Labour Disputes and Manufacturing Output in Indian States

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May 2019

Abstract

Per-capita value added from manufacturing activities substantially vary among the states in India. The variation has persisted over decades despite growth of the sector in almost all the states. Evidences point out that differences in *equilibria* among the states' manufacturing industries largely account for the sustained variation in per-capita output levels in the sector. The long-run equilibria in the states are largely determined by their total factor productivities (TFP). TFP levels differ due to differences in institutional characteristics such as industry and labour regulations, and the efficiency levels of the firms among the states in India. In existing literature, institutional differences explain a large part of the variation in output in states' manufacturing industries. An emerging strand of economic literature analyses the role of *uncertainties* in the determination of growth and business cycles (Baker, Bloom, and Davis (2012 and 2016)). This study aims to provide evidence if economic uncertainties play any role in the variation in equilibria among the states' manufacturing sector. In this study, economic uncertainty is measured by the number of man-days lost per 1000 workers in the industrial sector due to labour disputes. Evidences presented in the study show that the labour disputes display little sign of persistence in the states. In fact, labour disputes have fallen since 2002 in 6 states, viz. Haryana, Maharashtra, Rajasthan, Karnataka, Punjab and West Bengal. In other major states, labour disputes are characterised mostly as random events. With low 'persistence', labour disputes are likely to have negligible impact on the forward-looking investment decisions of the agents. In fact, evidences based on the Annual Survey of Industries data for the registered manufacturing plants between 2002 and 2015 for 16 major states in India show that the labour disputes do not have any significant effect on the equilibrium capital-labour ratios in the states' manufacturing sectors, after the differences in firm-level TFPs are accounted for. Labour disputes, however, reduce the firm-level TFP and thereby, affect the output levels. Using the years of states' Assembly elections and the duration of a political party in the state governments in a single spell as instruments for labour disputes in 2-stage least squares regression, the study finds that 1% higher labour dispute is associated with about 0.21% reduction in the firm-level TFP. However, for the 6 states where the labour disputes have fallen since 2002, this effect is significantly lower. The study suggests that a 1% higher labour dispute is associated with almost 0.08% lower value added per worker in the manufacturing industries. When both top and bottom 10% and 20% firms are excluded based on annual gross sales, these impacts are about 0.16% and 0.18%, respectively. Data shows that the year of states' Assembly election and the following year are both associated with an increase in labour disputes in the range of 50-60%. Therefore, in a representative scenario of increased labour disputes, the output from the states' manufacturing industries is estimated to be reduced by about 9%. The reduction could be up to 20% when top and bottom firms are excluded.

Keywords: Labour Disputes, Manufacturing, Equilibrium, Steady-state.

I. Introduction

Per-capita value-added from the manufacturing sector varies widely among the states in India. Figure 1 plots the average levels of net state domestic product (NSDP) from manufacturing sector relative to the total population, for the major states in India. The states in Figure 1 together account for more than 85% of India's manufacturing sector's value added and population[1]. The inter-state variation in the NSDP from manufacturing sector has persisted over the decades. Figures 2.1 to 2.4 plot the logarithms of the per-capita real NSDP for these states since 1994[2]. Barring exceptions like Jharkhand and Bihar, the manufacturing NSDP have grown in all states over these decades. Despite general growth, however, the inter-state variation has been widening. Figure 3 plots the coefficient of $\boldsymbol{\sigma}$-divergence, which is the standard deviation of the logarithm of per-capita NSDP from the states' manufacturing activities. The coefficient of $\boldsymbol{\sigma}$-divergence has increased persistently since 1994, indicating that the average variation of the states' per-capita manufacturing output around the sample mean for the variable have been increasing over the years.

