{D^0(X_0, O_A^0)}{D^1(X_0, O_A^0)}\frac{D^0(X_1, O_A^1)}{D^1(X_0, O_A^1)}$$

$$\text{Scale } \Delta \text{ w.r.t. CRS} = \sqrt{\left[\frac{\frac{T_1X_1}{P_1X_1}}{\frac{T_0X_0}{P_0X_0}}\times\frac{\frac{U_1X_1}{Q_1X_1}}{\frac{U_0X_0}{Q_0X_0}}\right]}$$

Annexure 6.1: Output Growth in India's Organised Manufacturing Sector and its Component Industries (Reform Period Classfication 1)

State/ Country	CHEM			FBT			LEATH			METAL			MTE			TEX			MFG		
	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II
AP	7.4	7.6	10.2	8.6	5.4	7.1	22.3	-4.4	3.5	13.0	7.0	12.0	8.0	6.6	5.6	8.8	-0.1	5.8	9.8	8.0	8.8
BIH*	6.0	-6.7	0.3	5.3	2.8	4.6	1.0	0.4	0.9	5.7	2.9	4.3	4.5	2.4	2.7	2.0	-4.9	-2.2	6.0	3.6	3.7
DEL	10.5	-4.0	4.1	5.5	5.1	4.0	21.3	11.5	20.7	3.2	0.5	2.4	8.0	1.0	1.1	10.8	3.1	9.1	7.9	3.5	6.2
GUJ	11.7	10.2	11.1	6.5	6.7	6.6	n.a.	n.a.	n.a.	6.8	6.7	9.3	10.2	7.0	9.0	2.7	5.1	3.8	4.8	12.4	8.6
HR	11.0	0.2	4.9	12.4	4.6	8.3	17.0	23.6	19.5	2.1	11.3	6.9	9.5	13.0	9.4	2.4	9.1	8.9	9.6	10.5	9.9
KAR	7.8	9.6	8.1	8.2	8.0	7.8	36.9	-2.3	13.8	3.8	9.2	7.6	10.4	8.5	10.3	7.6	6.6	10.0	8.7	10.0	9.5
KER	6.4	1.8	3.7	6.5	6.9	7.4	n.a.	n.a.	n.a.	4.8	8.6	6.0	5.5	7.1	6.3	3.1	5.0	4.8	4.9	8.2	6.8
MAH	8.6	3.1	6.5	6.9	7.0	7.1	13.5	-0.7	5.6	4.7	5.2	5.9	7.1	6.5	7.4	4.0	0.9	3.0	6.9	6.8	6.9
MP*	10.3	4.7	8.7	13.7	7.1	11.5	14.8	10.7	9.5	6.7	6.1	6.2	12.0	5.7	8.4	6.2	6.7	7.7	11.1	6.6	8.8
OR	28.6	15.5	28.5	4.9	11.7	10.6	n.a.	n.a.	n.a.	7.9	3.2	5.5	10.5	1.1	3.5	13.4	-12.3	-1.7	10.4	3.5	6.5
PU	18.8	17.9	15.4	10.0	4.2	5.6	9.7	17.1	13.1	5.1	4.3	5.7	10.3	4.7	8.3	9.6	3.4	6.8	10.2	3.1	6.0
RJ	10.2	13.6	9.7	8.4	8.7	9.2	16.2	-2.4	10.3	7.6	5.0	6.7	7.7	5.9	6.8	9.0	3.8	8.7	10.7	7.6	9.0
TN	6.3	3.7	6.0	6.6	5.5	6.3	8.5	3.9	7.8	4.8	9.6	8.2	8.0	8.1	7.5	9.3	9.5	10.4	7.3	6.8	8.0
UP*	15.0	3.6	9.5	10.0	5.2	7.1	10.7	10.3	9.9	8.3	6.3	7.1	12.2	9.3	10.3	6.2	3.2	5.1	12.2	5.6	7.4
WB	6.0	6.7	5.2	4.5	5.8	4.3	3.2	8.5	5.7	-0.5	5.4	3.1	0.6	-0.5	1.0	0.7	3.3	2.0	2.3	5.2	3.4
All India	9.4	6.5	8.4	8.0	5.6	6.7	9.5	7.3	9.1	5.4	6.3	6.5	8.1	8.2	8.2	6.3	4.5	6.3	7.9	6.6	7.3

