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# INVESTMENT CLIMATE AND TOTAL FACTOR PRODUCTIVITY IN MANUFACTURING: ANALYSIS OF INDIAN STATES

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## Foreword

ICRIER Working Paper No. 122 identified a slow deterioration in governance as one of the factors in the inability of the economy to show sustained growth take off after the reform of the early nineties. This paper investigates some of the elements of governance such as red tape and bureaucracy and the functioning of public utility monopolies on economic performance. It does so by first measuring total factor productivity growth across states and over time and then investigating the impact on TFPG of various governance factors that effect the investment climate. It demonstrates rigorously for the first time how poor governance and investment climate in States has low productivity growth and consequently adversely affected overall growth.

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**INVESTMENT CLIMATE AND TOTAL FACTOR PRODUCTIVITY IN MANUFACTURING: ANALYSIS OF INDIAN STATES**

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## Abstract

India has been undertaking significant liberalisation initiatives since 1991 with a view to improving the efficiency of manufacturing industries and achieving faster GDP growth. The effects of national level policies can differ considerably across the Indian states, depending upon the nature of various institutional factors and policies in the states, which can be classified under the broad heading 'investment climate' (IC). The present paper investigates the influence of IC on the levels of total factor productivity (TFP) in the organised manufacturing sector across the major Indian states.

Using data from the Annual Survey of Industries (ASI), we estimate multilateral TFP indices for the total registered manufacturing sector in all the major states for the period 1980-2000. For a comparison of the states with significantly different IC, we also present detailed estimates of TFP (at the 2-digit industry level) for three states – Maharashtra, Punjab, and Uttar Pradesh. These states are selected on the basis of the observation that Maharashtra and Uttar Pradesh rank respectively at the top and bottom in the ranking of states according to IC, while Punjab ranks somewhere in the middle. This ranking is based on the *Firm Analysis and Competitiveness Survey (FACS)* conducted jointly by the *Confederation of Indian Industries* (CII) and the *World Bank* in 2000 and 2003 in the Indian states. A descriptive analysis of TFP in the states' aggregate manufacturing and a comparison of TFP in individual industries across the three states indicate a positive relationship between a market friendly IC and TFP.

For the purpose of this study, the *World Bank* provided us the tabulated figures from FACS 2003 pertaining to certain quantitative indicators of IC in various industries across 12 Indian states. Using these data, we undertook an econometric analysis to investigate the influence of various dimensions of IC on TFP of states' manufacturing industries during the 1990s. The regression analysis, after controlling for other industry and year specific factors, clearly shows that IC matter for TFP. The dummies for the best and good IC states yields positive co-efficient with statistical significance, after considering the poor IC states as the base for comparison. Further, as expected, the value

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of the co-efficient is higher for the best IC states as compared to the good IC states. These dummies are based on the subjective notion of IC in the states expressed by business managers. Alternatively, we consider the average number of days required to get a new power connection in the state as a proxy for IC, which attains a statistically significant negative co-efficient (the result is the same if the proxy variable used is the number of days required to get a new telephone connection in the state).

The percentage of the management's time spent with government officials of regulatory and administrative issues is negatively associated with TFP. Further, mandays lost in industrial disputes has a negative association with TFP. On the other hand, the variables representing the availability of power for industrial use and disbursement of credit in various state industries are found to exert a positive influence on TFP.

In essence, a market friendly IC is essential for achieving higher level of TFP. This conclusion is robust, unaffected by the choice of IC indicator. Our analysis also shows that there are scopes for initiating policy measures to improve the overall or particular dimensions of IC in almost all the states. States that foster a market friendly IC would attract greater investment and grow faster while others lag behind. Thus, it is not surprising that India's overall economic progress since 1991 is leaving some of the states behind. Evidently, the most effective way to eliminate regional growth inequality is to ensure that the lagging states initiate reforms to make their IC more market friendly.

***Key words***: Investment climate, Total factor productivity, manufacturing, Indian states

***JEL***: L 50, D 24, L 60

# I Introduction

After nearly three decades of import substitution, economic liberalization was initiated in India in the early 1980s and got intensified since the early 1990s. Various aspects of production and trade are primarily determined by government policy under the import substitution policy regime, whereas, market forces assume greater significance in a liberalized economy. Unlike what used to be the case during import substitution, investment activities in India are no longer governed by the national planning and by the objective of achieving balanced regional development. Instead, investment decisions are now made on economic considerations: it depends upon the returns that investors expect and the uncertainties around those returns.

Though the national policy initiatives apply equally to all the Indian states, their effects can differ considerably across the states, depending up on the nature of various institutional factors and policies in the states, which can be classified under the broad heading 'investment climate' (henceforth IC). Thus, a market oriented macro and trade policies at the national level need to be complemented with policies that foster a market friendly IC in the states. To make the point emphatically, it is important to assemble credible evidence to show that a market friendly IC is indeed a crucial determining factor of industrial performance in the states. The present study is an attempt in that direction.

We investigate in this paper the influence of IC on the levels of total factor productivity (henceforth TFP) in the registered manufacturing sector across the major Indian states. Our focus on the levels, rather than the growth, of TFP is consistent with the approach followed in the recent literature that is concerned with the analysis of the role of institutions (or what is called social infrastructure) on the levels of aggregate productivity in a cross-country framework (Hall and Jones, 1999)[1]. We estimate TFP for the total registered manufacturing sector in all the major Indian states for the period 1980-2000. For a comparison of the states with significantly different IC, we also present detailed estimates of

[1] Hall and Jones (1999) also explain the rationale in support of focusing on the levels, rather than the growth, of productivity.

TFP (at the 2-digit industry level) for three states – Maharashtra, Punjab, and Uttar Pradesh. These states are selected on the basis of the observation that Maharashtra and Uttar Pradesh rank respectively at the top and bottom in the ranking of states according to IC, while Punjab ranks somewhere in the middle. This ranking is based on the "Firm Analysis and Competitiveness Survey (FACS)" conducted across the Indian states jointly by the World Bank and the Confederation of Indian Industry (CII). The FACS has been conducted twice in India, one contains data for the year 2000 and the other for the year 2003. The ranking of the states is on the basis of certain subjective notions of IC expressed by entrepreneurs and company managers.

The remainder of the paper is structured as follows. In Section II, we provide a brief overview of the existing studies that deal with the various aspects of IC in the Indian states. Section III discusses the methodology followed in the present study to measure TFP. A descriptive analysis of the estimates of TFP in the registered manufacturing sector of the states for the period 1980-2000 is provided in Section IV. The estimates of TFP for the total manufacturing are presented for the 17 major states, and at the 2-digit industry level for Maharashtra, Punjab and Uttar Pradesh. In Section V, we undertake a regression analysis to investigate the effect of IC on TFP, based on data for the 7 major industries and the 12 major states covered in FACS 2003. Details about the sources of data and construction of the variables are explained in the Appendix.

## II Investment Climate in Indian States: Evidence from the Existing Studies

In what follows, we provide a brief overview of the studies that deal with the various aspects of IC in the context of the Indian states.

### *II.1 Labor market regulation*

Labor regulations have been identified as an important element of IC in India. It is important to note two critical aspects of labor market regulation in India. First, labor regulation only applies to firms in the registered manufacturing sector. Second, the Indian constitution empowers state governments to amend the Industrial Disputes Act, 1947, which is the key piece of central legislation that sets out the conciliation, arbitration and adjudication procedures to be followed in the case of an industrial dispute. The state governments have extensively amended this Act during the post independence period. Besley and Burgess (2002) read the text of each amendment over the period of 1958-1992 and coded each amendment as pro-worker (+1), neutral (0) or pro-employer (-1). This procedure allowed them to ascertain whether labor regulations in a state are moving in a pro-worker or pro-employer direction. Having obtained the direction of amendments in any given year, they cumulated the scores over time to give a quantitative picture of the regulatory environment as evolved over time.

Following the above procedure, Besley and Burgess (2002) identified four states as pro-worker. These are: Gujarat, Maharashtra, Orissa and West Bengal. Six states have been identified as pro-employer: Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Rajasthan and Tamil Nadu. The states that did not experience any amendment over the period are: Assam, Bihar, Haryana, Jammu and Kashmir, Punjab and Uttar Pradesh. The cumulative scores for each of the states at the end of the period are shown in Table 1.

**Table 1: Index of Labor regulation in Indian States (cumulative scores for 1992)**

| Pro-Worker States | Score | Pro-Employer States | Score | Neutral States | Score |
|---|---|---|---|---|---|
| West Bengal | 4 | Andhra Pradesh | -2 | Assam | 0 |
| Maharashtra | 2 | Tamil Nadu | -2 | Bihar | 0 |
| Gujarat | 1 | Karnataka | -1 | Haryana | 0 |
| Orissa | 1 | Kerala | -1 | Jammu and Kashmir | 0 |
| | | Madhya Pradesh | -1 | Punjab | 0 |
| | | Rajasthan | -1 | Uttar Pradesh | 0 |

Source: Besley and Burgess (2002)

Making use of the variation in labor regulation across states and overtime, for the period 1958-1992, the regression analysis of Besley and Burgess (2002) indicated the following.

- Moving in a pro-worker direction led to a decline in the per capita output levels in the registered segment of the manufacturing sector.
- Moving in a pro-worker direction, however, led to an increase in the per capita output levels in the unregistered segment of the manufacturing sector.
- Moving in a pro-worker direction was associated with increases in urban poverty but does not affect rural poverty, reflecting the fact that the effects of labor regulation are mainly being felt in the registered sector which is found mainly in the urban areas.

Aghion et al (2003), extending the regression analysis of Besley and Burgess (2002), observed the following:

- States with more pro-worker regulation experienced less growth in output, employment, labor productivity and TFP for the 1980-1997 period.
- The negative impact of pro-worker regulation got magnified during the post-liberalization period. Thus, when market access is increased because of liberalization, it is even more damaging for industries to be located in a pro-worker state in terms of output, employment, labor productivity and TFP.

