MPRA

Munich Personal RePEc Archive

Organized versus Unorganized Manufacturing Performance in India in the Post-Reform Period

Kathuria, Vinish, Seethamma Natarajan, Rajesh Raj and Sen, Kunal

16. January 2010

Organized versus Unorganized Manufacturing Performance in India in the Post-Reform Period[♣]

Vinish Kathuria
Associate Professor, SJMSOM, IIT Bombay
vinish@iitb.ac.in
Rajesh Raj S N
Assistant Professor, Centre for Multi-Disciplinary Development Research, Dharwad
rajeshraj.natarajan@gmail.com
Kunal Sen (corresponding author)
Professor, IDPM, University of Manchester
Kunal.Sen@manchester.ac.uk

Abstract

This paper analyses the productivity performance of the Indian manufacturing sector using unit level data, which is aggregated at four-digit industry level for the period 1994-95 to 2004-05 for 15 major states. The study focuses on both the organized and unorganized segments of the manufacturing sector. Both partial and total factor productivity (TFP) measures have been employed to trace the productivity performance of formal and informal manufacturing sector. TFP is estimated using Cobb-Douglas production functions at the four-digit industry level. The estimation is carried out by employing the Levinsohn-Petrin method, which uses intermediate inputs as the proxy to address the potential simultaneity bias in production function estimations.

Our analysis reveals that labour productivity has increased for the organized sector over time whereas both labour productivity and capital intensity growth have slowed down in the unorganized sector during the 2000-01 to 2004-05 period. The production function analysis shows that capital has played a more significant role in the production process in both the sectors. TFP growth accelerated in the organized manufacturing sector during 2001-05 over 1995-2001 while the TFP decline that started in the first period (1995-2001) continued unabated even in the second period (2001-2005) in the unorganized manufacturing sector. We also find that output growth in both the sectors is productivity driven and not input driven. The improvement in TFPG of organized manufacturing in the post-2000 period as compared to the second half the 1990s across most states in India and that output growth was mostly productivity driven are important positive features of manufacturing performance in the post-reform period. However, the declining total factor productivity on one hand and increasing capital intensity of the unorganized sector is a cause of worry and raises several important questions.

Keywords: Productivity, Organized manufacturing, Unorganized sector, Industrial Sector.

[♣] This paper forms a part of a larger study examining the effect of state-business relations on the productivity of Indian firms funded by IPPG-University of Manchester, UK (www.ippg.org.uk). We are thankful to IPPG-University of Manchester and DFID-UK for financial support. We are also thankful to the Central Statistical Organisation, for providing us access to the data, and to Nilachal Ray for his strong interest in the research and for his many suggestions and comments. An earlier version of the paper was presented at the IEG-CSSSC international conference held at Institute of Economic Growth, Delhi during July 27-28. The authors thank conference participants for helpful comments. The usual disclaimers apply.

1. Introduction

The 1990s reforms in India were specifically targeted to the manufacturing sector. The emphasis on the manufacturing sector was due to the realization that the sector offers greater prospects for capital accumulation, technical change and linkages and hence job creation, especially for the semi-skilled and poorly educated segment of the labour force, which comprises most of India's working poor (Sen, 2009). There is apprehension about the role that agriculture can play in the growth process, given that the primary commodities have been facing a long run decline in prices in the world market (Sarris and Hallam, 2006). As a result, the prospect for the agricultural sector as a major employment provider and the driver of economic growth is bleak in the Indian context. Thus, the key to India's future economic growth and poverty reduction depends on the growth performance of a dynamic outward-oriented manufacturing sector which can significantly attract the large pool of surplus labour employed in low-productivity work in agriculture or in the urban informal tertiary sector.

The process of economic reforms introduced since 1991 has witnessed a gradual dismantling of industrial licensing, removal of import licensing for nearly all manufactured intermediate and capital goods, tariff reduction and relaxation of rules for foreign investment.[1] The reforms in respect to the industrial sector were intended to free the sector from barriers to entry and from other restrictions to expansion, diversification and modification so as to improve its efficiency, productivity, and competitiveness. Given that the main objective of reforming the manufacturing sector was to improve industrial efficiency, it would be appropriate to probe how far the reforms have contributed to the productivity performance of the Indian manufacturing sector.

There is a large body of literature on productivity growth, its components and determinants in the manufacturing sector in India. Recently attention has shifted to examine the relationship between economic reforms and productivity in the manufacturing sector. The findings of these studies are inconclusive. Krishna and Mitra (1998), Pattnayak and Thangavelu (2005), Unel (2003) among others find an acceleration in total factor productivity growth (TFPG) in the reform period whereas studies by Trivedi *et al*. (2000), Srivastava (2000), Balakrishnan *et al*. (2000) and Das (2004) find a deceleration in TFPG in the 1990s. The substantial variation in the impact of reforms across Indian states has been yet another subject of research interest. Ray (1997, 2002), Kumar (2006) and Aghion *et al*. (2008) have found evidence of tendency

[1] For a detailed review on the industrial policy reforms see Srinivasan (2000).

towards convergence in TFP growth rate among Indian states in the reform years in respect to organized manufacturing. A handful of studies in the recent years have also analyzed the productivity performance of the unorganized manufacturing sector, especially after the introduction of reforms (see for example, Unni *et al.*, 2001; Mukherjee, 2004 among others). However, we are not aware of any study that has attempted to analyze and compare the performance of the organized and unorganized segments of the Indian manufacturing sector, especially at the sub-national (state) level. One of the key components of reforms was gradual de-reservation of products meant for small-scale enterprises. Thus, the reforms would have impacted on the organized and unorganized manufacturing sectors directly and indirectly on the unorganized manufacturing sector because of the growing importance of subcontracting and outsourcing of activities to this sector. Hence, there is a need to assess the impact of reforms on both the segments of manufacturing.

In this study, we make an attempt to fill this visible gap in the literature by providing fresh evidence on productivity levels and growth of organized and unorganized manufacturing sector across major Indian states by employing a recently developed technique that accounts for simultaneity bias.[2] In order to do so, the study uses unit level (plant level) data for both the organized and unorganized sectors and aggregates the data to the 4-digit NIC level.

Specifically, the study proposes to address the following issues:

a) Is there significant difference in the productivity performance of organized and unorganized sectors in the post 1990s reform period?

b) Is there significant difference in the productivity growth of organized and unorganized manufacturing across the major states in India?

c) Whether the growth of output in the organized and unorganized sectors is input driven or productivity driven?

The scheme of the remaining paper is as follows. Section 2 discusses the methodology employed in the study. The database and variables used in the study are discussed in Section 3. Section 4 presents the composition of the manufacturing sector at the sub-national level. In section 5, we discuss the results of our productivity analysis. The last section concludes.

[2] Simultaneity bias or endogeneity problem arises because productivity is observed by the profit maximizing firms early enough to influence their input levels. This means that the firms will alter their use of inputs in case of any productivity shocks. Simple Ordinary Least Squares (OLS) estimation of the production function that are standard in the literature on the measurement of productivity in India would lead to biased estimates of TFPG.

2. Methodology

In this study, some selected indicators are used to ascertain the performance of the manufacturing sector. The foremost among them are partial and total factor productivity (TFP) estimates besides computing the capital-labour ratio. Labour productivity, defined as output per labour, is the partial factor productivity measure identified in this context. The capital-labour ratio, measured as real gross fixed assets divided by total number of persons engaged, is the other factor ratio used to capture the trends in performance of the manufacturing sector.

As regards TFP growth, we estimate the Cobb-Douglas (CD) production function in equation (1) separately for each of the 15 major Indian states.[3]

$$\ln Y_{ijt} = A_{it} + \beta_L \ln L_{ijt} + \beta_K \ln K_{ijt} \qquad \text{--------------- (1)}$$

The subscript 'i' indexes the state, 'j' indexes the industry and 't' indexes the time period. The variables Y, L and K represent the real value added, labour and capital input respectively. 'A' is TFP which represents the efficiency of the firm in transforming inputs into output.

The estimation of the coefficients of labour and capital using ordinary least squares (OLS) method implicitly assumes that the input choices are determined exogenously. However, firm's input choices can be endogenous too. For instance, the number of workers hired by a firm and the quantity of materials purchased may depend on unobserved productivity shocks. These are commonly overlooked by researchers but they certainly represent the part of TFP known to the firm. Since input choices and productivity are correlated, OLS estimation of production functions will yield biased parameter estimates. To correct this endogeneity bias, we employed a methodology recently developed by Levinsohn and Petrin (2003).

In the past, researchers have used several techniques to correct this bias such as the fixed effect estimation or the semi-parametric methodology developed by Olley and Pakes (1996) (henceforth OP). The fixed effects estimation however eliminates only unobservable *fixed* firm characteristics that may affect simultaneously input choices and TFP; there may still be unobserved *time varying* firm characteristics affecting input choices and TFP. The main idea behind the LP methodology is that an observable firm characteristic – intermediate inputs –

[3] The states included are Andhra Pradesh (AP), Assam, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh (MP), Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu (TN), Uttar Pradesh (UP), and West Bengal (WB).

can be used to proxy unobserved firm productivity and estimate unbiased production function coefficients.

Levinsohn and Petrin (LP) Methodology

Simultaneity arises because productivity is observed by the profit maximizing firms (but not by the econometrician) early enough to influence their input levels (Marschak and Andrews, 1944). This means that the firms will increase (decrease) their use of inputs in case of positive (negative) productivity shocks. OLS estimation of production functions thus yield biased parameter estimates because it does not account for the unobserved productivity shocks.

OP method overcomes the simultaneity problem by using the firm's investment decision to proxy unobserved productivity shocks. The estimation rests on two assumptions. First, productivity – a state variable in the firm's dynamic problem – is assumed to follow a Markov process unaffected by the firm's control variables. Second, investment – one of the control variables of the firm – becomes part of the capital stock with a one period lag. In the OP method, labour is treated as a non-dynamic input and capital is assumed to be a dynamic input. A firm's choice of labour has no impacts on the future profits of the firm. The OP estimation involved two steps. The coefficients of the variable inputs and the joint effect of all state variables on output are estimated in the first step. In a two input framework, the former is just labor and the latter are capital and productivity. Investment is assumed to be a monotonically increasing function of productivity and inverting the investment equation non-parametrically provides an observable expression for productivity. This expression is used to substitute the unobserved productivity term of the production function, hence allowing identification of the variable input elasticities.

The coefficients of the observable state variables (capital if there are only two inputs) are identified in the second step by exploiting the orthogonality of the quasi-fixed capital stock and the current change in productivity. A nonparametric term is included in the production function to absorb the impact of productivity, to the extent it was known to the firm when it chose investment in the last period. The second term included in equation (3) captures the unobserved productivity shock and uses the results of the first stage (i.e., equation 2).