There is wide range of consensus that the manufacturing activities in India would be necessary for the 'inclusive' and 'sustainable' growth for all facets of the economy. A slew of recent initiatives from the government of India such as 'Make in India' directly addresses the goal of boosting manufacturing activities within the national boundaries. The issue that the inter-state variations in the manufacturing activities worsened, has directly challenged the above goals for the policy makers. There is also less evidence that the non-manufacturing activities substitute manufacturing activities in the states. Figure 1 shows that the aggregate per-capita NSDP for the states are also far from being equal among the selected states, at a time when the per-capita manufacturing outputs vary so widely. Figure 3 shows that the coefficient of $\boldsymbol{\sigma}$-divergence for the aggregate per-capita NSDP has also widened since 1994, in line with the trend in the manufacturing sector. With lesser substitution of manufacturing activities by the non-manufacturing activities, the variations in the manufacturing base has decisive implications for the regional imbalance in economic prosperity.

From the point of view of the neo-classical economic theories of Ramsey (1928), Solow (1956), Koopmans (1963) and Cass (1965), the real per-capita output in an economy converges to its steady-state growth path in the long-run, subject to certain 'initial conditions'. At their steady-state, per-capita output continues to grow at the rate of growths in labour productivity, technology and institutional factors, summarised in the economy's total factor productivity (TFP). The steady-state growth path of per-capita output is determined by the TFPs. If TFPs differ among the economies, the equilibrium paths for the per-capita output will also vary. In that case, economies would converge to their respective long-run steady-state equilibria, differentiated by the TFPs and will continue to grow at the rate of changes in technology, labour productivity and institutional reforms. When the long-run equilibria differ, absolute convergence of the per-capita outputs for different economies to a single level cannot be made possible. The sustained growth without achieving convergence by the Indian states' manufacturing sectors hint at possible differences in the steady-state equilibria. Table 1 reports the test for $\boldsymbol{\beta}$-convergence following Barro and Sala-I-Martin, X. (1992 and 1995) among the sample states. In Table 1, change in the logarithm of value added per labour between years t and t-1 is regressed on the logarithm of the value added per labour in year t-1. The regression is obtained for five broad manufacturing industries; leather-textile, chemicals, metal products, electronics-machinery and miscellaneous others, excluding agriculture and petroleum-based industries, under each of these states. Additional details of the data are covered in Section 3. The same regressions are carried out also for the capital-labour ratios in these five industries. The regressions control for the unobserved characteristics

[1] Handbook of statistics on Indian States, Reserve Bank of India.

[2] National Account and other Government Survey data in India are reported for the fiscal year, which runs from April to March of the next year. For example, the fiscal year 1990-91 would refer to the period April 1990 to March 1991. For simplicity, fiscal year 1990-91 would be reported as 1991 in the study. This rule will be applicable for any fiscal year.

within each industry in each state by introducing dummy variables for all industry-state combinations. These dummy variables capture the states' institutional differences such the legislative framework, efficiency of governance, industry-labour relations and differences in policy towards each industry groups. In other words, they represent the aggregate TFPs for all combinations of state-industry. The regressions also control for the year-specific unobserved effects through the year-dummies. The coefficients of both the logarithms of capital-labour ratios and the value added per labour in year t-1 in Table 1 are negative and statistically significant. The results confirm that, over the sample period, the value added per labour and the capital stock per labour in the manufacturing industries among the states have converged to the 'steady-state' equilibria, after the differences in TFPs are taken into account. Therefore, sustained variation in the per-capita output from the states' manufacturing sectors can possibly be explained by the differences in equilibria due to differences in TFP.