### *II.2 Access to Finance*

Access to finance is crucial for the emergence of small business enterprises in rural areas and hence to reduce rural poverty. Burgess and Pande (2003) analyzed the impacts of rural branch expansion of banks in India, using panel data of the 16 main Indian states for the period 1961-2000. The key findings are the following:

- States with more rapid bank branch expansion into unbanked areas experienced greater increase of per capita output in the unregistered manufacturing sector.
- States with more rapid bank branch expansion into unbanked areas experienced greater poverty reduction.

### *II.3 Land Reform*

State governments in India have jurisdiction over land reform legislation. Besley and Burgess (2000) exploit this fact to examine whether legislated land reforms had an appreciable impact on growth and poverty in India. They used panel data on the 16 main Indian states from 1958 to 1992. By examining and coding the content of each land reform in a given state, Besley and Burgess (2000) develop a variable that measures the total stock of land reforms passed in state *s* by year *t*. The major finding of the study are:

- After controlling for the effects of other factors, states with greater incidence of land reforms have done better in reducing poverty.
- Land reform benefited the landless by raising agricultural wages.

### *II.4 Infrastructure*

Mitra et al (2002) examined the effects of infrastructure on TFP and technical efficiency of the manufacturing industries in the Indian states. They observed marked disparities in terms of physical, social and economic infrastructure across the states. The study used annual data from 1976 to 1992 for 17 industries and 15 states. Using the principal components analysis, a composite indicator of infrastructure availability was developed. The states that ranked top in terms of infrastructure availability were Maharashtra, Punjab, and Gujrat, followed by Tamil Nadu, Karnataka and Kerala. States on the lower end of the scale included Assam, UP, and Bihar, followed by Orissa, Rajasthan and Madhya Pradesh. The major findings of the study are:

- Infrastructure endowments have a significant role towards explaining the variation in TFP and technical efficiency across the state industries.
- The key infrastructure related factors for increasing industrial TFP and technical efficiency are: (i) investment in primary education, (ii) greater efficiency of the states' financial system in terms of deposit mobilization and credit distribution, and (iii) enhancing the potential of power production.

### *II.5 Business Manager's Perception of IC in the Indian States*

The Confederation of Indian Industry (CII) and the World Bank jointly conducted an Enterprise Survey on 1099 companies across 10 Indian states in the year 2000. The major industries covered in the study are Textiles, Garments, Pharmaceuticals and Consumer electronics. The purpose of the survey was to examine the role of IC on the competitiveness of firms. The business managers were asked to identify the states that they thought had a better or worse IC than the state in which they were currently based. They were also asked to say which of the states in their opinion had the best IC and which had the worst. The subjective ranking of the states according to IC is shown in Table 2.

**Table 2: Subjective Ranking of Best to Worst IC (FACS 2000)**

| States | % saying best minus % saying worst |
|---|---|
| ***Best IC*** | |
| Maharashtra | 38.6% |
| Gujarat | 23.1% |
| ***Good IC*** | |
| Tamil Nadu | 8.6% |
| Karnataka | 7.8% |
| Andhra Pradesh | 6.6% |

| States | % saying best minus % saying worst |
|---|---|
| ***Medium IC*** | |
| Delhi | 1.6% |
| Punjab | -0.7% |
| ***Poor IC*** | |
| Kerala | -16.1% |
| West Bengal | -21.9% |
| Uttar Pradesh | -32.6% |

Source: adapted from CII - World Bank (2002)

The CII-World Bank (2002) study also provides various quantitative indicators across the 10 states pertaining to (i) the regulatory burden on firms, (ii) the delays at customs houses, and (iii) the energy and interest costs. Detailed analyses of all these aspects are provided in the CII-World Bank (2002) study. Here, we highlight only some of the key findings:

- Labor productivity (value added per worker) varies with the IC: the best IC states have the highest productivity, followed by the good, the medium and the poor.
- There exists a fairly strong correlation between the subjective judgement of managers and various quantitative indicators of IC.
- A regression analysis showed that the levels of TFP are lower for the firms operating in the poor IC states as compared to those in the best, the good and the medium IC states.

- The extent of investment that a state can attract depends crucially upon the IC it fosters – better governed states attract more investment.

FACS 2003 covered 12 states and a larger number of industries (than FACS 2000). The industries covered in the survey consist of Food processing, Textiles, Garments, Leather goods, Pharmaceuticals, Electronic consumer goods, Electrical white goods, Auto components, Metal and metal products, Plastics and Machine Tools. The subjective ranking of the states according to IC, as expressed by the business managers, is presented in Table 3. A comparison of the ranking in Table 2 and Table 3 indicates that, while the state of Delhi improved the ranking from the *medium* to the *best*, the position of Gujarat dropped from the *best* to the *good*.

**Table 3: Subjective Ranking of Best to Worst IC (FACS 2003)**

| States | % saying best minus % saying worst |
|---|---|
| ***Best IC*** | |
| Maharashtra | 29.1 |
| Delhi | 16.7 |
| ***Good IC*** | |
| Gujarat | 9.6 |
| Andhra Pradesh | 8.6 |
| Karnataka | 6.8 |
| Punjab | 4.9 |
| Tamil Nadu | 3.7 |
| Haryana | 1.1 |

| States | % saying best minus % saying worst |
|---|---|
| ***Poor Investment Climate*** | |
| Madhya Pradesh | -6.8 |
| Kerala | -15.0 |
| West Bengal | -30.6 |
| Uttar Pradesh | -30.6 |

Source: Estimates provided by the World Bank

### *II.6 Educational Qualification of Manufacturing Workers in the States*

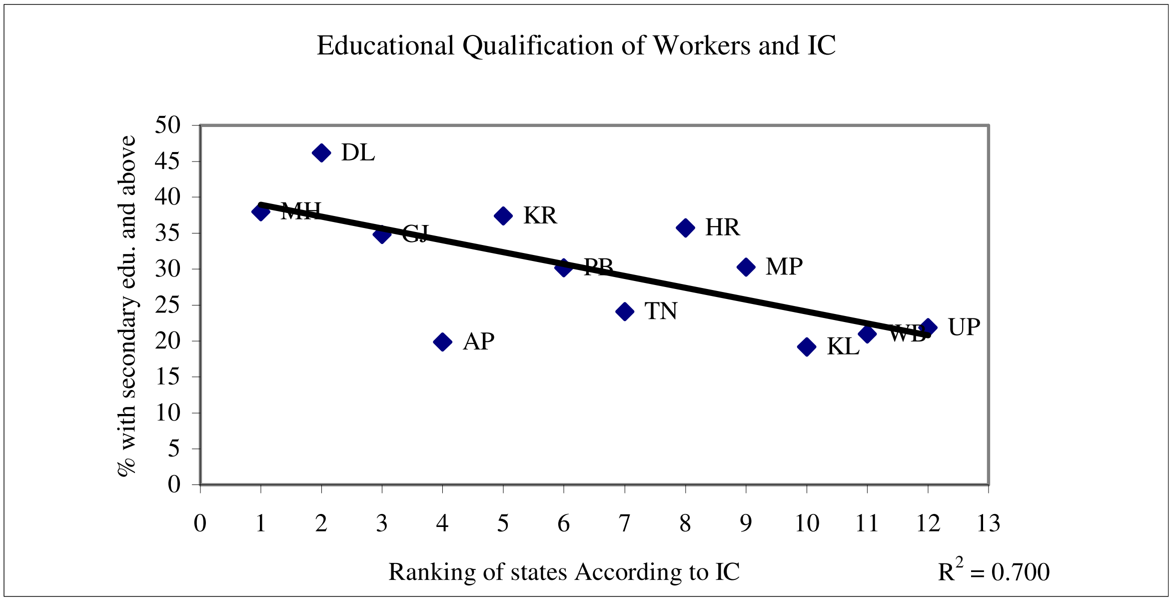
The educational qualification of workers engaged in the states' manufacturing industries might have a bearing on the nature of IC in the states. Drawing upon a study undertaken by Aggarwal (2004) for ICRIER, Table 4 presents the proportion of labor with secondary education and above within the category of total regular salaried labor engaged in the states' manufacturing sector. It is clear that the educational qualification of labor has been improving consistently in the majority of the states. Does the observed pattern in the educational quality of labor indicate a correlation with the perceived IC in the states? Table 4 indicates the answer in the affirmative. States with relatively more educated labor force in the manufacturing sector are indeed perceived as having better IC (see also Figure 1). The state of Andhra Pradesh, however, is a clear exception to this pattern.

**Table 4: Percentage of Total Manufacturing Workers (under Regular/Salaried Category) with Secondary Education and Above.**

| States | 38th Round of NSSO (1983) | 43rd Round of NSSO (1987-8) | 50th Round of NSSO (1993-94) | 55th Round of NSSO (1999-00) |
|---|---|---|---|---|
| **Best IC** | | | | |
| Maharashtra | 26.78 | 31.33 | 34.79 | 41.16 |
| Delhi | 28.24 | 35.42 | 39.67 | 52.62 |
| **Good IC** | | | | |
| Gujarat | 17.75 | 21.50 | 30.24 | 39.39 |
| Andhra Pradesh | 11.39 | 13.69 | 16.91 | 22.81 |
| Karnataka | 18.59 | 17.85 | 31.70 | 43.08 |
| Punjab | 17.36 | 28.47 | 32.22 | 28.12 |
| Tamil Nadu | 11.67 | 14.92 | 20.67 | 27.56 |
| Haryana | 18.17 | 24.76 | 34.23 | 37.26 |
| **Poor IC** | | | | |
| Madhya Pradesh | 10.79 | 22.32 | 28.96 | 31.63 |
| Kerala | 9.46 | 12.01 | 18.16 | 20.24 |
| West Bengal | 16.09 | 15.39 | 18.50 | 23.48 |
| Uttar Pradesh | 10.55 | 14.25 | 20.31 | 23.35 |
| **Not Classified** | | | | |
| Assam | 11.54 | 10.23 | 16.79 | 16.17 |
| Bihar | 10.23 | 21.05 | 25.26 | 25.29 |
| Himachal Pradesh | 17.42 | 14.06 | 21.05 | 34.16 |
| Rajasthan | 11.50 | 15.93 | 19.95 | 24.00 |
| Orissa | 8.75 | 13.59 | 33.06 | 20.54 |
| **II.6.1 All India** | 15.43 | 19.18 | 24.82 | 29.64 |

Source: Estimates taken from Aggarwal (2004).