The estimating equations for the two steps are

$$y_{it} = \beta . l_{it} + \gamma . k_{it} + h_i(i_{it}, k_{it}) + e_{it} \qquad \text{----------------(2)}$$

$$V_{it} = \gamma . k_{it} + g(\emptyset_{t-1} - \gamma . k_{t-1}) + \mu_{it} + e_{it} \qquad \text{----------------(3)}$$

The functions h and g are approximated non-parametrically by a fourth order polynomial or a kernel density. Once both the equations are estimated, we have estimates for all the parameters of interest. The labour coefficient is obtained in the first stage and capital coefficient in the second stage. These estimates are termed as OP estimates. A major advantage of this approach is the flexible characterization of productivity, only assuming that it evolves according to a Markov process. However, the method is not free from drawbacks. OP method demands a strictly monotonous relationship between the proxy, which is investment, and output. This means that observations with zero investment have to be dropped from the dataset in order for the correction to be valid. Given that not every firm will have strictly positive investment every year, this may lead to a considerable drop in the number of observations in the dataset, an obvious efficiency loss. This is all the more important for firms in the unorganized sector, where for years together firms hardly invest in capital. Levinsohn and Petrin (2003) developed an estimation technique that is very much similar to the one developed by OP. They suggest the use of intermediate inputs (*m*) as a proxy rather than investment.[4] Typically, many datasets will contain significantly less zero-observations in materials than in investment. This is what has been used in the present study. In LP, the first stage involves estimating the following equation:

$$y_{it} = \beta_0 + \beta_l l_{it} + \emptyset_t(m_{it}, k_{it}) + \varepsilon_{it} \qquad \text{------------------------------ (4)}$$

where $\emptyset_t(m_{it}, k_{it}) = \beta_k k_{it} + f_t^{-1}(m_{it}, k_{it})$ is a non-parametric function. The estimates of β_l and $\emptyset_t$ are obtained in the first stage.

The second stage of the LP estimation obtains the estimate of β_k. Here, like OP, LP assumes that productivity (ω) follows a first-order Markov process, and is given by

$$\omega_{it} = E[\omega_{it} | \omega_{it-1}] + \epsilon_{it} \qquad \text{--------------------------------- (5)}$$

This assumption states that capital does not respond immediately to ϵ_{it}, which is the innovation in productivity over last period's expectation (i.e., the shock in productivity). It leads directly to the following moment condition:

$$E[\epsilon_{it} | k_{it}] = 0 \qquad \text{------------------------------ (6)}$$

[4] LP use electricity as a proxy in their study. We could not use electricity as majority of firms in the unorganized sector are working without power which would lead to dropping considerable number of firms from our sample.

The equation (6) states that the unexpected part of the innovation in productivity in the current period is independent of this period's capital stock, which was determined by the previous period's investment. Using this moment condition, β_k can be estimated from the following expression:

$$\epsilon_{it}(\beta_k) = \omega_{it} - E[\omega_{it}|\omega_{it-1}] = (\hat{\emptyset}_{it} - \beta_k k_{it}) - \hat{\varphi}(\beta_k) \text{ ---------------------------- } (7)$$

This moment condition identifies the capital coefficient, β_k. The saliency of this strategy lies in the assumption that the current period's capital stock is determined before the shock in the current period's productivity.

3. Data and variables

Data

A key feature of the present paper is the use of unit level data for both organized and unorganized manufacturing sector. The data for the unorganized manufacturing sector for the selected states are obtained from the National Sample Survey Organization (NSSO) surveys on the unorganized manufacturing sector for 1994-95, 2000-01 and 2005-06.[5] In order to compare with the trends in the organized sector, data for the same three years were obtained from the Annual Survey of Industries (ASI).[6] We have aggregated the unit level data to arrive at the four-digit industry level data for each state. The data cleaning as necessitated by the requirements of the LP method and the research questions in mind involved the following steps: a) the study has considered only those industries for which three years of data were available; b) while aggregating the data up to four digit level, we have omitted units reporting zero or negative capital stock, zero output and zero employment; and c) as in 2000, Bihar, MP and UP were bifurcated and three new states Uttrarakhand, Chattisgarh and Jharkhand were formed, we merged these three states were merged with their parent states so as to have consistent data for all the three time periods. In the end, the total number of industries used for estimation ranged from 39 in Assam to 98 in UP and Maharashtra in the organized sector while it varied between 44 in Assam and 98 in UP in the unorganized sector (Table 1).

[5] The NSSO conducts surveys on the unorganized manufacturing sector quinquennially. Though the NSSO initiated this survey in 1978-79, a complete firm level dataset was available only from 1994-95. This fits well with our objective too.

[6] It is important to note here that the ASI data for 2005-06 is yet to be released. On account of it, we have considered the ASI dataset for the year 2004-05.

Table 1: Number of Industries used for analysis (at four digit level)

	Region	States	Organized Sector	Unorganized Sector
1	North	Punjab	84	69
2		Haryana	84	60
3		Rajasthan	85	63
4		Uttar Pradesh (UP)	98	98
5	East	Bihar	85	80
6		Assam	39	44
7		West Bengal (WB)	94	84
8		Orissa	65	53
9	Central	Madhya Pradesh (MP)	90	67
10	West	Gujarat	92	70
11		Maharashtra	98	90
12	South	Andhra Pradesh (AP)	95	69
13		Karnataka	95	64
14		Kerala	86	64
15		Tamil Nadu (TN)	97	81

It needs to be stated upfront that improvement in sampling approach and conceptual modifications introduced to accommodate the need for improved data collection may, to an extent, affect the comparability of NSSO data over time. There are also differences across rounds in terms of coverage of the survey. In the 56th round (2000-01), to minimize errors in data furnished, the reference period for collecting the data on GVA has been changed to '30 days preceding the date of survey' while in the earlier rounds it was collected with reference to a period of '365 days preceding the date of survey'. Similarly, in 2005-06 round, NSSO followed dual sampling procedure to give larger weight to DMEs (Directory Manufacturing Enterprises – enterprises employing more than 6 workers but not registered under the Factories Act). This conceptual difference between the rounds may not cause serious distortions as far as the entire unorganized manufacturing sector is concerned but may affect the comparison between different types of enterprises.[7]

Variables

The variables used in this exercise are output, labour, capital, and intermediate inputs. To make the values of output, capital and intermediate inputs comparable over time and across industries and states, suitable deflators have been used. The definition of the variables and the deflators used are as given below. The discussion also highlights various issues involved while selecting these variables.

[7] Given that DMEs are more productive than other types of enterprises in the unorganized manufacturing sector, more weight to DMEs in fact should result in estimation of the true productivity profile of unorganized sector rather than biasing it.

Output

Gross value added (GVA) is used as the measure of output in this study. Use of GVA at constant prices to represent output is a common practice in empirical literature (Goldar, 1986; Ahluwalia, 1991; Balakrishnan and Pushpangadan, 1994, 1998). A number of studies have also employed the gross output function framework by rejecting the 'implicitly maintained hypothesis' of seperability of intermediate inputs like materials and fuel from labour and capital inputs (Rao, 1996; Pradhan and Barik, 1998; Ray, 2002; Trivedi, 2004). These studies have argued that a production function approach which takes labor and capital as the only two inputs is meaningful only when material inputs are separable from their primary inputs. In contrast, Griliches and Ringsted (1971) argue that value added allows comparison between the firms that are using heterogeneous raw materials. According to Salim and Kalirajan (1999), GVA takes into account differences and changes in the quality of inputs. The use of gross output that demands the inclusion of raw material also as an input variable in the model might obscure the role of capital and labour in productivity growth and may lead to a bias in productivity growth (Hossain and Karunaratne, 2004).

The second crucial issue is with regard to the conversion of nominal value added into real value added. In practice, this is done using either single deflation (SD) or double deflation (DD) procedure. In the SD method, nominal value added is deflated by the output price index (Goldar, 1986; Ahluwalia, 1991). But this method has been criticized on the ground that it assumes that both the input and output prices change at the same rate (Rao, 1996; Balakrishnan and Pushpangadan, 1994; Pradhan and Barik, 1998). The alternative method is to deflate output and material inputs separately and then work out the real value added, i.e., DD method (Balakrishnan and Pushpangadan, 1994). Even DD is not free from drawbacks. The main issue that one may encounter while estimating real value added by DD is the estimation of an appropriate price index for material inputs. According to Dholakia and Dholakia (1994), "…even after the input groups are properly identified and the respective price indexes for each group are obtained, the weights attach to each input group would play a significant role in the determination of overall input price index".[8]

Since our study is covering the period following the post-1990s reforms when the economy was being more integrated to the world economy, the industries must be experiencing large relative price changes, significant changes in factor shares, and large changes in the value of

[8] It is also argued that the DD estimates are highly sensitive to the base year price index used for deflation (Dholakia and Dholakia, 1994; Goldar, 2002).

inputs relative to output. In this context of transition, the use of the DD procedure would be more ideal than the SD procedure. However, DD method demands deflating output and intermediate inputs separately using appropriate deflators. The method requires quantification of all items of output and input, availability of item-wise data on quantity and value and matching of items between the base year and the year for which these estimates are required. The method also necessitates estimations at very detailed level of items and is difficult to adopt, particularly for multi-product industry groups and in cases where inputs account for a significant part of output (NAS, 2007: 127). We could not use DD method for three reasons: a) ASI data consists of large number of multi-product firms; b) value added as a proportion of output is low in the organized sector which leads to GVA becoming negative for several industries with DD method for cases where the input price deflator is higher than the output price deflator (NAS, 2007: 127); and c) the non-availability of industry specific input deflators. Accordingly we used SD method. However, to see whether the estimated TFPG change substantially with the DD method, we estimated TFPG using DD method also.[9] In applying the DD method, we used the WPI for all commodities at 1993-94 prices to deflate nominal values of intermediate inputs in the organized and unorganized manufacturing sectors.

It should be noted that for a few firms, real value added was negative. We converted these values to one so as to take log transformation required for production function estimation.[10]

Capital

The measurement of capital input has been a controversial topic in the theoretical as well as the empirical literature. There is no universally accepted method for its measurement. As a result, several methods have been employed to estimate capital stock. In many studies, the capital unit is treated as a stock measured by the book value of fixed assets (Ray, 2002; Kumar, 2006) while in others it is considered as a flow, measured by the sum of rent, repairs, and depreciation expenses. In some other cases, the perpetual inventory method (PIAM) has been adopted for constructing capital stock series from annual investment data. In this case it is assumed that the flow of capital services is proportional to the stock of capital (Ahluwalia, 1991; Balakrishnan and Pushpangadan, 1994; Trivedi *et al*., 2000, 2004). It is important to note that each of these measures has its own shortcomings. The book value method has three limitations. First, the use of the 'lumpy' capital data would seem that in some years very large

[9] We do not report the detailed results in this paper due to lack of space; however, they are available on request.
[10] As indicated in the limitations of using the DD method, the number of industries with negative value added rose considerably when we employed DD method for ASI sector in the present study.

investment in capital has taken place and in other years, this figure would appear small thereby underestimating or overestimating the amount of capital expenditure (Mahadevan, 2002). Secondly, the physical stock of machinery and equipment may not be truly represented by the book value (Ray, 2002). Third, it does not address the question of capacity utilization (Kumar, 2006). The capacity utilization issue is not addressed in PIAM too (*ibid.*). The flow measure may be criticized on the ground that the depreciation charges in the financial accounts may be unrelated to the actual wear and tear of capital (Ray, 2002).