Annexure 6.2: Output Growth in India's Organised Manufacturing Sector and its Component Industries (Reform Period Classfication 2)

State/ Country	CHEM			FBT			LEATH			METAL			MTE			TEX			MFG		
	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II
AP	8.1	6.4	10.2	8.7	5.4	7.1	19.8	-4.2	3.5	13.6	6.1	12.0	6.6	6.2	5.6	8.6	-1.7	5.8	9.6	7.8	8.8
BIH*	7.8	-5.7	0.3	5.5	2.6	4.6	1.6	0.9	0.9	5.5	2.6	4.3	4.1	2.5	2.7	1.1	-5.6	-2.2	5.7	3.9	3.7
DEL	11.0	-4.5	4.1	5.4	5.8	4.0	23.3	10.4	20.7	3.9	0.9	2.4	5.5	0.5	1.1	11.7	2.4	9.1	8.3	3.5	6.2
GUJ	11.1	9.4	11.1	6.3	6.5	6.6	n.a.	n.a.	n.a.	8.2	6.5	9.3	9.9	6.3	9.0	2.2	4.7	3.8	4.9	12.7	8.6
HR	10.6	-0.1	4.9	12.3	4.4	8.3	16.1	23.1	19.5	2.4	11.6	6.9	9.8	14.9	9.4	3.7	8.6	8.9	9.3	10.2	9.9
KAR	8.3	10.6	8.1	8.1	8.1	7.8	33.8	-4.6	13.8	4.6	9.5	7.6	11.0	8.5	10.3	8.9	6.0	10.0	9.1	10.4	9.5
KER	6.4	2.0	3.7	6.8	6.8	7.4	n.a.	n.a.	n.a.	6.2	10.9	6.0	5.1	6.7	6.3	3.1	4.5	4.8	5.4	8.7	6.8
MAH	8.2	2.1	6.5	6.7	6.7	7.1	11.7	-2.4	5.6	4.5	4.2	5.9	6.5	5.4	7.4	3.7	0.0	3.0	6.4	6.1	6.9
MP*	10.6	4.1	8.7	15.0	7.6	11.5	13.4	11.4	9.5	3.8	2.9	6.2	11.6	5.4	8.4	6.8	6.6	7.7	10.4	5.8	8.8
OR	30.9	13.1	28.5	6.0	11.5	10.6	n.a.	n.a.	n.a.	8.2	3.5	5.5	10.2	2.0	3.5	12.5	-12.7	-1.7	10.6	3.8	6.5
PU	18.2	19.3	15.4	8.6	3.5	5.6	8.9	16.4	13.1	5.5	4.1	5.7	10.7	4.6	8.3	9.9	3.4	6.8	9.7	2.9	6.0
RJ	9.1	14.0	9.7	8.4	8.1	9.2	21.8	0.1	10.3	7.9	5.0	6.7	7.5	5.6	6.8	10.4	3.6	8.7	10.5	7.4	9.0
TN	6.7	3.5	6.0	6.6	5.2	6.3	8.9	3.2	7.8	5.6	9.9	8.2	7.6	8.1	7.5	9.3	8.9	10.4	7.3	6.5	8.0
UP*	15.6	3.7	9.5	9.8	5.1	7.1	10.2	10.2	9.9	8.9	7.0	7.1	11.9	9.3	10.3	6.5	3.1	5.1	11.6	5.4	7.4
WB	6.1	7.7	5.2	3.8	5.6	4.3	2.8	8.1	5.7	0.1	5.8	3.1	0.8	-0.9	1.0	0.6	3.2	2.0	2.2	5.3	3.4
All India	9.4	6.2	8.4	7.9	5.5	6.7	9.4	6.6	9.1	5.5	5.9	6.5	7.8	7.8	8.2	6.4	4.0	6.3	7.7	6.2	7.3