**Figure 1**




$R^2$ is estimated without including Andhra Pradesh. A rank is assigned to the states according to IC on the basis of Table 3. Accordingly, Maharashtra gets the rank 1. Though Uttar Pradesh and West Bengal share the same position according to Table 3, the last rank was assigned to the former on the basis of Table 2.

## III Measurement of Productivity

We have used a multilateral TFP index to measure the level of TFP in different states' manufacturing industries. The multilateral TFP index has the advantage that the productivity levels can be compared across states and also over time. Productivity level (of manufacturing) in Maharashtra in 1981-82 is taken as the base and the productivity level in each state-year (say, Punjab in 1990-91) is compared to this base. Thus, TFP of manufacturing in a particular state in a particular year is expressed as a ratio to the TFP level of manufacturing in Maharashtra in 1981-82. Since Maharashatra is the most industrialised state and the one with the best IC among the Indian states, it was the natural choice as a benchmark. As regard the choice of 1981-82 as the base year, the reason is that wholesale price indices are available with base 1981-82, and we have expressed the output and input series at the constant prices of 1981-82.

Multilateral TFP estimates have been made for aggregate registered manufacturing sector in 17 states for the years 1980-81 to 1999-00. Two sets of estimates have been made. The first set is based on the value-added function. Value added is taken as output, and physical capital and human capital adjusted labour as the two inputs. The second set is based on the gross output function, taking gross output as the measure of output, and physical capital, human capital adjusted labour, materials, energy, and services used as five inputs. As mentioned above, the output and input series are all expressed at the constant prices of 1981-82. The procedure adopted for deflation is explained in Appendix-A. It should be pointed out here that deflators for output, and intermediate inputs used for each state take into account the industrial composition of the state. For instance, the deflator for manufacturing value added in a state is constructed as a weighted average of price indices for various two-digit industries, the weights being based on the relative shares of the 2-digit industries in manufacturing value added.

Besides estimating TFP of the aggregate registered manufacturing sector in different states, we have made such estimates for 2-digit industries. These estimates have been made for 15 major industries for the period 1980-81 to 1999-00 for three states, namely Maharashtra, Punjab and Uttar Pradesh. Maharashtra and Uttar Pradesh rank respectively at the top and bottom in the ranking of states according to IC, while Punjab rank somewhere in the middle. The comparison of TFP of the 2-digit industries across the three states and over time would be useful for assessing the effect of IC on productivity.

One difference between the TFP estimates for aggregate registered manufacturing and those for 2-digit industries is that while labour has been adjusted for human capital for the former, such adjustment could not be made for the latter. Human capital adjusted labour has been measured as:

$$H = Le^{0.1S} \qquad \text{.....(1)}$$

where H denotes human capital adjusted labour, L is the number of persons engaged and S is the average years of schooling of the workers engaged in the states' manufacturing industries (see PREM notes, no. 42, September, 2000, World Bank). Using NSSO survey data, an estimate of average years of schooling could be made for manufacturing workers in each state for four years, 1983, 1987-88, 1993-94 and 1999-00.[2] These have been interpolated to work out a series on S for each state for the period 1980-81 to 1999-00. However, from the NSSO data, it is difficult to make reliable estimates of educational attainment of workers engaged in various two-digit industries. Therefore, while making the TFP estimates at 2-digit industry level, adjustment for human capital has not been done.

### III.1Multilateral TFP Index

For the estimates based on the value-added function (taking value added as output, physical capital and human capital adjusted labor as the two inputs), the multilateral TFP index may be written as:

$$TFP_{bc} = \left(\frac{Y_b}{Y_c}\right)\left(\frac{\bar{H}}{H_b}\right)^{\alpha_b}\left(\frac{\bar{K}}{K_b}\right)^{\beta_b}\left(\frac{H_c}{\bar{H}}\right)^{\alpha_C}\left(\frac{K_c}{\bar{K}}\right)^{\beta_c} \quad \text{.......................................................(2)}$$

Here, the index expresses the productivity level in state-year b as a ratio to the productivity level in state-year c. Y denotes value added, H human capital adjusted labor and K physical capital input.

$\bar{H}$ and $\bar{K}$ are geometric mean of labor and capital across all the observations (state-years). The exponents α and β are income shares of labor and capital in value added and must add to one. Let $SL_b$ be the income share of labor in state-year b and $\bar{SL}$ the arithmetic mean of labor share in value added across all the observations. Then, $\alpha_b$ may be written as:

$$\alpha_b = \frac{SL_b + \bar{SL}}{2} \quad \text{……………………………………………………………….….(3)}$$

[2] Estimates of the average years of schooling have been made using the detailed data provided by Aggarwal (2004) on the educational attainment of the manufacturing workers (registered sector) in different states.

In a similar way, $\beta_b$, $\alpha_c$ and $\beta_c$ may be defined.

The TFP index for the two-input case given in equation (2) can easily be extended to cases of more than two inputs. For the index based on gross output function involving five inputs (human capital adjusted labor, physical capital, materials, energy and services), as applied here, real value added ($Y$) is replaced by real gross output ($Q$). There are other terms involving comparison of input use in state-years b and c with the sample average (geometric mean). The exponents are simple averages of the factor shares in a state-year and the average for all observations, as in equation (3).

## IV Multilateral TFP Estimates for the States: A Descriptive Analysis

### *IV.1 Total Registered Manufacturing Sector*

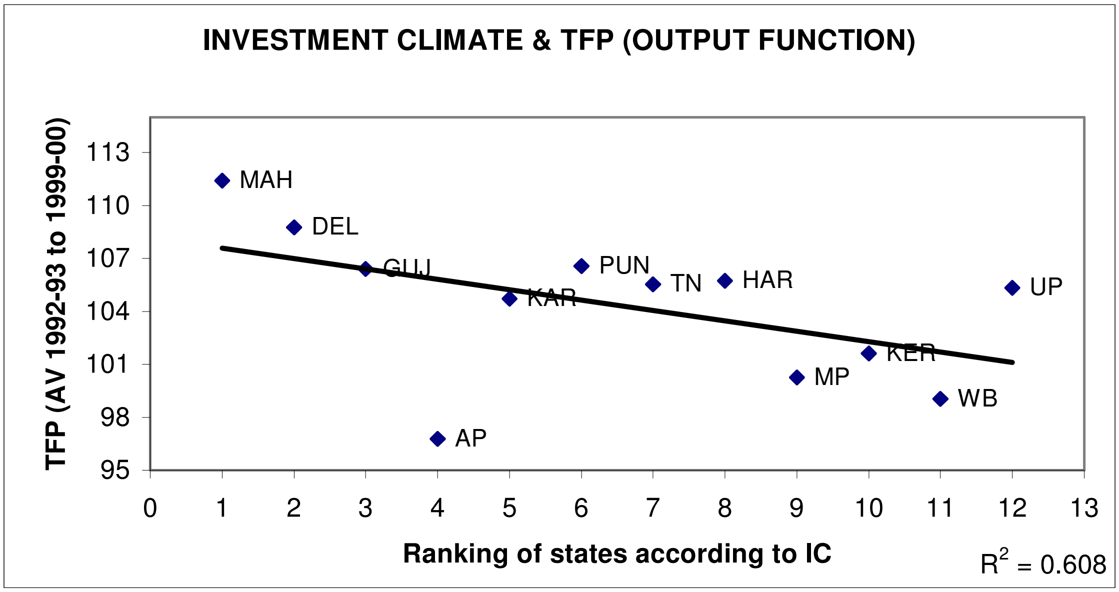
Table 5 provides the multilateral TFP estimates for the total registered manufacturing sector, based on both valued added and output functions, for the 17 major Indian states. It is clear that the two best IC states recorded the highest TFP levels for all the given time periods. Also, most of the good IC states show higher TFP levels as compared to the poor IC states. A striking exception to this pattern is Andhra Pradesh, whose track record with respect to TFP has been consistently poor. Figure 2 and 3 show the relationship between the subjective ranking of IC in the states (based on FACS 2003) and the average levels of TFP during the 1990s. It is evident that the states perceived as better with respect to IC were the ones showing higher TFP levels during the 1990s. As already indicated, a major exception is Andra Pradesh, which has been perceived as a good IC state, but the performance of that state in terms of TFP has been consistently poor.