Despite its limitations, most studies in the Indian manufacturing sector have used the PIAM to arrive at the time series of capital stock. In the present study, we have used data for different time points and the data does not provide information on the accumulated depreciation of capital. Hence, we could not employ PIAM. Instead we have used the total fixed assets as given in the ASI and NSSO reports to represent capital input in the organized and unorganized sector respectively. The capital input includes land, buildings and other construction, plant and machinery, transport equipment, tools and other fixed assets that have a normal economic life of more than one year from the date of acquisition. The total fixed assets were deflated by WPI for machine and machinery tools in both the sectors. The WPI for machine and machinery tools are not available at the industry level forcing us to use the values at the all India level to deflate gross fixed assets. The values are expressed in 1993-94 prices.

Labour

Total number of persons engaged is used as the measure of labour input. Since working proprietors / owners and supervisory/managerial staff have a significant influence on the productivity of a firm, the number of persons engaged was preferred to the total number of workers.

4. Basic Characteristics of Selected states – Cross-section analysis

In this section we look at the relative positions of 15 selected states in the organized and unorganized manufacturing sectors in terms of gross value added (GVA), employment (EMP) and fixed capital stock (FK) (Table 2). In 2005-06, the combined shares of 15 selected states (in all India totals) in GVA, EMP and FK were above 90 per cent in the unorganized manufacturing sector. In the organized manufacturing sector, these states account for about 80 per cent of GVA and more than 90 per cent of total workforce and capital invested. Maharashtra (row 9) is the leading contributor to employment in the organized manufacturing sector followed by Gujarat (row 4). Maharashtra has also contributed heavily to capital formation in the sector along with TN, AP and Gujarat. In terms of share in GVA, UP and Gujarat were the major contributors while the contribution by Maharashtra is found to be very low. In the unorganized manufacturing sector, Maharashtra and UP accounted for a major share in GVA and fixed capital stock. The largest contribution in employment in the unorganized sector came from WB followed by UP.

Table 2: Relative importance of major states in Indian manufacturing: 2005-06

	State	Expressed as a percentage of All India Total					
		Organized Manufacturing			Unorganized Manufacturing		
		GVA	EMP	FK	GVA	EMP	FK
1	AP	6.1	6.4	11.0	5.3	8.1	6.1
2	Assam	0.9	1.4	1.4	1.6	1.7	0.7
3	Bihar	9.2	6.2	2.5	3.9	6.6	3.7
4	Gujarat	10.1	14.4	9.6	7.2	5.1	7.1
5	Haryana	3.0	4.5	4.2	3.1	1.5	6.1
6	Karnataka	1.8	7.8	6.5	6.4	5.4	5.7
7	Kerala	2.4	1.6	3.8	3.9	3.8	5.0
8	MP	7.3	5.3	3.8	3.8	6.0	4.5
9	Maharashtra	5.5	19.5	13.7	15.7	8.0	16.5
10	Orissa	0.9	2.4	1.7	2.2	5.6	1.1
11	Punjab	4.0	2.3	4.6	2.6	1.6	4.2
12	Rajasthan	4.1	2.6	3.2	4.3	3.6	4.4
13	TN	8.0	8.7	15.0	9.4	9.2	11.2
14	UP	10.4	6.4	7.6	14.4	14.9	12.1
15	WB	6.8	4.1	6.1	9.6	15.1	6.5
	Total (15 states)	**80.4**	**93.4**	**94.9**	**93.4**	**96.2**	**95.0**

Notes: GVA – Gross Value Added; EMP – Employment; FK – Fixed Capital

5. Results – Labour productivity and LP estimations

Given the importance of labour productivity growth for improvements in the standard of living and quality of life, their trends are closely monitored by economists and policy makers. Labour productivity is the most commonly reported and widely understood measure of productivity (Ray, 2002). Balakrishnan (2004) argues that ignoring changes in labour productivity reflects an inadequate concern for potential increase in consumption. In the present study, we report levels of labour productivity for the selected states for the period 1994-2005. As expected, an employee in the organized manufacturing sector is more productive than an employee in the unorganized manufacturing sector (Figure 1 and Table 3).

Labour productivity in the organized manufacturing sector is, on an average, 4.4 times higher than that in the unorganized sector over the period 1994-2005 (row 16, column 3). Incidentally, the organized sector not only has higher productivity, but also has large regional variation as reflected in the value of the coefficient of variation (last row, Table 3). In the organized sector, labour productivity levels are highest in the states of Maharashtra, Gujarat and Karnataka[11] while Orissa and Bihar reported the lowest level of output per worker.

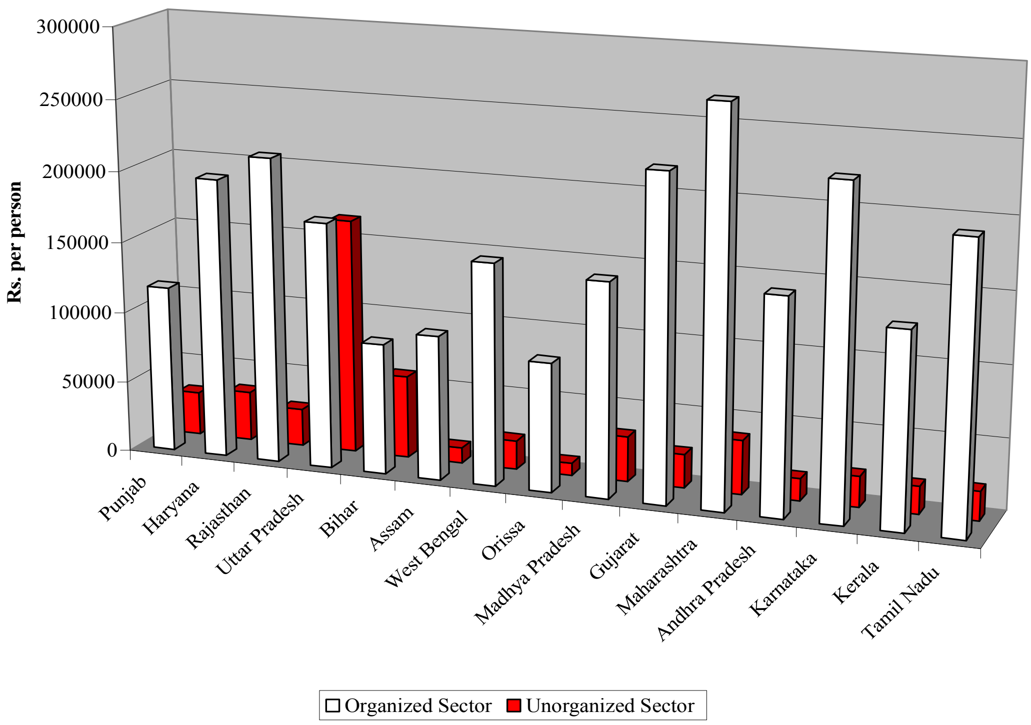

Figure 1: Region-wise Labour Productivity Levels in the organized and unorganized sectors, 1994-2005

Table 3: Region-wise Labour Productivity Levels (Rs./Employee) in the organized and unorganized sectors, 1994-2005

	States	Organized Sector (1)	Unorganized Sector (2)	Ratio of labour productivity (1)/(2)
1	Punjab	117,258	30,400	3.9
2	Haryana	196,970	34,712	5.7
3	Rajasthan	214,919	26,259	8.2
4	UP	172,966	165,576	1.04
5	Bihar	91,783	58,080	1.6
6	Assam	101,358	10,800	9.4
7	WB	155,601	20,276	7.7
8	Orissa	90,573	8,586	10.5
9	MP	149,918	31,820	4.7
10	Gujarat	226,971	23,739	9.6
11	Maharashtra	274,877	37,963	7.2
12	AP	151,235	15,604	9.7
13	Karnataka	229,955	21,749	10.6
14	Kerala	136,408	19,370	7.0
15	TN	199,920	20,618	9.7
	Mean	**172,907**	**39,706**	**4.4**
	CV	**0.52**	**0.36**	

[11] Importantly, these three states provide the bulk of employment in Indian manufacturing (refer Table 2).

UP is the state with highest level of labour productivity in the unorganized sector and the level is around three times higher than Bihar, the state ranked second in labour productivity level. Orissa and Assam are the states with lowest levels of labour productivity in the unorganized sector. In these two states along with Karnataka, AP and TN, the productivity in organized sector is nearly ten times than that of unorganized sectors. Surprisingly, UP (row 4) is the state where labour productivity level is more or less similar in both the sectors.

We tried to look deeper why the unorganized sector in UP has such a high productivity. Is it the 'NOIDA effect' – where some key industries like electronic components and auto components having high capital intensity and correspondingly high value added are located in NOIDA, or because of the National Capital Region effect, where the unorganized sector units are virtually in Delhi thus benefiting from agglomeration as part of a bigger region?, Or has there been higher weight assigned to DMEs (who are expected to be more productive and capital-intensive) in the NSSO survey for UP? Further investigation rules out the possibility that there was an over-sampling of DME units in UP. We find the higher labour productivity in UP is driven by some key industries, namely manufacture of television and radio receiver, motor vehicles, office, accounting and computing machinery, man-made fibres among others, where the labour productivity is significantly higher in the range of Rs. 1 million per worker.

A t-test is carried out to see whether the labour productivity in organized sector is significantly higher than the unorganized sector. We find that in 14 of the 15 states labour productivity in organized sector is significantly higher than that of unorganized sector. In UP, there is no statistical difference between labour productivity between the two sectors. Such differences looked in relation to overall share of organized manufacturing to total manufacturing has an implication for per capita income and catch-up (Figure 2). It can be seen from the figure that the states with larger share of organized manufacturing has significantly higher productivity differences across the two sectors as the relation between the two is non-linear.