Existing literature concerning the inter-state differences in the manufacturing sectors' performance in India broadly support the case of institutional differences. These differences create variations in the 'achievable' or the equilibrium levels of output by the states. Besley and Burgess (2004) shows that the states which adopted labour regulation acts in the pro-worker direction, generally experienced lower growth in output, employment and investment in the registered manufacturing activities between 1958 and 1992. In analysing the effects of 'delicensing', which is the process of dismantling central control over the entry and production in the manufacturing sectors, Aghion et. al. (2008) also came to the similar conclusion. Aghion et. al. (2008) show that, during the process of 'delicensing' in 1980's and 1990's, the pro-employer states experiences faster growth in the registered manufacturing sector. In similar studies, Veermani and Goldar (2005) and Topalova and Khandelwal (2011) also conclude that the institutional heterogeneity has resulted in uneven performance of the manufacturing sectors in different regions within India. In the recent empirical literature on business cycle and growth, the role of uncertainty in the economic policies have assumed significance. In the context of USA, Baker, Bloom and Davis (2012 and 2016) shows that policy uncertainty is associated with reduced investment and employment in policy-sensitive sectors like defence, health care, finance, and infrastructure construction. Bhagat, Ghosh and Rangan (2013) shows that increases in the magnitude of a similar measure of policy uncertainty has reduced aggregate growth in India after 2005. Their study shows that if the economic uncertainties were to decrease to the level of 2005, India's aggregate GDP growth would increase by 0.56% and the growth in fixed investment would increase by 1.36%. In the context of manufacturing sectors in Indian states, however, this area has remained largely unexplored. Although all the states in India face economic and policy uncertainties to varied extents, often temporarily shutting down industrial activities, it is not very clear if those uncertainties affect the long-run equilibria by affecting investments in the sectors. The present study fills this gap by quantitatively assessing, whether uncertainty has role in differentiating the states' equilibria in manufacturing activities among the Indian states. The issue examined in this study stands out differently from the wide range of available studies on labour regulation and industrial employment in India (see Bhattacharya (2006)). While those studies broadly address the institutional differences, the present study addresses the question of fluctuations in the expected outcome, or 'uncertainty', which so far, not been assessed quantitatively.

The existing literature point out difficulties in measuring uncertainties. Major issues involved in this regard are; separating risks from the uncertainties, uncertainties on account of technology versus policy, and demand shocks versus the supply shocks (Bloom (2014)). Most of the empirical literature, therefore, rely on certain proxies for the uncertainty. As proxy for the uncertainty, this study has used labour disputes in industrial activities. This study aims to answer the following questions: 1/ do labour disputes make significant differences to the equilibrium output in manufacturing sectors among the states in India? and 2/ if yes, by how much and if no, then how do they possibly affect the states' aggregate productions in the manufacturing?

The study is organised in the following way. After the introduction, certain concepts related to the uncertainty measures, their impacts on equilibria and the usefulness of labour disputes as proxy for the uncertainty are discussed in Section 2. Section 3 discusses the data used for the empirical analyses. Section 4 presents the results. Section 4 is divided as follows; first it discusses the characteristics of labour disputes in the major Indian states. Second, it discusses the effects of labour disputes on the states' capital-labour ratios and the firm-level TFPs. Third, it sums up by observing the effects of labour disputes on the states' aggregate output from the manufacturing industries. Section 5 concludes by discussing the results.

II. Labour Disputes: Uncertainty or TFP shocks?

Bloom (2014) provides a comprehensive coverage of the literature on uncertainty and its effects on growth. The major issue is, what constitutes uncertainty and how to develop a suitable measure for it. Broadly, the concept reflects a set of events that makes future outcomes on production and consumption, uncertain. Two concepts that Bloom (2014) cites from Frank Knight (1921) are useful. Knight (1921) distinguishes *risk* from the *uncertainty*. According to Knight, *risks* represent a known probability distribution over a set of purely 'random' events. In contrast, *uncertainty* is the agents' inability to determine the future outcomes. In light of this, the usefulness and certain aspects of labour disputes as a measure of uncertainty may be discussed. Labour disputes in India mostly occur from the uncertainty over production or sudden unexpected (by the workers) changes in decisions by the management. In certain cases, labour disputes persist over a period of time when there are ongoing issues with the states' laws governing the labour rights, the general industrial policies of the state, and the relation of the labour unions with the ruling political party in the states. Therefore, labour disputes can apparently have a mix of two components, one somewhat 'foreseeable', such as the existing industry-labour relationships in the states and the other, that occur mostly as random events that act as negative 'shocks' to the production.