### Table 5: Multilateral TFP in Registered Manufacturing Sector across Indian States (1980-81 to 1999-00)

| | Based on Value Added Function | | | | Based on Gross Output Function | | | |
|---|---|---|---|---|---|---|---|---|
| | 1980-1 to 1990-91 | 1992-3 to 1995-6 | 1996-7 to 1999-00 | 1992-3 to 1999-00 | 1980-1 to 1990-91 | 1992-3 to 1995-6 | 1996-7 to 1999-00 | 1992-3 to 1999-00 |
| **Best IC** | | | | | | | | |
| Maharashtra | 112.22 | 126.33 | 117.23 | 121.78 | 106.71 | 112.15 | 110.68 | 111.41 |
| Delhi | 105.93 | 132.53 | 137.96 | 135.63 | 103.16 | 108.58 | 108.90 | 108.76 |
| **Good IC** | | | | | | | | |
| Gujarat | 84.88 | 102.69 | 90.83 | 95.91 | 100.61 | 108.60 | 104.74 | 106.40 |
| Andhra Pradesh | 64.17 | 62.82 | 76.34 | 69.58 | 94.96 | 94.18 | 99.36 | 96.77 |
| Karnataka | 84.66 | 102.00 | 92.95 | 98.12 | 99.57 | 105.23 | 104.01 | 104.71 |
| Punjab | 79.06 | 93.64 | 108.62 | 101.13 | 98.54 | 104.39 | 108.73 | 106.56 |
| Tamil Nadu | 97.37 | 102.12 | 91.36 | 96.74 | 103.20 | 106.78 | 104.30 | 105.54 |
| Haryana | 93.57 | 100.68 | 112.26 | 106.47 | 101.46 | 104.00 | 107.47 | 105.74 |
| **Poor IC** | | | | | | | | |
| Madhya Pradesh | 71.13 | 82.11 | 88.65 | 85.38 | 94.64 | 99.01 | 101.51 | 100.26 |
| Kerala | 83.13 | 81.46 | 97.57 | 90.67 | 101.35 | 100.17 | 102.71 | 101.62 |
| West Bengal | 75.30 | 73.93 | 77.03 | 75.48 | 97.11 | 98.27 | 99.81 | 99.04 |
| Uttar Pradesh | 81.73 | 97.86 | 94.01 | 96.21 | 99.13 | 105.29 | 105.41 | 105.34 |
| **Not Classified** | | | | | | | | |
| Assam | 98.61 | 82.05 | 83.66 | 82.85 | 106.24 | 99.60 | 100.91 | 100.26 |
| Bihar | 62.10 | 71.85 | 116.57 | 91.01 | 91.95 | 96.19 | 108.11 | 101.30 |
| Himachal Pradesh | 67.03 | 90.30 | 96.14 | 93.22 | 93.42 | 98.31 | 100.21 | 99.26 |
| Rajasthan | 79.26 | 86.50 | 85.74 | 86.12 | 98.96 | 104.58 | 104.63 | 104.60 |
| Orissa | 60.85 | 54.39 | 60.80 | 57.60 | 89.18 | 88.66 | 91.79 | 90.22 |

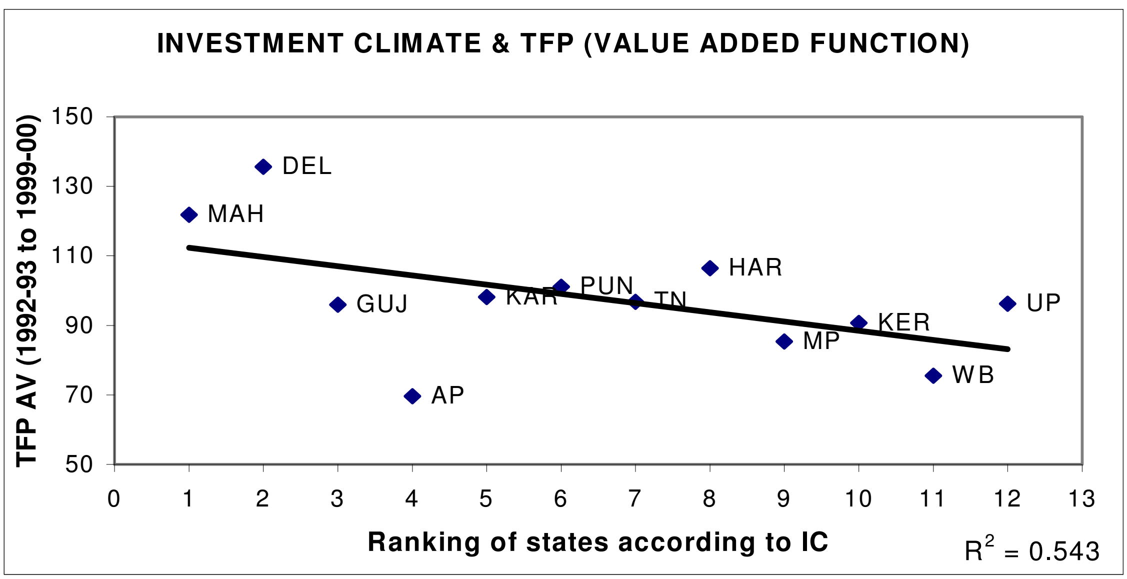
Note: (1) Averages of TFP levels are shown for four periods. While computing the averages, the years in which there was more than 50 per cent increase or decrease in gross output, value added, fixed capital, employment or materials (all real) have been excluded. The purpose is to make the averages less susceptible to short-terms fluctuations in the data. The same practice is followed in Tables 6 and 7. (2) The year 1991-92 has not been considered in the analysis because there was a severe balance of payments crisis in India, affecting the domestic industries.

Figure 2




$R^2$ is estimated without including Andhra Pradesh

Figure 3




$R^2$ is estimated without including Andhra Pradesh

## Table 6: Trend Growth Rates of TFP in Registered Manufacturing Sector (1992-93 to 1999-2000)

| | Based on Value Added Function | | | Based on Gross Output Function | | |
|---|---|---|---|---|---|---|
| | Growth Rate (% p.a.) | Average TFP Level from1992-3 to 1994-5 | Average TFP Level from1997-8 to 1999-00 | Growth Rate (% p.a.) | Average TFP Level from1992-3 to 1994-5 | Average TFP Level from1997-8 to 1999-00 |
| **Best IC** | | | | | | |
| Maharashtra | **-0.77** | 124.82 | 118.50 | **-0.04** | 111.32 | 110.76 |
| Delhi | **1.69** | 133.95 | 141.82 | **0.25** | 108.67 | 109.25 |
| **Good IC** | | | | | | |
| Gujarat | **-2.61** | 103.64 | 86.87 | **-0.78** | 108.19 | 103.50 |
| Andhra Pradesh | **4.68** | 58.42 | 76.50 | **1.18** | 92.48 | 99.10 |
| Karnataka | **-2.63** | 100.82 | 85.77 | **-0.35** | 104.58 | 101.97 |
| Punjab | **3.55** | 94.26 | 107.90 | **0.98** | 104.16 | 108.68 |
| Tamil Nadu | **-2.36** | 101.62 | 89.25 | **-0.44** | 106.08 | 103.58 |
| Haryana | **3.20** | 95.17 | 109.79 | **0.92** | 102.34 | 106.92 |
| **Poor IC** | | | | | | |
| Madhya Pradesh | **2.62** | 76.09 | 90.97 | **0.72** | 97.35 | 102.10 |
| Kerala | **3.63** | 81.46 | 99.09 | **0.40** | 100.17 | 102.37 |
| West Bengal | **1.47** | 73.56 | 78.45 | **0.53** | 97.73 | 100.20 |
| Uttar Pradesh | **-2.03** | 99.02 | 87.50 | **-0.18** | 105.08 | 103.66 |
| **Not Classified** | | | | | | |
| Assam | **1.78** | 80.43 | 89.84 | **0.61** | 98.45 | 102.19 |
| Bihar | **9.57** | 69.54 | 116.57 | **2.36** | 95.18 | 108.11 |
| Himachal Pradesh | **1.64** | 88.99 | 94.74 | **0.40** | 97.53 | 99.27 |
| Rajasthan | **0.48** | 85.40 | 86.67 | **0.23** | 103.97 | 104.96 |
| Orissa | **3.71** | 53.18 | 65.17 | **1.02** | 88.29 | 93.31 |

Table 6 presents the trend growth rates of TFP during the 1990s. Comparison of the growth rates across the states should be made keeping in mind the large differences in the base period level of TFP in the states. Growth rates are generally found high in states that start with relatively low levels of TFP at the beginning of the period and vice versa. Thus, states like Andra Pradesh, Madhya Pradesh, Kerala, West Bengal, Bihar and Orissa, which all had low TFP levels to start with, showed relatively higher growth rate. Among the best and good IC states, Delhi, Punjab, Haryana and Andhra Pradesh showed positive productivity growth, while growth has been negative in other best and good IC states.

Among the poor IC states, Madhya Pradesh, Kerala and West Bengal showed positive TFP growth. This is not surprising, as the TFP levels at the beginning of the period were relatively low in these states. Whereas, the state of Uttar Pradesh, which had a TFP level comparable to that of the good IC states at the beginning of the 1990s, showed one of the lowest TFP levels by the end of the 1990s.

### *IV.2 TFP at 2-Digit Industry Level: Comparison of Maharashtra, Punjab and Uttar Pradesh*

The analysis in the previous section indicates a positive relationship between TFP in the aggregate registered manufacturing and a market friendly IC. Does the observed relationship between IC and TFP hold also at the level of individual industries? We estimate TFP at the 2-digit level of National Industrial Classification (NIC) for three states with substantially different IC. The selected states are Maharashtra, Punjab, and Uttar Pradesh. According to both FACS 2000 and FACS 2003, Maharashtra and Uttar Pradesh ranked respectively at the top and bottom in the ranking of states according to IC, while Punjab ranked somewhere in the middle.

Table 7 shows the 2-digit level estimates of TFP for the three states. The general pattern is as expected: in most of the industries, Maharashtra shows higher TFP than others, while Punjab generally achieve higher TFP than Uttar Pradesh. There are, however, certain important exceptions at the level of specific industries. Punjab shows higher TFP than Maharashtra in Food Products (during the entire period), Cotton Textiles (during the entire period), Textile Products (during the 1980s), and Metal Products and parts (during the 1990s). Beverages and Tobacco is the only industry in which Uttar Pradesh recorded higher TFP as compared to both Punjab and Maharashtra during the entire period. There is no other single industry where Uttar Pradesh compares better than Maharashtra, though the former compares significantly better than Punjab in some cases. These are Paper products, Printing & Publishing (during the 1980s), Leather and Leather Products (during the 1980s), Chemicals and Chemical Products (during the entire period), Non-Metallic Mineral Products (during the 1990s), Machinery and Repair of Capital Goods (during the entire period).