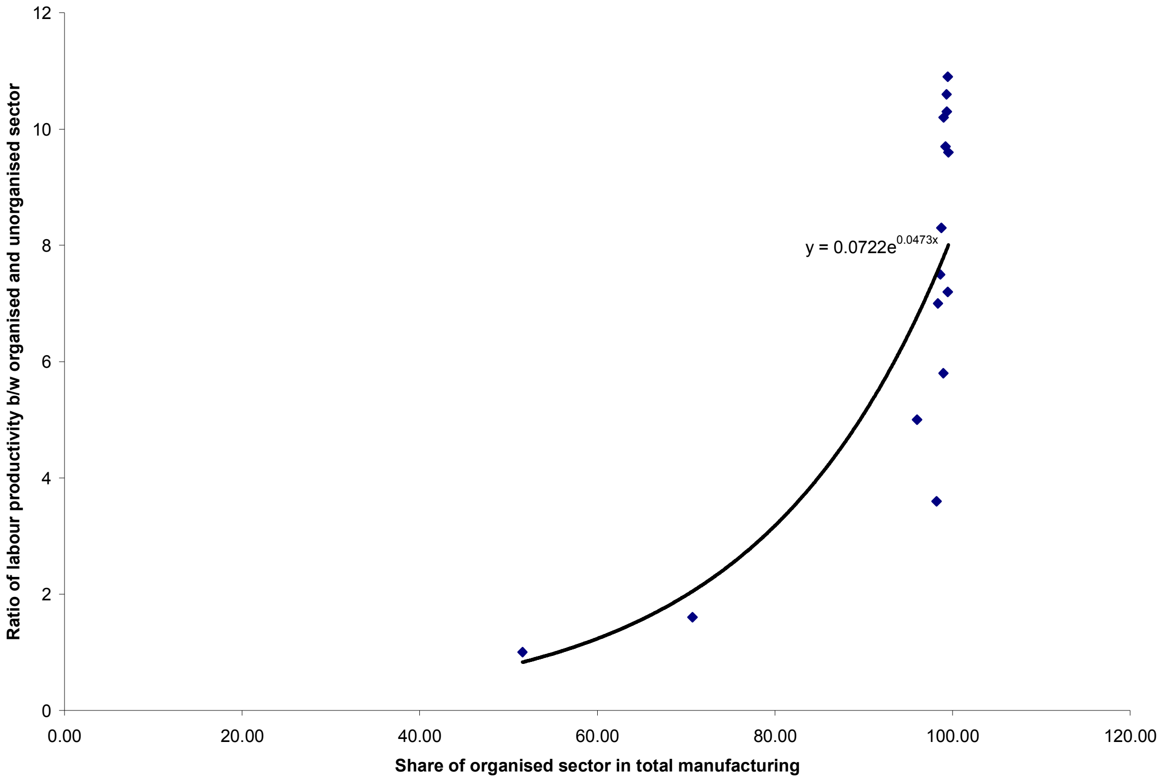

Figure 2: Relationship between organized sector's share in total manufacturing and ratio of labour productivity between the organized and unorganized sectors

Labour Productivity - Trend

Table 4 reports the trends in labor productivity for individual states in the organized and unorganized sectors. The Table shows that labour productivity has grown steadily in all the states in the organized sector.[12] It grew at a rate of 6.7 per cent per annum during 1994-2005. The growth was lower in the period 1994-2001 with an annual rate of 6.1 per cent in this period, which increased to 7.6 per cent per annum during 2001-2005. Half of the states witnessed increased growth in the second sub-period, 2001-2005. As regards the unorganized sector, labour productivity witnessed a fluctuating trend. It grew in the first period but fell slightly in the second period. The overall labour productivity growth during 1994-2005 was 3.1 per cent per annum. The labour productivity grew faster in the second period in five states namely Haryana, WB, TN, Karnataka and Maharashtra. Six out of 15 states witnessed marked decline in labour productivity in the second period in the unorganized sector.

[12] It is to be noted that wherever growth rate has been computed in Table 4 or elsewhere, it is the compound annual growth rate (CAGR) for the period. The CAGR is calculated as $[(Y_t/Y_o)^{(1/t)}-1]*100$, where Y_t and Y_o are the terminal and initial values of the variable and 't' is the time over which CAGR has to be calculated.

Table 4: Growth in Labour Productivity

	State	Organized Sector			Unorganized Sector		
		1994-2001	2001-2005	1994-2005	1994-2001	2001-2005	1994-2005
1	Punjab	4.08	4.28	4.16	8.26	1.98	5.36
2	Haryana	6.67	11.06	8.40	3.12	7.59	5.12
3	Rajasthan	8.25	2.91	6.08	6.98	3.61	5.44
4	UP	8.54	8.10	8.37	8.08	5.33	6.82
5	Bihar	3.53	10.90	6.42	2.41	-4.05	-0.58
6	Assam	5.77	4.78	5.37	4.78	-26.33	-10.72
7	WB	6.85	20.09	11.96	7.13	11.41	9.05
8	Orissa	5.85	2.51	4.50	5.92	-13.27	-3.28
9	MP	9.54	-0.40	5.45	18.89	8.99	14.28
10	Gujarat	6.55	10.62	8.16	5.13	-4.48	0.65
11	Maharashtra	6.26	4.70	5.63	2.66	9.45	5.69
12	AP	3.96	11.32	6.84	15.84	-18.86	-1.47
13	Karnataka	6.34	16.31	10.22	6.81	9.14	7.86
14	Kerala	2.97	-0.27	1.67	4.03	-8.37	-1.80
15	TN	8.55	0.19	5.13	3.53	5.13	4.25
	Mean (15 states)	**6.08**	**7.63**	**6.66**	**6.90**	**-0.85**	**3.11**

Capital-Labour Ratio - Trend

In the context of a developing economy, the most forceful argument in favour of small enterprises, which are mostly in the unorganized sector, is their allegedly more efficient use of capital and labour. It is argued that these enterprises generally produce output utilizing less capital and more labour than large units. Thus, small firms are deemed as labour (or less capital) intensive and large firms as (more) capital intensive. We verify this in the context of manufacturing sector in India. In addition, it is pertinent to look at the regional variation in capital-labour ratio especially in the post-90s reforms period. In the post reforms period of the 1990s, the firms' access to capital increased significantly due to the far reaching reforms in the financial sector during the period (Sen and Vaidya 1997). On the other side, labour laws still need reforms and rationalization. These developments might have induced the firms to invest more on capital rather than employing more labour. This is well substantiated by data in Table 5 and Figure 3. The organized sector, which has easier access to capital, employs more capital to labour than the unorganized sector and is, thus, more capital intensive than the unorganized sector. In the organized sector, level of capital intensity is highest in Gujarat, Karnataka and Maharashtra, the three most industrialized states and lowest in Bihar, a predominantly agrarian state.

Interestingly, the unorganized sector in UP is not only highly capital intensive, but its capital intensity is as high as that of the organized sector. On the other hand, Assam has the lowest capital intensity among all the states. The capital intensity of organized manufacturing is at least 9 times than that of unorganized manufacturing in Assam, AP, Orissa, Karnataka and WB with Assam leading the way.

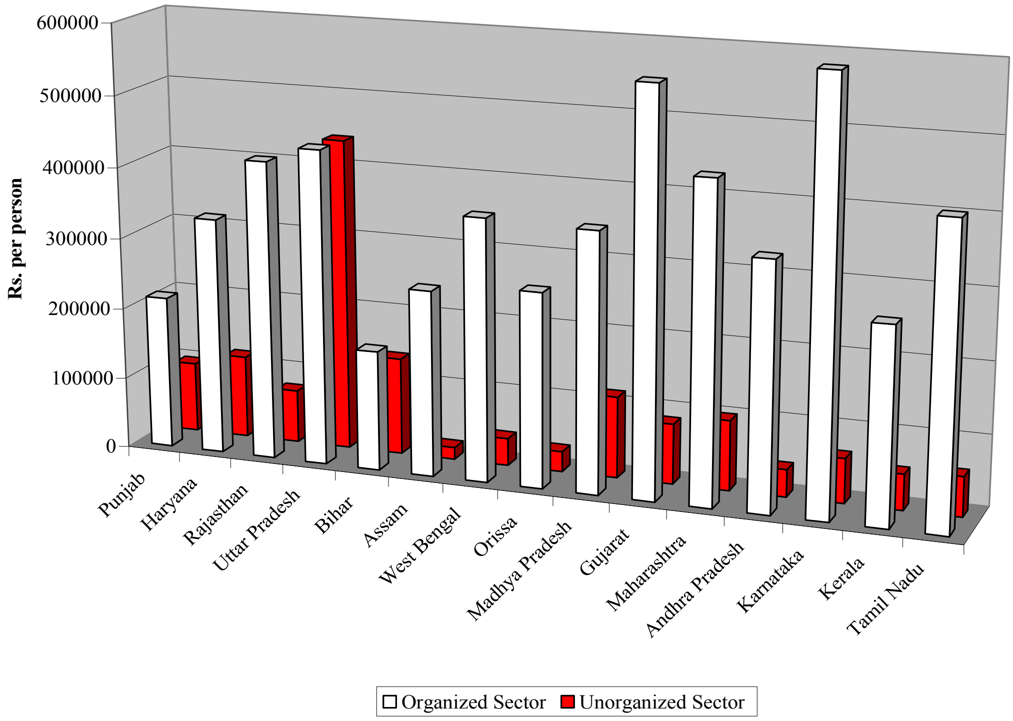

Figure 3: State-wise capital-labour ratio in the organized and unorganized sectors, 1994-2005

Table 5: Region-wise capital-labour (K/L) ratio (Rs./employee) in the organized and unorganized sectors, 1994-2005

	States	**Organized Sector (1)**	**Unorganized Sector (2)**	**Ratio of K/L ((1)/(2))**
1	Punjab	214,114	98,060	2.2
2	Haryana	332,515	115,502	2.9
3	Rajasthan	419,587	74,023	5.7
4	UP	441,798	438,586	1.0
5	Bihar	168,146	136,207	1.2
6	Assam	260,576	16,926	15.4
7	WB	367,414	38,382	9.6
8	Orissa	272,897	28,443	9.6
9	MP	363,498	114,258	3.2
10	Gujarat	563,539	84,761	6.6
11	Maharashtra	445,683	98,203	4.5
12	AP	345,789	38,595	9.0
13	Karnataka	595,077	63,042	9.4
14	Kerala	274,300	50,171	5.5
15	TN	419,747	56,169	7.5
	Mean	**375,705**	**108,522**	**3.5**
	CV	**0.28**	**0.18**	

A low capital intensive production has implications for labour productivity as is evident from the following graphs (Figures 4 and 5) between capital intensity and labour productivity, which are positively sloped. The figures show that capital intensity is a major driver of labour productivity in the unorganized manufacturing sector as compared to the organized sector. While one unit of change in capital intensity leads to only 0.46 per cent increase in labour productivity in the organized manufacturing sector, this rises to 0.67 per cent in the unorganized manufacturing sector. This is expected as firms in the unorganized sector have a low capital base (row 16, column 3 of Table 5) and the marginal impact with increase in capital would be more in the sector.