Uncertainty about the production arises when labour disputes are more 'persistent'. Labour disputes are 'persistent' when the similar patterns of the disputes are repeated in at least some of the subsequent periods. In that case, the current period labour disputes can be taken as a good guess for the labour disputes in the immediate future. Disputes are 'persistent' when the cause of the disputes are not fully resolved by the states in a year, so that similar events repeat in the subsequent years. Due to such 'persistence' or the repetitive nature of the labour disputes, agents may raise doubt about the future outcome from the production. So following Knight (1921), the 'persistent' labour disputes may be categorised as *uncertainty*. The *risks* are, on the other hand, purely unexpected random events occurring over time. As Bloom (2014) acknowledges, any measure of uncertainty has a mix of both *risk* and *uncertain* components. Labour disputes are not exception. However, it may be useful to identify the 'dominant' trait within the given data for the states. When labour disputes largely represent random events or *risks*, the autoregressive term of order 1 i.e. AR(1) will be closer to 0, in a regression where the number of labour disputes are regressed on its own lag. On the other hand, when labour disputes are persistent, the AR(1) term will be closer to 1. The latter is the case of *uncertainty*.

Uncertainties and random *shocks* have different implications for the aggregate investment and production. As Bloom (2014) points out, higher uncertainty reduces aggregate investment and hiring through at least two channels: "real options" ((Bernanke 1983; Brennan and Schwartz 1985; McDonald and Siegel 1986)) and higher risk premia. In the first case, uncertainty makes firms cautious about investment and hiring due to large adjustment costs (Ramey and Shapiro (2001) and Cooper and Haltiwanger (2006), Nickell (1986) and Bloom (2009)). Firms may wait or delay their decisions when there are uncertainties regarding the future and such delay reduce potential output in the near term. In the latter case, the risk-avert investors want to be compensated for the higher risk. Since uncertainty leads to increasing risk premia, they raise the cost of finance, and thus reduce investment. Uncertainty also increases the probability of default and thereby raising the default premium and aggregate

deadweight cost of bankruptcy. Therefore, *uncertainty* reduces the equilibrium capital stocks for an economy by reducing investment activities. This situation might be consistent with the 'persistent' labour disputes. In contrast, when disputes are mostly 'unforeseeable' random events, they do not likely make much difference to the forward-looking investment behaviour by the firms. However, when labour disputes occur, it reduces output through stoppages in work, shutting of the factories etc. Such random disputes reduce the firm-level TFP. Therefore, when labour disputes are not 'persistent', they are likely to be characterised as 'TFP shocks' rather than *uncertainties*.

In view of the above, the empirical part of the study in Section 4 has broadly been divided into the following. First, the study would assess if labour disputes in the states are 'persistent' or just the random 'TFP shocks'. Depending upon the 'type' of labour disputes identified, second part of the empirical assessment would confirm if labour disputes affect equilibrium capital-labour ratios of the states, or just affects the firms' TFPs. In either case, the final output in the manufacturing industries are affected. The third part of Section 4 summarises the impact of labour disputes on the aggregate output.

III. Data

Labour disputes in the states are measured by the number of man-days lost per 1000 workers in the industrial sector due to disputes in a year. The number of man-days lost due to industrial disputes are obtained from several rounds of the publication on "Statistics on industrial disputes, closures, retrenchments and lay-offs in India", published by the Labour Bureau, Ministry of labour and employment, Government of India. The reports publish annual figures on the state-wise aggregate man-days lost due to disputes in industrial sector. Industrial disputes include strikes and lockouts. The industrial sector in these reports are defined according to the National Industrial Classification (NIC) 1998, 2004 and 2008. The industrial sector generally includes, apart from the manufacturing, the mining and construction activities, and electricity generation. The number of man-days lost due to disputes in the industrial sector are available between 2002 and 2015. In the study, labour dispute is defined as the number of man-days lost per 1000 workers in the industrial sector in the state for a year. The number of workers in the industrial sector is obtained by multiplying the states' total population by the percent of population working in the industrial sector in 2010 in principal status, where the latter is obtained from the Labour Bureau's Report on Employment and Unemployment Survey (2009-10). Total population figures for the states are available for the years 2001 and 2011, the years when the decadal census were conducted. The population figures for the intermediate years and the years after 2011 are obtained by applying the compound average annual growth rate of population between 2001 and 2011 for each state. In the regressions, labour disputes are expressed in their natural logarithm.