In short, the analysis in this section reveal that the observed relationship between IC and TFP hold also at the level of individual industries. The general nature of IC prevailing in a state exerts a critical influence for every state industry.

## Table 7: Multilateral TFP across Industries and States

| | | Based on value added function | | Based on output function | |
|---|---|---|---|---|---|
| Industries | States | 1980-81 to 1990-91 | 1992-93 to 1999-2000 | 1980-81 to 1990-91 | 1992-93 to 1999-2000 |
| Food Products (20 + 21) | Maharashtra | 137.0 | 189.4 | 104.6 | 110.1 |
| | Punjab | 179.5 | 219.3 | 108.8 | 113.2 |
| | Uttar Pradesh | 124.8 | 144.9 | 103.1 | 106.5 |
| Beverages and Tobacco (22) | Maharashtra | 127.8 | 88.7 | 106.6 | 88.8 |
| | Punjab | 119.1 | 102.1 | 106.9 | 90.7 |
| | Uttar Pradesh | 177.2 | 173.8 | 117.1 | 106.3 |
| Cotton Textiles (23) | Maharashtra | 92.6 | 79.5 | 95.9 | 92.9 |
| | Punjab | 93.6 | 121.8 | 96.1 | 101.9 |
| | Uttar Pradesh | 59.5 | 50.4 | 87.0 | 85.7 |
| Woolen and Silk Textiles (24) | Maharashtra | 109.6 | 92.2 | 104.6 | 102.1 |
| | Punjab | 105.8 | 78.3 | 104.4 | 99.0 |
| | Uttar Pradesh | 77.8 | 72.3 | 94.3 | 96.7 |
| Textile Products (26) | Maharashtra | 117.1 | 131.9 | 94.2 | 93.7 |
| | Punjab | 142.3 | 115.0 | 97.2 | 90.8 |
| | Uttar Pradesh | 73.9 | 93.3 | 85.0 | 88.5 |
| Wooden Furniture and Fixtures (27) | Maharashtra | 126.7 | 98.4 | 115.8 | 82.4 |
| | Punjab | 107.3 | 82.8 | 110.4 | 80.0 |
| | Uttar Pradesh | 63.2 | 73.6 | 94.4 | 73.0 |
| Paper products, Printing, and Publishing (28) | Maharashtra | 86.1 | 73.5 | 91.6 | 82.1 |
| | Punjab | 43.5 | 51.1 | 75.6 | 74.5 |
| | Uttar Pradesh | 55.3 | 47.7 | 81.2 | 72.7 |
| Leather and Leather Products (29) | Maharashtra | 144.9 | 155.9 | 104.9 | 114.2 |
| | Punjab | 81.4 | 140.6 | 99.2 | 114.0 |
| | Uttar Pradesh | 91.5 | 120.3 | 100.1 | 112.3 |
| Chemicals and Chemical Products (30) | Maharashtra | 113.7 | 161.1 | 109.4 | 128.9 |
| | Punjab | 45.4 | 80.7 | 86.4 | 106.2 |
| | Uttar Pradesh | 71.0 | 104.6 | 97.9 | 113.8 |
| Rubber, Plastic, and Petroleum products (31) | Maharashtra | 122.4 | 145.4 | 109.6 | 107.0 |
| | Punjab | 109.5 | 128.2 | 106.9 | 107.0 |
| | Uttar Pradesh | 81.6 | 73.5 | 109.5 | 104.5 |
| Non-Metallic Mineral Products (32 | Maharashtra | 95.2 | 81.8 | 98.2 | 92.8 |
| | Punjab | 52.8 | 45.9 | 87.5 | 84.9 |
| | Uttar Pradesh | 48.0 | 56.3 | 82.8 | 85.3 |
| Basic Metal and Alloys Industries (33) | Maharashtra | 98.0 | 88.7 | 100.8 | 100.7 |
| | Punjab | 87.4 | 84.5 | 99.9 | 101.2 |
| | Uttar Pradesh | 84.7 | 87.2 | 98.4 | 100.2 |
| Metal Products and parts (34) | Maharashtra | 100.1 | 77.2 | 97.3 | 88.5 |
| | Punjab | 66.0 | 86.7 | 87.4 | 90.7 |
| | Uttar Pradesh | 59.5 | 65.7 | 86.5 | 86.0 |
| Machinery and Repair of Capital Goods (35+36+39) | Maharashtra | 108.9 | 118.3 | 105.9 | 109.2 |
| | Punjab | 61.4 | 93.7 | 92.0 | 103.0 |
| | Uttar Pradesh | 91.2 | 106.2 | 101.9 | 106.7 |
| Transport Equipment and Parts (37) | Maharashtra | 116.0 | 171.4 | 104.7 | 120.0 |
| | Punjab | 83.0 | 89.7 | 99.1 | 105.6 |
| | Uttar Pradesh | 64.7 | 88.6 | 92.2 | 101.9 |

Note: Calculations were not done for two industries because of poor data quality. These are Manufacture of Jute (25) and Misc. Manufactures (38).

## V Investment Climate and Total Factor Productivity: Regression Analysis

In what follows, we utilize regression technique to investigate whether IC matters for TFP. The period of the analysis is from 1992-93 to 1997-98. The data at the 2-digit level of National Industrial Classification (NIC) – 1987 are used for the 12 states covered in FACS 2003. The specific industry groups included in the regression analysis, with the corresponding two digit codes of NIC, are: (i) Food manufacturing and Processing (20+21); (ii) Textiles (23+24+25); (iii) Garment (26); (iv) Leather Manufacturing (29); (v) Chemicals (30); (vi) Machinery (35+36); and (vii) Transport Equipments (37). It may be noted that the selection of these industries is done keeping in mind the nature of the available data on some of the IC indicators. Appendix-A discusses the details regarding the nature of the database used in the regression analysis. Appendix-B gives the average values of the dependent (TFP) and explanatory variables and inter-correlation matrix among the explanatory variables used for the regression analysis.

Two alternative econometric approaches are adopted to investigate the effect of IC on TFP. First, the regression equation specified relates the multilateral TFP index to various available indicators of IC in the states.

$$MTFP = \gamma + \delta_1 IC_1 + \delta_2 IC_2 + \ldots\ldots\ldots + \delta_n IC_n + u \qquad \ldots\ldots(4)$$

Where *MTFP* represents the multilateral TFP index (based on the value added function) in industry ($_i$) state ($_s$) and year ($_y$). For estimating MTFP, the productivity level in one industry (i.e., Textiles) in Maharashtra in 1981-82 is taken as the base and the productivity level in each state-industry-year (say, Punjab in Transport Equipments in 1997-98) is compared to this base. The explanatory variables $IC_1$, $IC_2$, …… $IC_n$ are the various available indicators of IC, and $u$ is the usual error term.

The second approach followed in the present study is similar to that in the CII-World Bank (2002) study. The regression equation specified relates gross value added-labor ratio to capital-labour ratio, and real wage rate for each industry ($_i$) state ($_s$) and year ($_y$), along with IC. The relationship is taken to be log-linear in gross value added-labour ratio, capital-labour ratio and real wage rate. Thus, the regression equation may be expressed as:

$$\ln (Y / L) = \alpha + \beta_1 \ln (K / L) + \beta_2 \ln (w) + \delta_1 IC_1 + \delta_2 IC_2 + \ldots\ldots + \delta_n IC_n + u \qquad \ldots(5)$$

where $Y$ is the real gross value added and $L$ is the total labor force engaged in manufacturing, $K$ is the capital stock, and $w$ is the real wage rate. It may be noted in this context that in a number of studies, ln (Y/L) has been regressed on ln (K/L) along with other determinants of productivity. As (K/L) is included as one of the variables to explain (Y/L), the co-efficients $\delta_1, \delta_2, \ldots\ldots \delta_n$, in effect, captures the effect of IC on TFP rather than labor productivity. Equation (5) implicitly assumes the underlying production function to be Cobb-Douglas. By including the real wage rate ($w$) in the equation, we allow the production function to be more general. It may be pointed out that a log-linear relationship between Y/L, K/L and w arises in the Hildebrand-Liu (1965) specification of the Variable Elasticity of Substitution (VES) production function, which has the Cobb-Douglas, and the CES (Constant elasticity of substitution) production function as special cases.

To incorporate the effect of IC in the regression model, we consider a number of alternative variables in equations (4) and (5). In addition, year and industry dummies are included in all the specifications. This is necessary to control for the influence of year-specific and various unobserved industry-specific factors.

To begin with, drawing upon the classification of states according to IC in Table 3, we consider the following indicators:

| | |
|---|---|
| *BestIC* | Dummy for the best IC states |
| *GoodIC* | Dummy for the good IC states |

The poor IC states are taken as the base for comparison. If IC indeed matters for TFP, we expect statistically significant positive coefficients for both *BestIC* and *GoodIC*. A stronger condition is that the positive coefficient value of *BestIC* is higher that that of *GoodIC*.

The results of the least square regressions corresponding to equations (4) and (5) are shown in Table 8 and 9, respectively[3]. In both the tables, the co-efficient values corresponding to *BestIC* and *GoodIC* are indeed consistent with what is being hypothesized. The levels of TFP in the best and good IC states are higher than those in the poor IC states. Furthermore, the best IC states have higher TFP than the good IC states. The values of the *t*-ratio and co-efficient corresponding to the variable *GoodIC* increases significantly when an additional dummy for the state of Andhra Pradesh is included in equation (4) [compare the specifications 1 and 2 in Table 8]. Thus, clubbing the state of Andhra Pradesh with the group of good IC states pulls down the co-efficient value of the variable *GoodIC.* However, as to equation 5, the *t*-value of the co-efficient of *GoodIC* is very high even without a dummy for Andhra Pradesh, though including the dummy indeed raises the co-efficient value of *GoodIC* [compare specifications 1 and 2 in Table 9]. This result concerning the state of Andhra Pradesh is expected, as the track record of that state with respect to TFP has been consistently poor despite being perceived as a good IC state in FACS.