Annexure 6.3: Employment Growth in India's Organised Manufacturing Sector and its Component Industries (Reform Period Classfication 1)

State/ Country	CHEM			FBT			LEATH			METAL			MTE			TEX			MFG		
	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II
AP	-0.9	4.9	3.3	0.6	0.1	1.8	14.3	-6.6	1.2	8.1	-2.7	4.4	0.8	0.1	0.6	0.4	-3.6	-0.7	1.4	0.8	2.1
BIH*	-1.7	-6.4	-3.7	-7.1	-1.3	-0.9	-0.4	-1.3	-1.6	2.6	-3.3	-1.3	0.8	-8.2	-3.3	-1.6	-5.2	-3.9	-0.3	-4.0	-1.8
DEL	3.7	-9.1	-1.6	2.7	-3.1	-0.7	12.5	15.1	13.0	0.0	-1.9	-1.1	2.6	-4.4	-3.8	0.3	0.7	1.6	1.7	-2.4	0.2
GUJ	3.8	3.9	4.8	-2.0	-1.2	-0.4	-0.5	-3.5	1.6	2.0	-0.3	1.6	1.3	0.7	1.9	-4.4	-2.7	-2.8	-0.9	0.7	0.8
HR	1.2	-4.3	-0.6	4.1	-0.1	2.9	16.2	23.1	18.7	-1.6	0.3	0.5	3.0	3.5	1.1	-1.6	4.8	3.5	2.1	2.5	3.0
KAR	0.4	4.8	2.7	-2.5	2.2	0.8	23.5	-6.3	9.6	-0.8	-0.7	0.7	3.7	0.4	2.0	-0.1	6.0	5.4	0.8	2.0	2.3
KER	1.4	2.9	5.0	-2.3	0.7	2.2	n.a.	n.a.	n.a.	2.7	0.5	1.3	1.1	0.1	1.0	-1.2	3.0	1.1	-1.1	0.6	1.6
MAH	0.3	-1.0	0.4	-1.0	2.5	1.8	8.8	-4.8	1.3	-1.7	0.0	0.1	-1.2	0.1	0.3	-2.8	-4.8	-2.9	-1.1	-0.3	0.2
MP*	2.3	0.5	2.9	0.4	-2.7	0.1	7.8	2.0	3.0	4.2	-0.3	1.7	2.6	-1.7	1.3	-2.6	-3.8	-2.1	1.8	-1.4	1.0
OR	12.2	11.3	17.6	-1.7	8.6	7.4	n.a.	n.a.	n.a.	1.3	0.3	1.4	4.2	-6.9	-0.8	6.5	-12.7	-2.5	1.1	-1.3	1.0
PU	10.4	-5.1	3.4	5.8	3.3	3.0	10.6	9.0	8.4	0.3	-0.3	0.6	4.6	-0.7	2.7	3.6	0.2	1.4	4.5	1.1	2.4
RJ	-1.1	9.9	3.6	-1.9	1.9	1.9	-0.8	23.0	11.0	2.2	-0.5	1.1	0.4	-2.3	-1.0	2.4	1.0	2.7	2.6	1.3	2.4
TN	3.8	1.5	3.2	-2.2	-0.3	0.5	9.2	-0.7	4.9	-2.0	4.0	2.1	2.4	-2.2	0.3	2.2	4.9	4.3	1.8	1.3	2.5
UP*	4.0	-0.6	2.5	-2.9	-2.7	-1.6	5.3	6.2	4.1	1.3	2.6	1.1	3.2	-2.6	0.7	-0.4	-3.2	-2.2	0.2	-1.8	-0.2
WB	-2.2	-1.5	-1.4	-3.1	1.0	0.6	-3.4	2.2	-0.9	-2.3	-3.2	-1.9	-4.7	-7.6	-4.2	-3.9	-1.0	-1.8	-3.4	-2.8	-1.9
All India	1.7	1.7	2.4	-0.9	-3.3	-0.5	6.1	2.1	4.4	0.6	-0.6	0.5	0.6	-1.0	0.5	-1.4	0.0	0.1	0.3	-1.1	0.5