Data on the manufacturing activities are obtained from the Annual Survey of Industry rounds between 2001 and 2015. Annual Surveys of Industries are the surveys of plants in the 'registered' industrial activities. 'Registered' firms account for about 68% of the total value added by the manufacturing activities in India (Table 1a in Appendix). Plants are stratified within each 5-digit industry at the district level. The industrial classifications in the survey follow the National Industrial Classification (NIC) of 1998, 2004 and 2008. For the state-level aggregate regressions, the survey data has been aggregated for the corresponding 2-digit industries within each state. In the study, the plants and the 2-digit industries are referred to as 'firm' and 'industry', respectively. The study uses state-level aggregate data for the following five manufacturing industries: leather-textile, chemicals, metal products, electronics-machinery and miscellaneous other manufacturing industries. The miscellaneous manufacturing activities include all industrial activities, excluding the agriculture-based industries, food processing activities, petroleum refineries and related products, electricity generation, mining activities and construction activities. Table 2a in Appendix presents the corresponding 2-digit NIC codes for these broad industries included in the study. Manufacturing activities are analysed for the following 16 states in India: Andhra Pradesh, Assam, Bihar, Chhattisgarh, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. The

state Jharkhand was removed as the data on man-days lost due to industrial disputes were not available for the state for most of the years between 2002 and 2015. The erstwhile state of Andhra Pradesh was bifurcated in 2014 into two: Andhra Pradesh and Telangana. The data on the industrial performance and other state aggregates including the industrial disputes for these states were combined, wherever applicable. These 16 states account for over 85% of India's net domestic product from the manufacturing sector between 2010 and 2015. The descriptive statistics for the manufacturing industries are presented in Tables 3.1a and 3.2a in the Appendix.

The study uses the following concepts for deriving its main results. First, the impacts of labour disputes are obtained on the aggregate value added for the manufacturing industries. The value added by a firm is defined as the value of gross sales (Rs.) minus the total value of inputs (Rs.) consumed by the firm during a year. The inputs include that are purchased domestically as well as the imported ones. The labour force is measures as the total man-days worked by the workers in the firm during a year. The capital stock is measured as the value of fixed capital (Rs.) installed with the firm at the beginning of the concerned year. In certain cases, the value of fixed capital at the beginning of a year were not available from the survey data. In those cases, the field has been replaced with the value of fixed capital at the end of the year, if available. The nominal values reported in Indian Rupee (Rs.) are deflated by the all-India consumer price index for the industrial workers (CPI-IW) with the base year 2001. The aggregate variables are the summation of all firms' values for each state-industry combination. The aggregate data is observed between 2002 and 2015 for each of the five industry groups in each of the 16 states. In the regressions, aggregate value added, labour force and capital stocks are expressed in their natural logarithms.

In some aggregate regressions, the study uses state-level physical infrastructure and banking infrastructures to capture certain state-specific characteristics. Physical infrastructure is defined as the underlying factor between per-capita power availability in mega-watt, aggregate lengths (in km) of state highways, national highways and railways in relation to the states' land area (sq. km). The formula used for deriving physical infrastructure is; 0.6126* per-capita power availability + 0.5968* (length of state highways + national highway) + 0.1693* length of railways. In the regressions, physical infrastructure is expressed in its natural logarithm. The banking infrastructure is defined as the value of outstanding bank credit to the industrial sector as percent of the net domestic product from the industrial sector of the state. Industrial sector includes, apart from manufacturing, the mining and construction activities, and electricity generation. All the pertinent data for constructing physical and banking infrastructure are obtained from the Handbook of Statistics on Indian States, published by Reserve Bank of India.