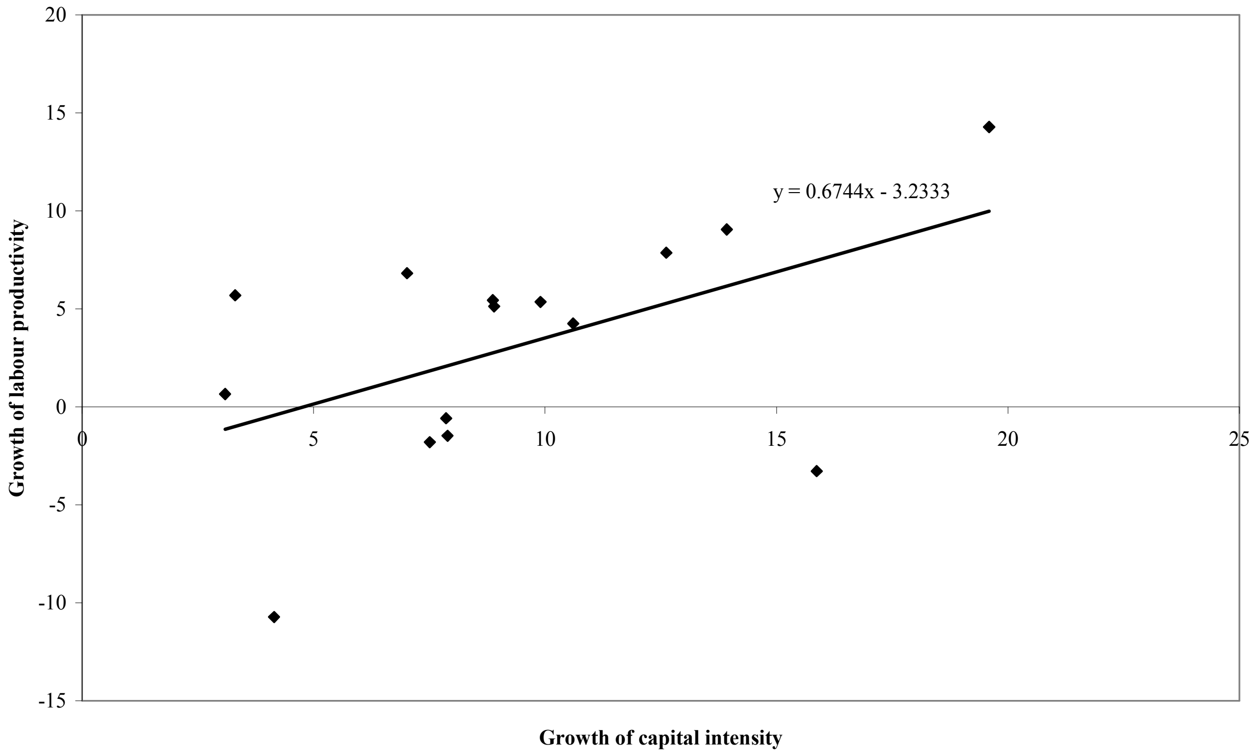

Figure 4: Relationship between growth of labour productivity and capital intensity, unorganized manufacturing sector – 1994-2005

We have also examined the movements in capital intensity in organized and unorganized sectors of Indian states over time (Table 6). We notice an across-the-board increase in capital intensity in both the sectors over time in all the 15 major states. The capital-labour ratio grew faster in the unorganized sector (rate of 9.3 per cent per annum) as compared to the organized sector (annual growth rate of 7.4 per cent). In both the sectors, capital-labour ratio registered a faster growth in the first period (1994-2001) than that in the second period (2001-2005). The growth was marginally faster in the unorganized sector in the first period but was significantly higher in the second period than in the organized sector. In the organized sector, only Assam and WB recorded an improved growth performance in capital intensity during

2001-2005 while TN, Maharashtra and Bihar registered a similar growth performance in the unorganized sector.

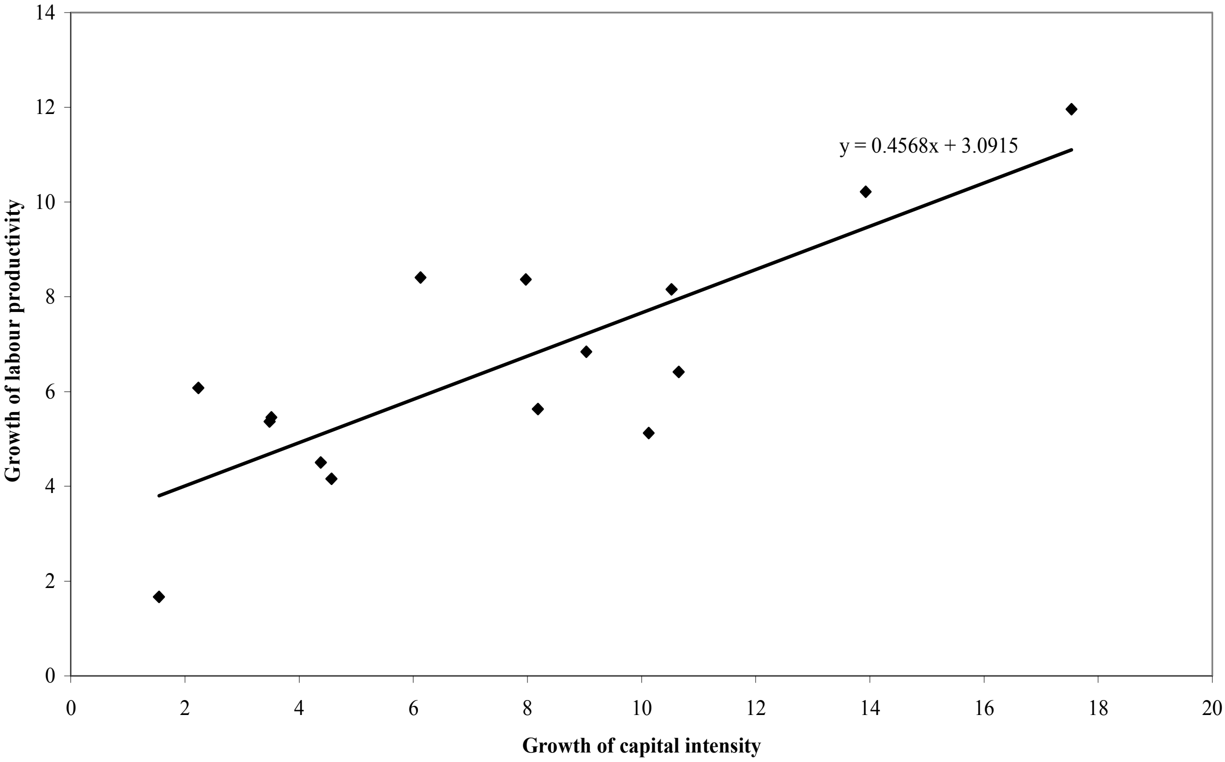

Figure 5: Relationship between growth of labour productivity and capital intensity, organized manufacturing sector – 1994-2005

Table 6: Growth in Capital Intensity

	State	**Organized Sector**			**Unorganized Sector**		
		1994-2001	**2001-2005**	***1994-2005***	**1994-2001**	**2001-2005**	***1994-2005***
1	Punjab	9.31	-2.17	*4.56*	14.57	4.55	*9.90*
2	Haryana	9.76	0.90	*6.13*	9.46	8.23	*8.90*
3	Rajasthan	5.66	-2.70	*2.24*	12.98	4.14	*8.87*
4	UP	25.62	-13.97	*7.97*	25.58	-11.66	*7.02*
5	Bihar	11.70	9.09	*10.65*	4.30	12.29	*7.86*
6	Assam	2.49	4.98	*3.48*	6.84	1.01	*4.15*
7	WB	15.92	19.99	*17.53*	13.40	14.56	*13.92*
8	Orissa	5.95	2.08	*4.38*	18.71	12.54	*15.87*
9	MP	6.52	-0.84	*3.51*	27.05	11.22	*19.59*
10	Gujarat	16.38	2.30	*10.53*	-0.49	7.55	*3.09*
11	Maharashtra	14.45	-0.57	*8.18*	1.99	4.91	*3.31*
12	AP	14.60	1.18	*9.03*	11.15	4.12	*7.89*
13	Karnataka	29.85	-6.37	*13.93*	12.88	12.31	*12.62*
14	Kerala	1.76	1.22	*1.54*	15.96	-1.82	*7.51*
15	TN	15.98	1.89	*10.12*	6.73	15.44	*10.61*
	Mean	**12.14**	**1.08**	***7.41***	**12.46**	**6.00**	***9.32***

Total factor productivity growth

One of the problems in partial factor productivity approach is its failure to capture the contribution of other inputs in the production process. It is also argued that a rapid growth in a partial factor productivity measure could be due to a rapid growth in an omitted input category and thus could be quite misleading (Diewert, 2003). This may be true for organized manufacturing in India, which has shown an average growth in labour productivity to the tune of 6.66 per cent for the past 15 years (last row, Table 4) and correspondingly increase in capital intensity (last row, Table 6). Similarly, the partial measures are incapable of identifying the causal factor accounting for observed productivity growth. This problem could be resolved by analyzing TFP growth, which encompasses the effect not only of technical progress but also of better utilization of capacities, learning-by-doing, and improved skills of labour (Ahluwalia, 1991). Various methods have been adopted to measure TFP such as the growth accounting method, the production function approach, Data Envelopment Analysis, stochastic frontier approach and so on. In this paper, we have calculated the growth in TFP using a production function approach, where the function is estimated using the LP method. The production function analysis also provides estimates of output elasticity of labour and capital. We have estimated the production function for 15 major Indian states separately for organized and unorganized sectors using four-digit industry level data for the three time periods.[13]

The estimated CD production function (Table 7) shows that, barring few states, the elasticity of output with respect to labour and capital is significantly different from zero in the unorganized manufacturing sector. In 12 out of 15 states, the elasticity of capital is relatively higher than that of labour, implying that the former played a more significant role in the production process. Only in Bihar and MP, the contribution of capital is found to be insignificant. This corroborates our previous finding that the firms in the unorganized sector are moving towards a more capital intensive production process (refer to Table 6 in the previous section). Perhaps this may be the reason why we find increasing returns to scale in all the 15 states in unorganized sector, whereas it is only in 8 states that returns to scale are increasing in the organized sector. However, the relatively lesser role played by labour in the production process is a cause for concern as the unorganized segment is the larger employment provider by a wide margin vis-à-vis organized sector.

[13] The estimation is carried out in STATA 11.

In the organized manufacturing sector, capital is a significant contributor to GVA in 9 states and in 8 states, barring Kerala, its contribution is more than that of labour. In Punjab, WB, Assam, MP and Gujarat, the contribution of capital is not significant while in two states – Haryana and Rajasthan - the contribution from labour is insignificant. Orissa is the only state where the contributions from both labour and capital are found to be insignificant.