Using similar type of dummy variables as in the present study, the CII-World Bank (2002) study observed that the group of poor IC states has lower TFP levels as compared to other states. It is important to note that the dummy variables used in both the studies are based on the business managers' perception of IC in various states. The use of such indicator may well be opposed on the ground that the business managers' perception could be biased and may have nothing to do with the actual IC and that the use of some objective indicators of IC could tell a different story. In addition, some elements of arbitrariness are bound to occur in the categorization of the states as *best*, *good,* and *poor* IC states. In view of these concerns,

[3] Industry and year dummies are included in all the specifications, the base industry taken for comparison being Textiles while the base year being 1992-93. To economize with space and to simplify the tables, we do not report the co-efficients corresponding to the year and industry dummies. However, it is worth noting that all the industry and year dummies were positive with statistical significance in most cases. Thus, the levels of TFP are higher in other industries as compared to Textiles and also for other years as compared to 1992-93. It may also be noted from Table 9 that the underlying production function in equation (5) works well: capital labor ratio ($K / L$) and real wage rate ($w$) yield expected signs with statistical significance.

we ask the question: Does the effect of IC on TFP still hold if we use certain quantitative indicators of IC, instead of the dummy variables? We first consider the following variable.

*POWER* Average number of days required to get a new power connection in the state

This variable yields a statistically significant negative co-efficient (see specification 3 in Table 8 and 9) adding credence to the results reported above based upon the dummy variables. An alternative indicator of IC, which is again quantitative in nature, in the states is:

*TELE* Average number of days required to get a new telephone connection in the state

Yet again, the IC variable yields results in the expected line in that the co-efficient of *TELE* turns out to be negative and significant in both equation (4) and (5). Thus, the results obtained with respect to the business managers' perception of IC are consistent with that obtained using some of the available quantitative indicators. Clearly, IC matters for TFP, irrespective of the variables used to measure IC and irrespective of the econometric approaches followed to analyze the relationship between the two. In what follows, we consider, one by one, a number of additional quantitative indicators, representing different dimensions of IC, to further strengthen our conclusion.

Stringent labor regulations have often been identified as one of the major reasons for the poor competitiveness and growth of India's manufacturing sector as compared to other countries. Despite more than a decade of liberalization in various constituents of economic policies, the policies concerning the labor market continue to be very restrictive in India, primarily for political reasons[4]. Nevertheless, states differ to a certain extent with respect to the degree of labor market flexibility (freedom to hire and fire) and the incidence of industrial disputes. As already noted, the extent of labor market regulation might vary across the states

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[4] A number of studies show that labor regulation in India adversely affect not only the competitiveness of the manufacturing sector but also the overall level of employment, particularly in the registered manufacturing sector.

as the Indian constitution empowers the state governments to amend the Industrial Disputes Act, 1947. It is pertinent to examine if the differences in the labour market conditions across the states have any bearing on TFP in the states' manufacturing industries. We first consider the following variable:

MANDAYS Number of man days lost per employee in industrial disputes in state $_s$ and year $_y$

The co-efficient of this variable, as expected, attains negative sign with statistical significance, suggesting the critical importance of a harmonious industrial relations in the states. It is difficult to gauge the differences with respect to labour market flexibility (freedom to hire and fire) across the states. However, we have made use of certain proxy variables. First, based upon the classification of the Indian states according to labour regulation by Besely and Burgess (2002) in Table 1, we include the following dummy variables[5]:

| | |
|---|---|
| Pro-employer | Dummy for the pro-employer states |
| Neutral | Dummy for the neutral states |

The group of pro-worker states is taken as the base for comparison. These variables are expected to yield positive coefficients with larger value for the former than for the latter. It is clear from Table 8 and 9 that the co-efficient of both the dummies are indeed positive, though the value of the coefficient does not turn out to be larger for *Pro-employer* as compared to *Neutral*. Thus, it may be concluded that the states that undertook labor regulation in the pro-worker direction experienced lower levels of TFP as compared to the states that undertook regulation in the pro-employer direction or were neutral.

5 The cumulative index of labor regulation (constructed by Besley and Burgess) is available for the year 1992 and before, not for the years considered in our regression analysis. Thus, the dummy variables, rather than the actual cumulative scores for the year 1992, are thought to be appropriate. The state of Delhi is considered as a neutral state.

The tabulated data from FACS 2003, made available to us by the World Bank, include a variable defined as "excess manpower as percent of total employment". This variable, however, did not yield statistically significant negative co-efficient in any of the specifications and was finally dropped from the analysis.

In short, the above results clearly indicate the adverse effect on TFP of labor unrest in the states. However, a definite conclusion regarding the effects of labor market flexibility on TFP does not emerge from our analysis, perhaps because of the inappropriate variables used to capture labor market flexibility. In this context, however, it is worth referring to the study by Aghion et al (2003), yet again. Using a larger time series-cross sectional data, they analyzed the effect of the direction of labor regulation in the Indian states, measured by the actual Besely and Burgess index, on TFP and other indicators of performance. To reiterate the findings of Aghion et al (2003), the states with more pro-worker regulation experienced less growth in labor productivity and TFP (and also other indicators) for the 1980-1997 period and the negative effect of pro-worker regulation got magnified during the post-liberalization period. In view of these findings, we tend to believe that labor market flexibility is important for faster TFP growth, though a definite conclusion does not emerge from the present study.

The extent of the regulatory burden on firm is an indicator of how fair and market friendly the business environment is. The business environment may be considered more market friendly if the incidence of regulatory visit to the firm by the government inspectors is fewer. Thus, we include:

*MTR* Percentage of the management's time spent with government officials of regulatory and administrative issues in industry $_i$ and in state $_s$

The coefficient of this variable, as expected, is negative and significant (see Table 8 and 9).

A stable and sufficient power supply from the public grid is likely to be crucial for higher productivity growth. In order to determine the effect of power supply condition in the state, we include:

$E/L$ Electricity sales (in million KwH) for industrial use as a proportion of total persons engaged in the state's registered manufacturing sector in state $_s$ and year $_y$.

This variable yields a statistically significant positive co-efficient suggesting that a stable and sufficient power supply condition is important for the faster growth of TFP. Finally, we include the variable:

$C/K$ Real industrial credit by the Scheduled Commercial Banks as a proportion of capital stock in state $_s$ industry $_i$ and year $_y$.

As to the effects of industrial credit on TFP, the exact direction of causation appears to be a matter of some concern. While availability of credit is important for enhancing productivity, it may also be true that better performing industries and states may get relatively more credit from the banks as compared to others. To reduce the severity of the simultaneity problem, one year lagged value of $C/K$ was considered in the regression. The co-efficient of this variable turns out to be positive and statistically significant (see Table 8 and 9). However, because of the potential simultaneity problem, the results with respect to industrial credit may be taken as only suggestive.

**Table 8: Effects of Investment Climate on TFP (Multilateral TFP Index is the Dependent Variable, Pooled OLS regression results, 1992-93 to 1997-98)**

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) |
|---|---|---|---|---|---|---|---|---|---|---|
| BestIC | 63.765 (10.86)* | 63.765 (5.87)* | - | - | - | - | 67.004 (6.03)* | 64.117 (5.91)* | - | 50.157 (4.62)* |
| GoodIC | 4.625 (0.98) | 8.725 (1.80)*** | - | - | - | - | 7.689 (1.61)*** | 10.558 (2.19)** | - | 9.752 (2.02)** |
| AP dummy | - | -24.595 (-3.88)* | - | - | - | - | -26.798 (-3.80)* | -32.721 (-4.56)* | - | -25.485 (-4.01)* |
| POWER | - | - | -0.725 (-5.99)* | - | -0.702 (-5.92)* | -0.690 (-5.88)* | - | - | -0.755 (-6.12)* | - |
| TELE | - | - | - | -0.506 (-5.01)* | - | - | - | - | - | - |
| MANDAYS | - | - | - | - | -0.823 (-1.98)** | - | - | - | - | - |
| Pro-employer | - | - | - | - | - | 3.021 (0.47) | 14.895 (2.19)** | - | - | - |
| Neutral | - | - | - | - | - | 8.652 (1.21) | 16.835 (2.01)** | - | - | - |
| MTR | - | - | - | - | - | - | - | -0.9979 (-3.06)* | - | - |
| E / L | - | - | - | - | - | - | - | - | 1150.37 (2.11)** | - |
| C / K | - | - | - | - | - | - | - | - | - | 308.544 (3.84)* |
| Constant | 70.298 (9.59)* | 70.299 (9.64)* | 123.808 (13.73)* | 98.710 (14.76)* | 127.711 (13.50)* | 117.712 (13.43)* | 58.642 (6.45)* | 84.056 (-3.06)* | 111.781 (11.51)* | 68.834 (9.51)* |
| N | 504 | 504 | 504 | 504 | 504 | 504 | 504 | 504 | 504 | 504 |
| $R^2$ | 0.24 | 0.25 | 0.17 | 0.15 | 0.18 | 0.18 | 0.26 | 0.26 | 0.18 | 0.27 |

Note: (i) Industry and Year dummies are included in all the specifications, (ii) heteroscedasticity corrected 't' values are in parentheses, (iii) * significant at 1% level; ** significant at 5% level; *** significant at 10% level.