Several regressions use the firm-level total factor productivity (TFP), aggregated within each states-industry combination. The firm-level TFPs are estimated in two steps. In the first step, following Ghani et. al (2016). logarithm of the firms' value added are regressed on the logarithms of labour force and capital stocks of the firms (Table 4.1a in Appendix). The regression additionally controls for the following effects by using dummy variables, and the interaction of these dummies with the firms' labour force and capital stocks: 2-digit industries, states, whether a firm is a public limited company (including public sector) or categorised as self-employment by the Annual Survey of Industry surveys and the firms' (percentile) position in the distribution of gross sales within each state-industry combination. Related literature establishes that the firm-level TFPs are positively associated with the human capital. However, variables such as human capital, technology etc. are likely to be 'endogenous', which means they could be correlated with the unobserved firm-specific factors. For example, a more 'efficient' firm is likely to be more profitable in business and therefore, be able to afford improved, cost saving technology and hire better human capital. Since the Annual Survey of Industries is a stratified sampling of firms in each district and 5-digit industry classifications, it is not possible to observe data for a firm over all the sample years. Therefore, the regression in Table 4.1a in Appendix could not include the firm-level fixed effect dummies. When such fixed effects are not included, the coefficients of human

capital and technology would be biased, if these variables are included in the firm-level regression in Table 4.1a. In order to avoid this problem, the regression in Table 4.1a in Appendix is executed without these two variables. In Table 4.2a in Appendix, estimated residuals from the regression in Table 4.1a are regressed on the firm-level human capital and technology. Following Corvers (1997), human capital is defined as the inverse of the share of workers in the firms' aggregate man-days worked by all employees. Technology is defined as the output-input ratio, i.e. the ratio of firms' value added to the total value of inputs purchased during the year. Both technology and human capital are expressed in their natural logarithm in the regression reported in Table 4.2a in Appendix. The regression in Table 4.2a includes dummy variables for 2-digit industry, and the firms' percentile positions in the distribution of human capital and technology, each. The estimated residuals from the regression in Table 4.2a in Appendix represent the firm-level TFPs. Following Ghani et. al. (2016) the states' aggregate TFP for the firms is defined as the arithmetic mean of these estimated firm-level TFPs. Regressions in Table 4.1a and Table 4.2a use the logarithm of gross sales as the weight.

IV. Results

a. Labour Disputes: Persistent or Just Random Events?

Between 2002 and 2015, labour disputes varied widely among the states. The average number of man-days lost per 1000 workers in the industrial sector due to disputes stood at staggeringly high of over 503 for West Bengal for the whole sample period, followed by Kerala (152) and Andhra Pradesh (112). On average, between 2002 and 2015, Bihar registered the lowest labour disputes at about 5.7, preceded by Uttar Pradesh and Madhya Pradesh, each at about 7.3. The aim of this section is to see if the industrial disputes in the states are 'persistent', which means if the AR(1) coefficient of the regressions of states' labour disputes on its own lag is sufficiently close to 1. The implications of the 'persistence' of labour disputes are discussed in detail in Section 2.