Table 7: LP estimates (at the four-digit level)

States	Organized Sector		Unorganized Sector	
	Labour	Capital	Labour	Capital
Punjab	0.803* (0.442)	0.050 (0.346)	0.749* (0.202)	0.621* (0.16)
Haryana	0.529 (0.478)	0.718* (0.338)	0.686* (0.157)	0.709* (0.187)
Rajasthan	0.283 (0.271)	0.523* (0.21)	0.432* (0.061)	0.907* (0.091)
Uttar Pradesh	0.433* (0.21)	0.713* (0.14)	0.415* (0.196)	0.709* (0.119)
Bihar	0.551* (0.2)	0.769* (0.181)	0.844* (0.269)	0.192 (0.316)
Assam	0.888* (0.341)	0.321 (0.207)	0.311* (0.090)	0.998* (0.183)
West Bengal	0.500* (0.276)	0.19 (0.205)	0.293* (0.043)	0.785* (0.061)
Orissa	0.225 (0.547)	0.326 (0.263)	0.333* (0.050)	0.902* (0.083)
Madhya Pradesh	1.181* (0.403)	0.092 (0.287)	0.634* (0.332)	0.326 (0.418)
Gujarat	1.326* (0.488)	0.233 (0.404)	0.519* (0.132)	0.870* (0.146)
Maharashtra	0.140* (0.084)	0.637* (0.097)	0.289* (0.051)	0.878* (0.137)
Andhra Pradesh	0.436* (0.118)	0.445* (0.138)	0.443* (0.067)	0.904* (0.169)
Karnataka	0.543* (0.288)	0.648* (0.278)	0.423* (0.117)	0.910* (0.147)
Kerala	0.666* (0.201)	0.430* (0.2)	0.331* (0.068)	1.083* (0.093)
Tamil Nadu	0.241* (0.085)	0.766* (0.136)	0.467* (0.054)	0.669* (0.1)

Notes: * - indicates the coefficient is statistically significant at minimum 10% level. Figure in parenthesis are the standard errors.

Since the organized sector is more capital intensive (last column of Table 5) and has higher labour productivity, a t-test is carried out to see whether output elasticity with respect to labour and capital are different across the two sectors. The results reveal that labour and capital coefficients are significantly different between the two sectors in all the states except UP. In case of UP, both the labour and capital coefficients are not significantly different across the two sectors. Perhaps this may be the reason that the labour productivity and capital intensity is same for both the sectors for the state.

TFP growth estimates

The TFP reported a marginal increase in the organized manufacturing sector over the period 1994-2005 (Table 8). A comparison of TFPG during 1994-2001 and 2001-2005 reveals that TFP growth accelerated in the latter period as compared to the former. The average annual TFPG for the 15 states was 0.04 per cent in the first period, which increased to 3.1 per cent in the second period. We also find that the aggregate growth masks the inter-regional differences in productivity growth. Only Kerala and Punjab witnessed a TFPG similar to the one observed for the sector as a whole. TFP in Kerala grew at an annual rate of 0.4 per cent in the period 1994-2001 and then accelerated to 3.17 per cent per annum in the second period (2001-2005) while it increased to 2.2 per cent from 1.7 per cent in Punjab.[14] Assam registered growth in TFP in both the periods, though TFPG slowed down in the second period. A turnaround in TFPG is noticed in the organized sectors of 9 out of 15 states in the second period. In MP, Gujarat and Assam, TFP slowed down in the second period while it declined in Bihar. On the whole, Gujarat registered the highest growth in TFP followed by MP and Assam in the period 1994-2005.

[14] This increase in TFP in organized sector in Kerala can be easily linked to the fall in employment in the state during the period.

Table 8: Total Factor Productivity Growth in the Organized Sector

State	1994-2001			2001-2005			1994-2005		
	Obs.	**Mean**	**SD**	**Obs.**	**Mean**	**SD**	**Obs.**	**Mean**	**SD**
Punjab	83	1.74	22.81	83	2.22	21.70	81	3.04	10.64
Haryana	82	-2.97	22.43	81	2.56	31.47	82	-1.79	15.70
Rajasthan	82	-0.73	22.46	83	1.09	36.87	82	-1.96	22.38
UP	96	-1.28	19.05	97	6.65	24.24	96	1.29	10.53
Bihar	84	-0.94	24.71	79	-3.80	27.02	84	-5.24	22.16
Assam	36	3.89	32.78	37	1.66	22.33	36	4.06	10.34
WB	92	-0.59	14.37	91#	4.82	42.77	93	-0.94	14.16
Orissa	62	-0.08	16.07	63	1.23	27.11	64	-0.69	18.37
MP	87	6.31	28.54	87#	0.71	22.14	88	4.69	11.58
Gujarat	90	5.52	30.34	87#	0.74	29.15	90	5.20	17.90
Maharashtra	95	-6.17	8.86	97	5.14	17.08	96	-1.64	6.63
AP	91	-1.32	11.87	94	9.57	40.13	93	1.71	7.50
Karnataka	93	-0.16	20.34	94	8.20	51.56	90	2.83	10.95
Kerala	82	0.47	14.12	82	3.13	20.09	83	-0.31	12.10
TN	94	-3.11	11.54	96	3.25	24.25	95	-0.58	6.91
Mean		**0.04**			**3.14**			**0.64**	

Notes: * estimated from the data without outliers.[15]. # For WB, MP and Gujarat there were more outliers (1 each in WB and MP and 2 in Gujarat) having very high TFPG value (very close to mean + 2StdDev) for period 2 affecting overall TFPG, hence have been removed.

We noticed a completely different picture with regard to TFP growth in the unorganized manufacturing sector (Table 9). TFP reported a steady decline over the period 1994-2005. The decline that started during 1994-2001 continued unabated in the period 2001-2005 with a decline of 16 per cent in this period. Majority of the states registered TFP decline in both the periods. Only two states - Bihar and MP – registered TFP growth during 1994-2001 while UP is the only state where TFP grew in the period 2001-2005.[16]

[15] On checking standard deviation of TFP growth, it was found that for some states, few industries were influencing TFPG. The present table gives TFP growth estimates after omitting the industries falling beyond mean+/-2*StdDev. The TFPG estimates from the data with outliers are available on request.

[16] As we noted earlier, we have also computed TFPG using the DD method. The correlation between SD and DD method for the entire period (1994-05) is found to be 0.7 and 0.9 for organized and unorganized manufacturing respectively. This indicates the direction of TFPG change across the 15 states is similar, whether one uses the SD or DD method for the study period (though the absolute values will obviously differ across the two methods). This suggests that the issue of which deflation procedure to use to calculate TFPG in Indian manufacturing may be of second order importance.

Table 9: Total Factor Productivity Growth in the Unorganized Sector

State	1994-2001			2001-2005			1994-2005		
	Obs.	**Mean**	**SD**	**Obs.**	**Mean**	**SD**	**Obs.**	**Mean**	**SD**
Punjab	66	-7.69	10.39	65	-3.72	24.57	65	-6.25	12.02
Haryana	57	-8.91	10.55	56	-11.04	21.26	57	-10.63	10.69
Rajasthan	61	-7.60	10.23	62	-11.48	20.51	61	-9.96	10.10
UP	96	-2.80	21.58	96	4.44	20.83	96	0.60	9.51
Bihar	79	0.74	24.26	79	-13.75	31.26	79	-8.48	22.20
Assam	41	-3.89	10.92	42	-32.52	12.27	42	-18.33	7.73
WB	80	-4.54	8.49	80	-10.75	21.38	82	-8.48	10.55
Orissa	49	-6.67	10.40	49	-34.18	9.74	47	-20.29	4.59
MP	66	7.99	32.95	64	-4.06	23.38	65	4.92	14.92
Gujarat	69	-2.51	12.06	66	-19.38	16.90	66	-10.70	8.83
Maharashtra	86	-2.45	10.22	88	-4.74	22.70	87	-4.03	12.06
AP	66	-3.08	9.88	66	-26.98	16.26	67	-14.73	9.08
Karnataka	61	-3.64	10.79	60	-26.52	15.20	60	-15.26	9.52
Kerala	60	-13.70	12.39	61	-22.21	14.30	62	-17.94	8.89
TN	77	-1.42	6.96	78	-23.14	19.21	77	-12.59	9.63
Mean		**-4.01**			**-16.00**			**-10.14**	

Notes: Estimated from the data without outliers.

The declining role of labour in the production process and the falling total factor productivity on one hand and increasing capital intensity of the sector on the other hand, is a cause of worry and raises several important questions. Is capital being under-utilized? Or is the easy availability of imported capital goods following the trade reforms of the 1980s and 1990s inducing more unorganized sector firms to invest in capital relative to labour? Can the increase in capital intensity be explained by investment by unorganized firms in generators and invertors? We do not have the data to disentangle alternate explanation of this puzzling phenomenon, but these issues can be an area of further research.

Discussion

Several researchers have argued that output growth is because of an increase in factor inputs and not because of the increase in productivity. This we have seen especially in newly industrializing economies (NIEs), where the output growth is seen as largely as a result of factor accumulation (Krugman 2004).

An attempt is made to ascertain whether output growth in Indian manufacturing is a result of productivity growth or factor accumulation. The scatter plots in Figures 6 and 7 and Table 10 clearly show that the growth in GVA in both the sectors is mostly productivity driven and not input driven.[17] This is further supported by the value of the correlation coefficient between

[17] It should be noted that the estimates of GVA growth in the National Accounts Statistics (NAS) for the unregistered manufacturing sector across the 15 states are not strictly comparable with our estimates of GVA in Table 10. To obtain the output series of the unregistered manufacturing sector from 2001 onwards, the Central Statistical Organization first calculated gross value added per worker from the All-India Census of Small-Scale

growth of value added and TFP growth. The effect, however, is stronger in the unorganized sector (last row, Table 10).