**Table 9: Effects of Investment Climate on TFP (Ratio of Real Gross Value Added to Labor is the Dependent Variable, Pooled OLS regression results, 1992-93 to 1997-98)**

| Variables | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ln (K / L)* | 0.269 (3.83)* | 0.268 (3.82)* | 0.290 (4.52)* | 0.286 (4.61)* | 0.224 (3.03)* | 0.256 (3.99)* | 0.236 (3.38)* | 0.230 (3.38)* | 0.222 (3.23)* | 0.244 (3.61)* | 0.294 (3.94)* | 0.251 (3.42)* |
| *Ln (w)* | 0.720 (6.54)* | 0.696 (6.30)* | 0.679 (8.10)* | 0.699 (8.68)* | 0.781 (6.89)* | 0.757 (8.56)* | 0.777 (7.12)* | 0.779 (7.23)* | 0.782 (7.30)* | 0.750 (7.02)* | 0.729 (6.71)* | 0.787 (7.40)* |
| *BestIC* | 0.225 (3.45)* | 0.232 (3.54)* | - | - | 0.147 (2.02)** | - | 0.207 (3.20)* | 0.162 (2.27)** | 0.167 (2.37)** | 0.212 (3.19)* | 0.167 (2.64)* | 0.111 (1.64)*** |
| *GoodIC* | 0.150 (3.38)* | 0.181 (4.10)* | - | - | 0.109 (2.45)** | - | 0.138 (3.25)* | 0.122 (2.70)* | 0.135 (3.02)* | 0.162 (3.80)* | 0.155 (3.47)* | 0.126 (2.76)* |
| *AP dummy* | - | -0.205 (-3.40)* | - | - | - | - | - | - | - | - | - | - |
| *POWER* | - | - | -0.004 (-4.84)* | - | - | -0.003 (-4.56)* | - | - | - | - | - | - |
| *TELE* | - | - | - | -0.0034 (-3.81)* | - | - | - | - | - | - | - | - |
| *MANDAYS* | - | - | - | - | -0.011 (-2.95)* | - | - | -0.009 (-2.46)* | -0.007 (-1.91)** | - | - | -0.009 (-2.49)* |
| *Pro-employer* | - | - | - | - | - | 0.128 (3.00)* | 0.088 (2.09)** | - | | - | - | - |
| *Neutral* | - | - | - | - | - | 0.178 (4.07)* | 0.198 (4.50)* | - | | - | - | - |
| *MTR* | - | - | - | - | - | - | - | -0.008 (-2.65)* | -0.008 (-2.69)* | -0.009 (-2.99)* | - | -0.008 (-2.46)* |
| *E / L* | - | - | - | - | - | - | - | - | 7.260 (1.50) | 9.957 (2.10)** | - | - |
| *C / K* | - | - | - | - | - | - | - | - | - | - | 1.222 (2.03)** | 1.058 (1.62)*** |
| *Constant* | 0.123 (0.54) | 0.068 (0.30) | 0.373 (1.93)** | 0.294 (1.60) | 0.352 (1.41) | 0.419 (2.14)*** | 0.152 (0.68) | 0.442 (1.74)*** | 0.341 (1.45) | 0.192 (0.84) | 0.143 (0.65) | 0.455 (1.81)*** |
| *N* | 504 | 504 | 504 | 504 | 504 | 504 | 504 | 504 | 504 | 504 | 504 | 504 |
| $R^2$ | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 | 0.69 | 0.70 |

Note: (i) Industry and Year dummies are included in all the specifications, (ii) heteroscedasticity corrected 't' values are in parentheses, (iii) * significant at 1% level; ** significant at 5% level; *** significant at 10% level.

Having established the relationship between a number of IC indicators and TFP, it now emerges pertinent to provide a rough quantitative assessment of the extent of productivity and output loss in various states on account of adverse IC. To that effect, we undertake a simulation exercise utilizing the co-efficient values of some of the important IC indicators. Our preferred specification to be used in the simulation is specification (7) in Table 9. This specification of the production function equation (5) yields statistically significant co-efficient values for *Best IC, Good IC, MANDAYS,* and *MTR*, which we utilize to simulate the extent of TFP and output loss in various states. The two major IC variables excluded from the simulation (i.e. not included in the chosen specification) are E / L and C / K, representing electricity sales and industrial credit in the states. The omission of C / K is deliberate in view of the possible simultaneity problem discussed above. The variable E / L was dropped on the grounds of statistically insignificance of the coefficient of that variable when included along with the other variables in the chosen specification, because of potential multicollinearity.

The FACS 2003 data suggest that the percentage of the management's time spent with government officials of regulatory and administrative issues (MTR) is high even in the states that are otherwise perceived as having the best or good IC in a broader sense. In fact, the mean value of MTR is found to be the least in two of the poor IC states: Madhya Pradesh and Uttar Pradesh. Thus, for simulating the TFP and output loss on account of MTR, the state of Madhya Pradesh, which has the lowest value for MTR, is taken as the norm. As to simulating the TFP and output loss on account of MANDAYS, the state of Delhi is taken as the norm, as mandays lost in industrial disputes is the least in that state. As far as the business manager's perception of IC is concerned, the best IC states (Maharashtra and Delhi) are taken as the norm. Under the above assumptions, we simulate the total TFP and output lost in each state on account of having had failed to attain the best practices with respect to the chosen dimensions of IC.

**Table 10: TFP and Output Lost on account of adverse IC in Various States**

| | MTR | MANDAYS (average for 1992-3 to 1997-8) | % of TFP lost on account of adverse IC | Gross value added (in millions of rupees) lost in 1999-2000 on account of adverse IC |
|---|---|---|---|---|
| **Best IC** | | | | |
| Maharashtra | 16.17 | 2.16 | -8.70 | 8381.11 |
| Delhi | 12.88 | 0.67 | -4.72 | 4680.97 |
| **Good IC** | | | | |
| Gujarat | 24.11 | 2.67 | -19.56 | 13504.05 |
| Andhra Pradesh | 9.64 | 5.83 | -10.62 | 11765.05 |
| Karnataka | 14.77 | 2.27 | -9.05 | 36834.77 |
| Punjab | 11.57 | 2.96 | -10.54 | 4368.75 |
| Tamil Nadu | 14.23 | 2.06 | -11.02 | 7421.89 |
| Haryana | 9.90 | 4.29 | -9.47 | 7393.146 |
| **Poor IC** | | | | |
| Madhya Pradesh | 7.05 | 0.99 | -16.49 | 5285.17 |
| Kerala | 21.01 | 6.76 | -32.88 | 42009.27 |
| West Bengal | 17.49 | 19.32 | -41.08 | 74599.32 |
| Uttar Pradesh | 7.98 | 2.62 | -18.68 | 47368.27 |

The results of the simulation are shown in Table 10, which gives a rough idea of the extent of output lost (in millions of rupees) in one year (1999-2000) across the states. It is clear that there is scope for improvement in IC in almost all the states. However, the percentages of output lost are the highest in the poor IC states in general and the states of West Bengal and Kerala in particular. Within the group of poor IC states, the extent of loss is less in Uttar Pradesh and Madhya Pradesh as compared to West Bengal and Kerala because of the relatively better position of the former two states with respect to MTR and MANDAYS. Among the good IC states, Gujarat suffered the highest on account of the highest incidence of MTR in that state. The states of Tamil Nadu, Punjab and Karnataka also lost considerably, particularly on account of high MTR. High incidence of industrial disputes contributed significantly to the industrial output loss in Andhra Pradesh and Haryana. The states of Maharashtra and Delhi also experienced output loss on account of regulatory hassles.

In short, the simulation exercise clearly indicates that no single state can be considered as the best in terms of all the dimensions of IC, though some states, on an average, score better than others. There are scopes for initiating policy measures with a view to improve the overall or particular dimensions of IC in almost all the states.

## VI Conclusion and Implications

The study analyzed the influence of investment climate (IC) on total factor productivity (TFP) in the registered manufacturing sector across the major Indian states. We started with a brief overview of the existing studies that deal with the various aspects of IC in the context of the Indian states. These studies establish the critical importance of labor market flexibility, access to finance, availability of infrastructure etc for improving industrial productivity, overall growth, and hence, for eradicating poverty. Appropriate re-distributive policies such as land reforms also have positive impact on poverty eradication.

The present study provided ample evidence to prove unequivocally that IC matters. A market friendly IC was found to be essential for achieving higher levels of TFP in the manufacturing sector. This conclusion is very robust, unaffected by the choice of IC indicator.

New investment will be undertaken only if the IC is market friendly. Under such circumstances, states that foster better IC would grow faster and be able to eradicate poverty quicker while others lag behind. Thus, it is not surprising that India's overall economic progress during the 1990s has been leaving some of the states behind. Evidently, the most effective way to eliminate regional growth inequality is to ensure that the lagging states initiate reforms to make their IC market friendly.

There are scopes for initiating policy measures with a view to improve the overall or particular dimensions of IC in almost all the states. In particular, the following policy actions are imperative for enhancing the competitiveness of the manufacturing sector in the states.

- Make the regulatory regime across all the states, including Maharashtra, Delhi and Gujarat, simpler and hassle free.
- Initiate power reforms to provide a stable and sufficient electricity for industrial use

- Introduce legislative changes to make the labor market more flexible, with appropriate compensation package for labor
- Ensure a harmonious industrial relations in the states
- Improve the availability and quality of basic infrastructure, and
- Provide easy access to finance

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## Appendix-A

### *Database*

For making the estimates of TFP, data have been drawn mainly from the *Annual Survey of Industries* (ASI), Central Statistical Organization (CSO), Government of India. The *Economic and Political Weekly Research Foundation* has created a systematic, electronic database using the ASI results for the period 1973-74 to 1997-98. Concordance has been worked out between the industrial classifications used till 1988-89 and that used thereafter (NIC-1970 and NIC-1987), and comparable series for various three- and two-digit industries have been prepared. We have used this database for the study, drawing data for the period 1980-81 to 1997-98. For 1998-99 and 1999-00, we have made use of a special tabulation of the ASI data according to NIC-1987, which was prepared by the CSO for a research project undertaken at the ICRIER.