Annexure 6.4: Employment Growth in India's Organised Manufacturing Sector and its Component Industries (Reform Period Classfication 2)

State/ Country	CHEM			FBT			LEATH			METAL			MTE			TEX			MFG		
	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II	I	II	I & II
AP	-1.4	3.3	3.3	1.2	-0.2	1.8	13.2	-6.8	1.2	9.6	-11.1	4.4	0.7	-0.2	0.6	0.4	-4.3	-0.7	1.7	0.5	2.1
BIH*	-0.9	-5.9	-3.7	-6.0	-2.2	-0.9	-0.6	-1.0	-1.6	1.8	-5.4	-1.3	0.9	-8.7	-3.3	-2.2	-5.6	-3.9	-0.2	-4.2	-1.8
DEL	4.0	-9.9	-1.6	2.5	-3.2	-0.7	13.4	17.0	13.0	-0.4	-2.0	-1.1	0.5	-4.9	-3.8	0.5	0.2	1.6	1.8	-2.7	0.2
GUJ	3.5	2.9	4.8	-1.4	-1.4	-0.4	0.8	-4.6	1.6	2.6	-2.7	1.6	1.1	-0.1	1.9	-4.4	-3.3	-2.8	-0.8	0.2	0.8
HR	1.2	-5.1	-0.6	4.5	-0.5	2.9	13.5	20.6	18.7	-1.2	1.2	0.5	1.2	2.9	1.1	-0.5	4.9	3.5	2.2	2.2	3.0
KAR	0.5	5.0	2.7	-2.1	2.2	0.8	23.1	-8.6	9.6	-0.5	-0.8	0.7	3.4	-0.1	2.0	0.8	5.5	5.4	1.0	1.6	2.3
KER	2.1	1.7	5.0	-1.3	-0.2	2.2	n.a	n.a	n.a	2.7	-2.0	1.3	1.5	0.3	1.0	-1.6	2.4	1.1	-0.4	0.0	1.6
MAH	0.1	-1.7	0.4	-0.4	2.5	1.8	7.8	-5.8	1.3	-1.9	1.0	0.1	-1.2	-0.5	0.3	-3.0	-5.8	-2.9	-1.1	-0.9	0.2
MP*	2.8	0.0	2.9	1.1	-3.0	0.1	7.2	2.6	3.0	1.6	-4.8	1.7	2.9	-2.0	1.3	-2.1	-4.0	-2.1	1.6	-2.4	1.0
OR	14.9	10.3	17.6	-0.7	7.1	7.4	n.a	n.a	n.a	1.5	-1.4	1.4	4.4	-7.4	-0.8	6.2	-14.1	-2.5	1.4	-1.8	1.0
PU	10.2	-6.3	3.4	4.3	2.6	3.0	9.8	9.1	8.4	0.3	-1.1	0.6	4.9	-1.1	2.7	3.5	0.3	1.4	3.9	0.7	2.4
RJ	-1.2	10.6	3.6	-0.9	1.8	1.9	2.7	28.3	11.0	2.2	-2.8	1.1	0.0	-2.8	-1.0	2.7	0.6	2.7	2.6	1.1	2.4
TN	3.9	1.2	3.2	-1.6	-0.8	0.5	9.6	-1.0	4.9	-1.6	5.6	2.1	2.1	-2.7	0.3	2.3	4.5	4.3	2.0	0.8	2.5
UP*	4.4	-0.9	2.5	-2.6	-3.2	-1.6	4.7	6.7	4.1	1.4	2.1	1.1	3.3	-3.0	0.7	-0.8	-3.4	-2.2	0.3	-2.2	-0.2
WB	-2.0	-1.6	-1.4	-2.7	0.4	0.6	-3.3	2.7	-0.9	-2.0	-1.5	-1.9	-4.0	-8.1	-4.2	-3.7	-1.3	-1.8	-3.0	-3.2	-1.9
All India	1.7	1.1	2.4	-0.4	-4.0	-0.5	6.3	1.9	4.4	0.5	-1.6	0.5	0.7	-1.4	0.5	-1.3	-0.5	0.1	0.4	-1.7	0.5

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