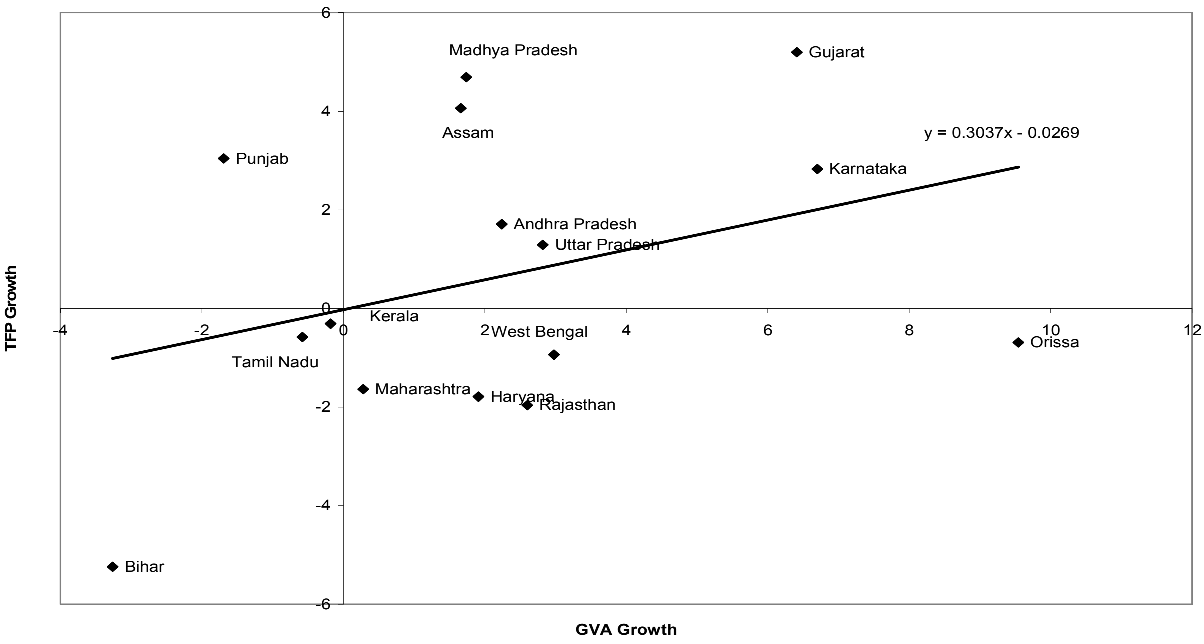

Figure 6: GVA growth Vs TFP growth, Organized Sector -1994-2005

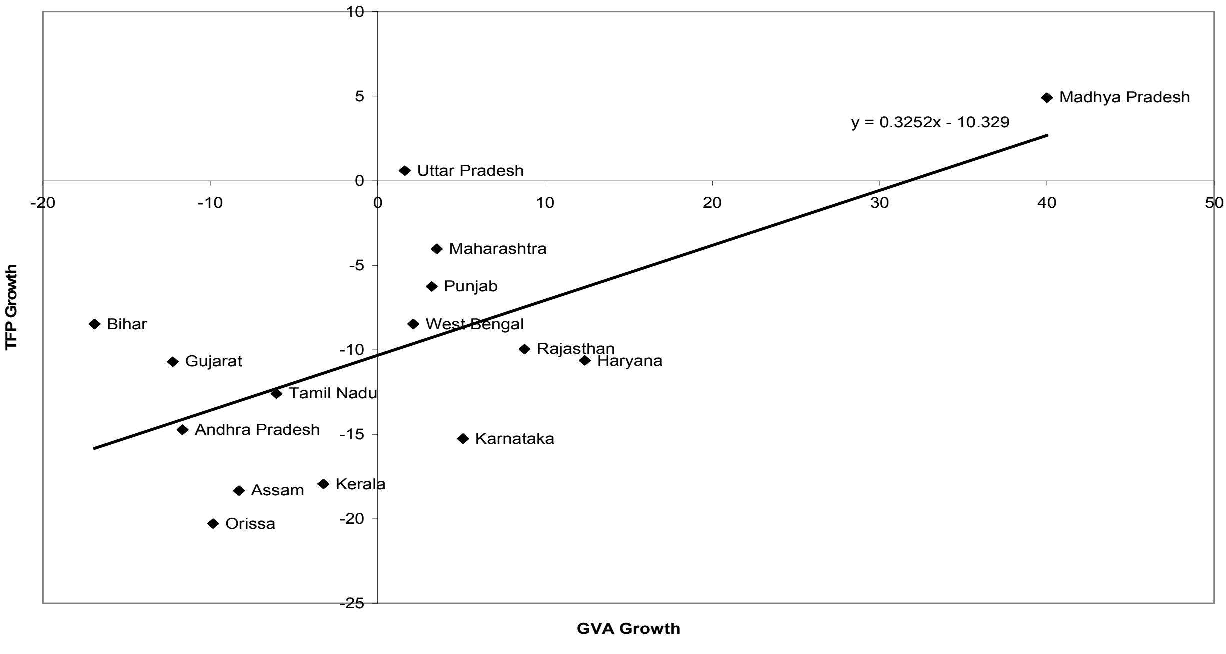

Figure 7: GVA growth Vs TFP growth, Unorganized Sector – 1994-2005

Industrial (SSI) Units, 2001/2002, and the NSSO 2000/2001 survey of unorganized manufacturing sector and multiplied these estimates by workforce estimates from the Employment-Unemployment Survey of 1999/2000. These were then updated for later years using the index of industrial production (IIP) at NIC1998 3 digit level (which includes both the organized and unorganized sectors) (see NAS 2007, Ch 13). As is well known, the IIP series is highly problematic in India (see Nagaraj 1999). Our calculation of GVA (and hence, TFPG) in the unorganized manufacturing sector in the 1994-2005 period is based on actual surveys, in comparision with the interpolated data presented in the NAS.

Table 10: Trends in GVA and TFP, 1994-2005

States	**Organized Sector**		**Unorganized Sector**	
	GVA Growth	**TFPG**	**GVA Growth**	**TFPG**
Punjab	-1.69	3.04	3.23	-6.25
Haryana	1.91	-1.79	12.38	-10.63
Rajasthan	2.60	-1.96	8.78	-9.96
UP	2.82	1.29	1.62	0.60
Bihar	-3.26	-5.24	-16.92	-8.48
Assam	1.66	4.06	-8.29	-18.33
WB	2.98	-0.94	2.13	-8.48
Orissa	9.54	-0.69	-9.83	-20.29
MP	1.74	4.69	40.00	4.92
Gujarat	6.41	5.20	-12.24	-10.70
Maharashtra	0.28	-1.64	3.54	-4.03
AP	2.24	1.71	-11.66	-14.73
Karnataka	6.70	2.83	5.11	-15.26
Kerala	-0.18	-0.31	-3.24	-17.94
TN	-0.58	-0.58	-6.05	-12.59
Correlation coefficient	**0.35****		**0.64***	

Notes: '*' and '**' implies the values are significant at minimum 5 and 10 per cent level respectively; TFP growth is calculated after removing the outliers.

The lack of a strong complementary relationship between the large and small firms is regarded as one of the major limitations of the development of small manufacturing sector in India. Of late, subcontracting and outsourcing are emerging as important developments that connect small and micro units with large units, to the benefit of both. Many studies have pointed out that the increased growth of the unorganized sector in recent years was a result of substantial increases in outsourcing by the organized sector (Ramaswamy 1999). It is regarded as an important source of efficiency and competitiveness for these industries, most markedly for the small enterprises. According to this view, if there is a benevolent relationship between the two, it would have definitely favored the production process in the unorganized sector, which would get reflected in its productivity. But our findings do not support this view point as the productivity has declined in the unorganized sector while it increased in the organized sector. In addition, the low value of the correlation coefficient between TFPG of organized and unorganized sectors rules out the existence of any significant relationship between the two (Figures 8, 9 and 10).