For the purpose of deflating output and inputs, wholesale price indices have been used from the official series on Index number of wholesale prices in India. Construction of materials and energy price indices requires input-use weights (discussed later), for which the input-output matrix for 1993-94 prepared by the CSO has been used.

Various IC indicators used in the study come from different sources. For the purpose of this study, the World Bank provided us the tabulated figures from FACS 2003 pertaining to some of the IC indicators. These indicators include (i) the subjective ranking of the states according to IC (see Table 3), (ii) Average number of days required to get a new power connection in the state (*POWER*), (iii) Average number of days required to get a new telephone connection in the state (*TELE*), and (iv) Percentage of the management's time spent with government officials of regulatory and administrative issues in various state industries (*MTR*).

Since the IC indicators mentioned above are based on FACS 2003, the selection of the industries for the regression analysis in Section V was made keeping in mind the major industries covered in FACS 2003. The industries covered in FACS 2003 are: (i) Food processing, (ii) Textiles, (iii) Garments, (iv) Leather goods, (v) Pharmaceuticals, (vi) Electronic consumer goods, (vii) Electrical white goods, (viii) Auto components, (ix) Metal and metal products, (x) Plastics, and (xi) Machine Tools. However, the industry level break-up of the data on IC indicators, made available to us by the World Bank, exclude the last three of the above listed industries covered in FACS 2003. Thus, the industry-specific data on MTR is not available for Metal and metal products, Plastics, and Machine Tools.

Consistent with the nature of FACS data, the industries selected for the regression analysis, with the corresponding NIC codes, are: (i) Food manufacturing and Processing (20+21); (ii) Textiles (23+24+25); (iii) Garment (26); (iv) Leather Manufacturing (29); (v) Chemicals (30); (vi) Machinery (35+36); and (vii) Transport Equipments (37). It is clear that some of these industries (Chemicals, Machinery and Transport Equipments) do not match exactly with the industrial break up of FACS 2003, though it is possible to find the exact mapping for these industries at the 3-digit level of NIC. But this option was not considered since we noted serious fluctuations in the series at the 3-digit level for the states, possibly because of significant discrepancies in the ASI with regard to the coverage of and response from the factories over the years. Data at the 2-digit level industries are used, as the state level data at that level of aggregation is noted to be free from serious fluctuations. Thus, the data on MTR corresponding to Pharmaceuticals and Auto components are used respectively for Chemicals, and Transport Equipments. And, the simple average of MTR in Electronic consumer goods, Electrical white goods is applied for Machinery.

Data pertaining to electricity sales and credit are from the publications of the Centre for Monitoring Indian Economy (CMIE), namely "Energy, 2000" and "Money and Banking, 2000". Credit is deflated by the wholesale price index for machinery. Estimates of mandays lost per employee in industrial disputes (MANDAYS) are made drawing data from the "Indian Labor statistics" of the Labor Bureau, Government of India.

*Measurement of output and inputs*

**Output:** Real gross output and real gross value added are used as the measure of output for the TFP estimates based on the gross output function and value added function, respectively. To obtain the output deflator for manufacturing sector in a state, the deflators constructed for two-digit industries (from the series on wholesale price indices) are combined according to the relative shares of the 2-digit industries in the manufacturing output.

**Labor:** Total number of persons engaged, with adjustments made for human capital based on average years of schooling, is taken as the measure of labour input. This includes working proprietors. For TFP estimates at the two-digit level industries, it has not been possible to make the adjustment for human capital. Therefore, in such estimates, labour input is measured by the number of persons engaged.

**Capital:** Net fixed capital at constant prices is taken as the measure of capital input. The construction of the net fixed capital series has been done by the perpetual inventory method. The relationship between net fixed capital stock in year T, denoted by $K_T$, the benchmark capital stock, $K_0$, and the net investment series, $\{I_t\}$, may be written as:

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

Net investment in year t is related to gross investment in year t and capital stock in the previous year by the following equation:

$$I_t = GI_t - \delta K_{t-1}$$

Here, GI denotes gross investment and δ is the rate of depreciation, which is taken as five percent. In this regard, we follow Unel (2003) and assume the average life of fixed assets to be 20 years.

To provide further details of the capital stock measurement, the benchmark (1980-81) estimate of net fixed capital stock is obtained by applying a factor of 2.57 to the book value of fixed capital in 1980-81 reported for manufacturing sector in various states in the ASI, i.e.,

$$K_0 = 2.57 \times B_0$$

where $B_0$ is the book-value of fixed capital in the benchmark year (1980-81).

The *National Accounts Statistics* (NAS) provides estimates of net fixed capital stock for registered manufacturing at current and 1993-94 prices. We take the estimate for 1980-81 and shift the base year of prices to 1981-82 (because all other series used are at the constant prices of 1981-82). Thus, we obtain net fixed capital stock in registered manufacturing in 1980-81 at 1981-82 prices. This is divided by the book value of fixed capital in 1980-81 reported in the ASI. The ratio is found to be 2.57, which has then been applied for all states.

The method used for the estimation of gross fixed investment at 1981-82 prices is expressed by the following equation:

$$G_t = \frac{[B_t - B_{t-1} + D_t]}{P_t}$$

In this equation, $B_t$ is the book-value of fixed assets in year t and $D_t$ is the depreciation of fixed capital in year t as reported in the ASI. $P_t$ is the price index for capital goods (base 1981-82), for which we have used the implicit deflator for gross fixed capital formation for registered manufacturing in the NAS.

**Material input:** The reported series on material has been deflated to obtain material input at constant prices. The construction of the deflator has been done in two steps. In the first step, a deflator for materials is constructed for each two-digit industry considering the pattern of materials consumption as given in the input-output table for 1993-94 and taking wholesale price indices for different input-output sectors (the best available from the official series are used). In the next step, a weighted average of the materials price index of different two-digit industries is taken to derive the materials price index for manufacturing in a state. The weights used are the consumption of material in various two-digit industries in the state in 1981-82 (based year of price indices).

**Energy input:** Energy input at constant prices is obtained a manner similar to that used for materials. For each two-digit industry a price index for energy is formed considering the relative expenditures on coal, petroleum products and electricity as given in the input-output table for 1993-94 and using wholesale price indices for these three categories of products. Then, a weighted average of these indices is taken to obtain an energy price index for manufacturing in a state. The weights are the expenditure on energy of different two-digit industries in the state in 1981-82.

**Services:** ASI does not provide data on services used by industrial enterprises. However, data are reported on materials, energy (coal, petroleum products, wood, electricity, gas, etc.) and total inputs. The difference between total inputs and the cost of materials and energy is taken as a measure of services purchased by the industrial units because a major part of this likely to be on account of services provided by other agencies. The series so obtained has been deflated by a deflator for services constructed from the NAS. The input-output table for 1993-94 indicates the purchases of services (transport, banking and insurance, etc.) made by the manufacturing sector in that year. For these sectors, the NAS reports GDP at current and constant prices, which are used to work out implicit deflators. The input-output table indicates the weights to be used for combining them; these are the relative size of flows from the services sectors to the manufacturing industries. Thus, a weighted average of the implicit deflators of different services sectors is taken and a deflator of services bought by manufacturing industries is formed.

## Appendix-B

Summary statistics of variables used for regression analysis

| Variables | Obs | Mean | Std. Dev. |
|---|---|---|---|
| MTFP | 504 | 129.7982 | 63.5015 |
| Y / L | 504 | 0.5132 | 0.3979 |
| K/L | 504 | 1.3521 | 1.2334 |
| w | 504 | 0.1315 | 0.0684 |
| POWER | 504 | 55.9642 | 22.5964 |
| TELE | 504 | 30.5925 | 23.6491 |
| MTR | 504 | 14.4066 | 7.6016 |
| MANDAYS | 504 | 4.3805 | 5.9038 |
| E/L | 504 | 0.0117 | 0.0044 |
| C/K | 504 | 0.0172 | 0.0382 |

Note: Notation explained in the text.

Inter-Correlation matrix among explanatory variables

| | K/L | w | POWER | TELE | MTR | MANDAYS | E/L | C/K |
|---|---|---|---|---|---|---|---|---|
| K/L | 1.00 | - | - | - | - | - | - | - |
| w | 0.58 | 1.00 | - | - | - | - | - | - |
| POWER | 0.05 | -0.03 | 1.00 | - | - | - | - | - |
| TELE | 0.07 | -0.01 | 0.59 | 1.00 | - | - | - | - |
| MTR | 0.13 | 0.04 | 0.10 | 0.33 | 1.00 | - | - | - |
| MANDAYS | -0.09 | 0.01 | 0.14 | 0.10 | 0.15 | 1.00 | - | - |
| E/L | 0.09 | 0.01 | 0.14 | -0.23 | -0.04 | -0.35 | 1.00 | - |
| C/K | -0.14 | -0.05 | -0.19 | -0.09 | -0.02 | -0.05 | -0.05 | 1.00 |
| Pro- Employer | -0.13 | -0.12 | 0.29 | 0.18 | -0.10 | -0.22 | 0.02 | 0.18 |
| Neutral | 0.07 | -0.04 | -0.38 | -0.15 | -0.32 | -0.21 | -0.02 | 0.20 |
| Pro-Worker | 0.01 | 0.18 | -0.16 | -0.17 | 0.43 | 0.36 | 0.07 | -0.04 |
| BestIC | -0.01 | 0.23 | -0.31 | -0.27 | 0.01 | -0.23 | 0.11 | 0.45 |
| GoodIC | -0.01 | -0.19 | -0.02 | -0.12 | 0.02 | -0.18 | -0.09 | -0.23 |
| PoorIC | 0.02 | 0.03 | 0.26 | 0.34 | -0.03 | 0.37 | 0.01 | -0.11 |