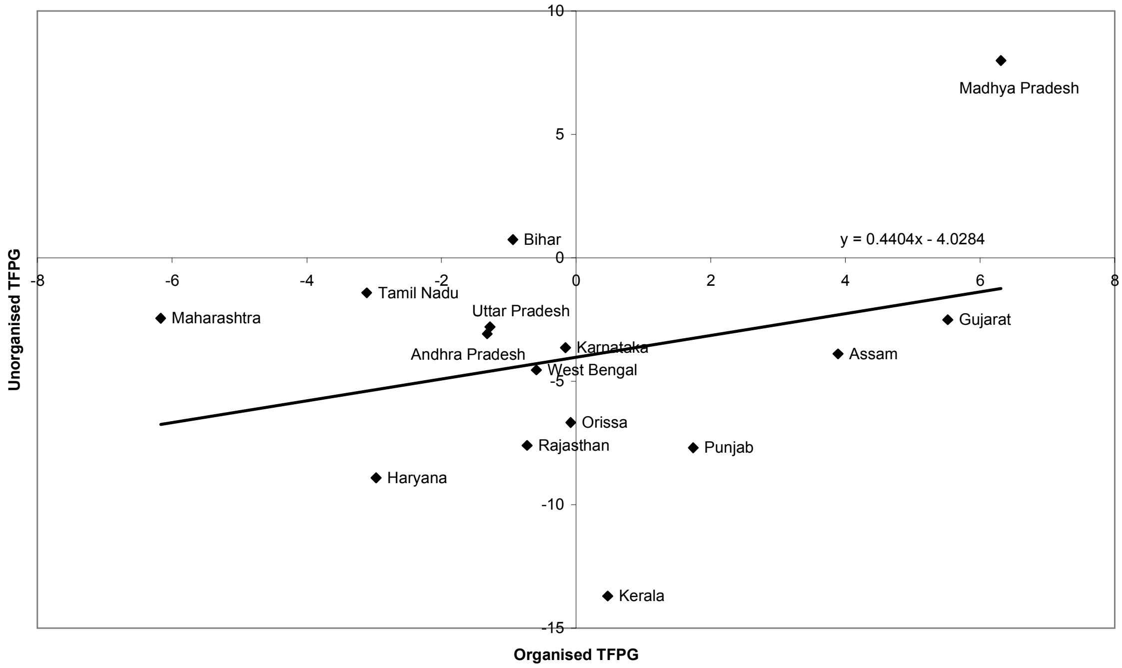

Figure 8: Organized TFPG Vs Unorganized TFPG, 1994-2001

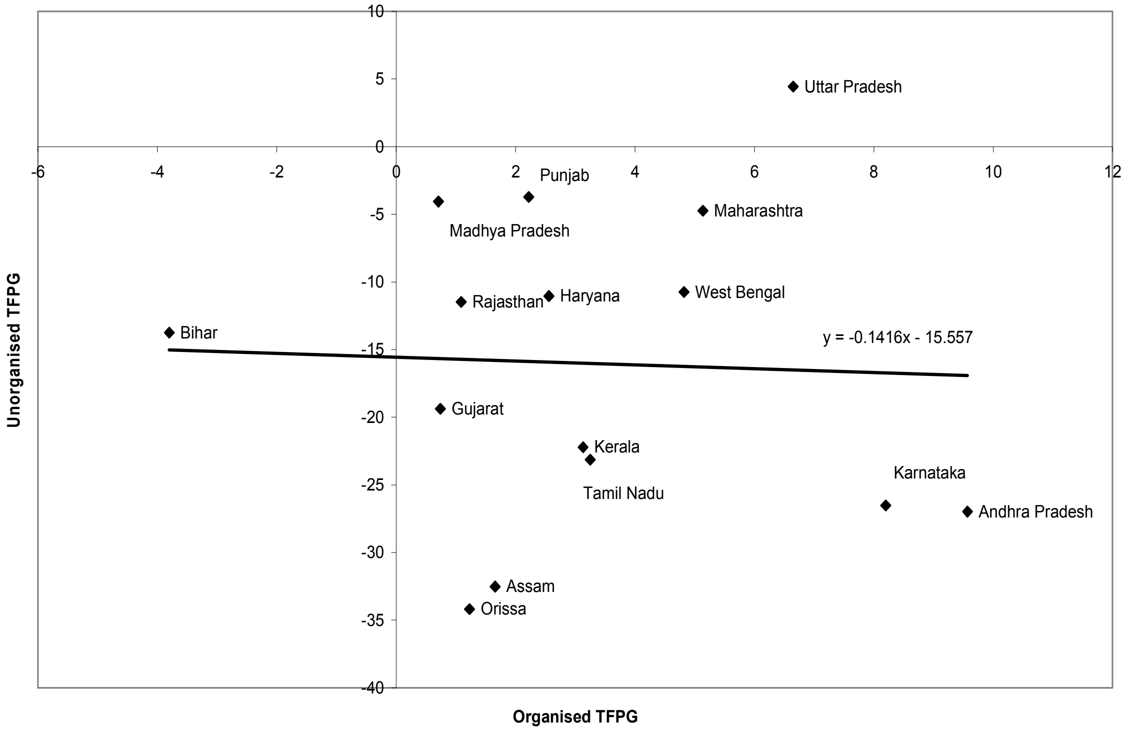

Figure 9: Organized TFPG Vs Unorganized TFPG, 2001-2005

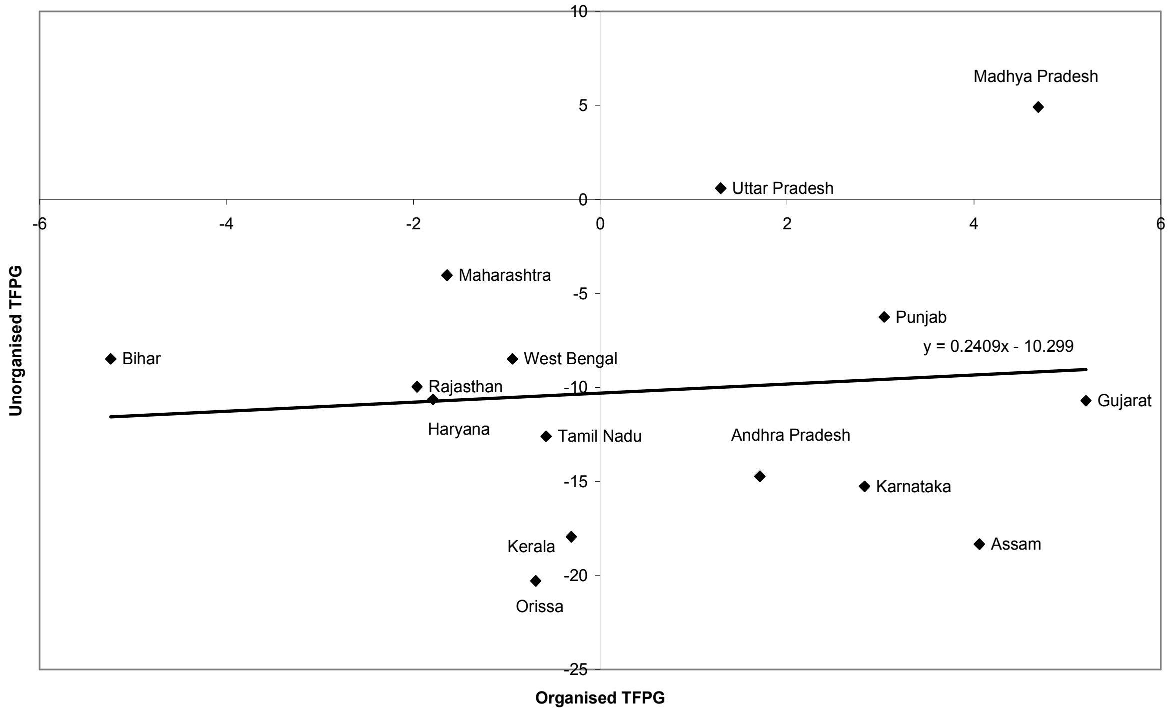

Figure 10: Organized TFPG Vs Unorganized TFPG, 1994-2005

6. Conclusions

This study analysed the productivity performance of the organized and unorganized segments of the Indian manufacturing sector at the sub-national level for the period 1994-95 to 2004-05. By doing so, the study also examined the impact of reforms on their performance. Both partial and total factor productivity methods were employed to compute productivity levels and growth rates. Labour productivity is the partial factor productivity measure used in the study while a Cobb-Douglas production function is employed to estimate TFPG. To correct the endogeneity bias associated with the production function estimation, we employed a method recently developed by Levinsohn and Petrin.

Our analysis reveals that labour productivity has increased for the organized sector over time whereas both labour productivity and capital intensity growth have slowed down in the unorganized sector during the 2000-01 to 2005-06 period. Our production function analysis shows that capital rather than labour played a significant role in the production process in the organized and unorganized manufacturing sector. A relatively lesser role was played by labour in the production process in the unorganized sector. This is a cause for concern as this segment is a significantly larger employment provider as compared to its counterpart, the organized sector.

TFP grew steadily in the organized manufacturing sector while there was a decline in the unorganized manufacturing sector. The declining role of labour in the production process and the falling total factor productivity on one hand and increasing capital intensity of the sector on the other hand, is a cause of worry and raises several important questions. Our analysis also shows that the growth in GVA is mostly productivity driven not input driven in both the sectors.

The study gives an account of TFP and its growth for organized and unorganized manufacturing sector. By doing so, it opens up a number of avenues for future research. Why did the performance of unorganized sector deteriorate in the post-2000 period? What role did opening up of the economy with respect to the financial sector and international trade play in this decline? Why is the performance of the unorganized sector so poor, in spite of the scaling back of reservation policies? Why did the performance of the organized manufacturing sector improve in the post-2000 period, when there were no significant economic reforms? Has liberalization resulted weakening of the linkages between organized and unorganized sector? Why is the performance of states differing so significantly with respect to TFP in manufacturing despite the fact that all the states are subjected to similar reforms? What role did the relationship between subnational states and the business sector play in explaining such a varied performance? These issues will be the focus of our research in the future.

References

Aghion P, Burgess R, Redding S and Zilibotti F (2008) The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India, *American Economic Review*, 98, No. 4, 1397–1412.

Ahluwalia, I.J. (1991) Productivity and Growth in Indian Manufacturing, Oxford University Press, New Delhi.

Balakrishnan, P and K. Pushpangadan (1994) "Total Factor Productivity Growth in Manufacturing Industry: A Fresh Look", Economic and Political Weekly, 29: 2028-35.

Balakrishnan, P. (2004) "Measuring Productivity in Manufacturing Sector", Economic and Political Weekly, April 3-10.

Balakrishnan, P. and Pushpangadan, K. (1998), What do we know about productivity growth in Indian industry? Economic and Political Weekly, 33, 2241–46.

Balakrishnan, P., Pushpangadan, K, and Suresh Babu, M (2000) Trade liberalisation and productivity growth in manufacturing: Evidence from firm-level panel data, Economic and Political Weekly 35, 3679-3682.

Das, D. K. (2004) Manufacturing productivity under varying trade regimes, 1980-2000, Economic and Political Weekly, 39, 423-433.

Dholakia, R. H. and Dholakia, B. H. (1994) Total factor productivity growth in Indian manufacturing, Economic and Political Weekly, 29 , 342-344

Diewert, W.E. Services and the New Economy: Data Needs and Challenges, Discussion Paper No. 03-09, Department of Economics, University of British Columbia (UBC), Vancouver, Canada, 2003.

Goldar, B. (2002) TFP growth in Indian manufacturing in 1980s, Economic and Political Weekly, 37, 4966–4968.

Goldar, B. Productivity Growth in Indian Industry, Allied Publishers, New Delhi, 1986.

Grilliches, Z. and Ringsted V. (1971) Economies of Scale and Form of the Production Function, North-Holland Publishing Company, Amsterdam.

Hossain, M.A. and Karunaratne, N.D. (2004) "Trade liberalization and technical efficiency: evidence from Bangladesh manufacturing industries", The Journal of Development Studies, 40, 87-114.

Krishna, P. and Mitra, D. (1998) Trade liberalization, market discipline and productivity growth: new evidence from India, Journal of Development Economics, 56, 447-462.

Krugman, P. (2004) The myth of Asia's miracle, Foreign Affairs 73, no. 6: 62–78.

Kumar, S (2006) A decomposition of total productivity growth: A regional analysis of Indian industrial manufacturing growth, International Journal of Productivity and Performance Management, 55, No. 3/4, 311-331.

Levinsohn, J. and Petrin, A (2003) 'Estimating Production Functions Using Inputs to Control for Unobservables,' Review of Economic Studies, 70, 317–342.

Mahadevan, R. (2002) Is there a real TFP growth measure for Malaysia's manufacturing industries?, ASEAN Economic Bulletin, 19, 178-190.

Marschak, J. and Andrews, W. H., (1944) 'Random Simultaneous Equations and the Theory of production,' Econometrica, 12, 143–205.

Mukherjee, D. (2004) Productivity in the small manufacturing enterprises: determinants and policy issues, The Indian Journal of Labour Economics, 47, 913-927.

Nagaraj, R. (1999) How Good are India's Industrial Statistics? An Exploratory Note, Economic and Political Weekly, 34.

NAS (2007) National Accounts Statistics – Sources & Methods, Chapter 13, CSO, Govt. of India, New Delhi.

Olley, G. S. and Pakes, A. (1996) 'The Dynamics of Productivity in the Telecommunications Equipment Industry',' Econometrica, 64 (6), 1263–1297.

Pattnayak, S. S. and Thangavelu, S.M. (2005) Economic reform and productivity growth in Indian manufacturing industries: an interaction of technical change and scale economies, Economic Modelling, 22, No.4, 601-615.

Pradhan, G. and Barik, K. (1998) Fluctuating total factor productivity in India: evidence from selected polluting industries, Economic and Political Weekly, 33, M25–M30.

Ramaswamy, K. V. (1999). The Search for Flexibility in Indian Manufacturing: New Evidence on Outsourcing Activities. Economic and Political Weekly, 6 February, pp. 363–68.

Rao, J.M. (1996) "Manufacturing Productivity Growth: Method and Measurement", Economic and Political Weekly, 31: 2927-36.

Ray, S. C. (1997) Regional variations in productivity growth in Indian manufacturing: a nonparametric analysis, Journal of Quantitative Economics, 13, 73-94.

Ray, S. C. (2002) Did India's economic reforms improve efficiency and productivity? a nonparametric analysis of the initial evidence from manufacturing, Indian Economic Review, 37, 23-57.

Salim, R. A. and K.P. Kalirajan (1999) "Sources of output growth in Bangladesh food processing industries: a decomposition analysis", The Developing Economies, 37, 247-269.

Sarris, A. and Hallam, D. (2006) Agricultural Commodity Markets and Trade, Edward Elgar, Cheltenham.

Sen, K. (2009), Trade Policy, Inequality and Performance in Indian Manufacturing, Routledge, London

Sen, K. and R.R. Vaidya (1997), The Process of Financial Liberalization in India, Delhi: Oxford University Press.

Srinivasan, T.N., 2000. Eight Lectures on India's Economic Reforms. Oxford University Press, New Delhi.,

Srivastava, V. (2000), "The Impact of India's Economic Reforms on Industrial Productivity, Efficiency and Competitiveness." Report of a project sponsored by the Industrial Development Bank of India. New Delhi: National Council of Applied Economic Research.

Trivedi, P. (2004) An inter-state perspective on manufacturing productivity in India: 1980-81 to 2000-01, Indian Economic Review, 39, 203-237.

Trivedi, P., A. Prakash and D. Sinate (2000) Productivity in Major Manufacturing Industries in India: 1973-74 to 1997-98, Study No. 20, DRG, RBI, August.

Unel, Bulent (2003) Productivity Trends in India's Manufacturing Sectors in the last Two Decades, IMF Working Paper No. WP/03/22.

Unni, J., Lalitha, N. and Rani, U. (2001) Economic reforms and productivity trends in Indian manufacturing', Economic and Political Weekly, 36, 3915-22.