There exist wide inter-year fluctuations in the labour disputes for many states. The coefficient of variation of labour disputes measured by the ratio of standard deviation to the simple average for all the sample years was highest for Kerala and Andhra Pradesh, at 1.7 and 1.3, respectively, followed by Uttar Pradesh (1.3). The coefficient of variation was lowest for Bihar at 0.45, preceded by Gujarat and West Bengal, each at about 0.5. Given such inter-year variations within a state, generally it is difficult to assess whether industrial disputes possess any persistence. The AR(1) coefficient in Table 2 is small, and statistically insignificant. The interaction terms of AR(1) with the state-dummies are also statistically insignificant for most of the states. However, certain common patterns could be identified among the states. Albeit fluctuations, labour disputes have generally fallen in Haryana, Karnataka, Maharashtra, Punjab, Rajasthan and West Bengal. The study categorises these states as **Group 1**. Although Kerala and Andhra Pradesh displayed very high levels of man-days lost due to industrial disputes prior to 2007, the levels have greatly moderated after 2007, except for a spike in 2009 in case of Andhra Pradesh. The study categorises Kerala and Andhra Pradesh as **Group 2**. Assam, Uttar Pradesh and Tamil Nadu do not display much discernible pattern and hence are classified as one group i.e. **Group 3**. The remaining states viz. Bihar, Chhattisgarh, Gujarat, Madhya Pradesh and Orissa are classified as **Group 4**. For the states in Group 4, the man-days lost due to the industrial disputes generally moderated between 2007 and 2011 from the prior years, before rising again since 2012. The above classifications are shown in Figures 4.1 to 4.4.

Columns 1 and 2 in Table 3 show the coefficients of regression of labour dispute in the industrial sector on its own first-order lag, for the groups formed above. The AR(1) term is interacted with the dummy variables representing Groups 1, 2 and 3, as defined above. The dummy variable for Group i assumes a value 1 if the corresponding observation belongs to a state categorised under Group i, otherwise 0. Group 4 serves as the reference group in the regression. As exogenous sources of labour disputes, the dates of states' Assembly elections are used. The regression uses dummy variable that

assumes value 1, if, in a year, the state had Assembly election. States' Assembly elections are generally held in every five years. However, the states' election cycles differ among the states. Table 5a in the Appendix shows the years of Assembly elections for the states under consideration. Similar dummy variables are also used for the year preceding and the year following the states' Assembly elections. A variable that indicates the number of years that the incumbent party had been ruling the state, is also used. In case of change in the ruling party of the state government in a certain year, the variable starts from the value 1, increasing by 1 every following year, until the ruling party changes again. The regression also uses a dummy variable, which assumes value 1, if the state government was in coalition with India's union government in a year.

The coefficient of AR(1) term of the states' labour dispute interacted with the Group 1 dummy variable in column 1 of Table 3 is 0.54 and statistically significant. This means, the number of man-days lost per 1000 workers due to disputes in the industrial sector in the states under Group 1 in a year is roughly 54% of the previous year, after controlling for the states' elections and few other governance issues. This is consistent with the observation in Figure 4.1 that the industrial disputes have generally fallen in states in Group 1. The coefficient of AR(1) term interacted with the Group 3 dummy variable is 0.35 but significant only at 10% level. The AR(1) coefficient without any interaction term represents the reference group, i.e. Group 4. This coefficient is much closer to 0 and is statistically insignificant. This means that the industrial disputes in states under Group 4 do not display any significant trend and are mostly random in nature. The coefficient of AR(1) term interacted with the Group 2 dummy variable is also statistically insignificant, as expected. Column 2 of Table 3 repeats the same regression by including dummy variables for all the years and the interaction of those year-dummies with the dummy variables for Group 1, 2 and 3. The coefficient of the AR(1) term interacted with the Group 1 dummy variable remains very close to that in Panel 1. The coefficient of the AR(1) term interacted with the Group 3 dummy variable increases to 0.57 and is now significant at 1%. The coefficient of the AR(1) term interacted with the Group 2 dummy variable is negative but significant only at 10%. The negative coefficient indicates that the industrial disputes generally oscillate around a trend, represented by the sum of the coefficient of Group 2 dummy and the constant term of the regression. The 'persistence' term for the reference group or Group 4, i.e. the AR(1) term without any interaction remains statistically insignificant like Panel 1. Columns 1 and 2 in Table 3 shows that the four groups display distinct characteristics represented by the differences in AR(1) terms for the industrial disputes. Although the coefficients of AR(1) interacted with both Group 1 and Group 3 dummies in column 2 of Table 3 are similar in magnitude, the coefficient of the interaction term with Group 1 dummy variable is more robust in two specifications in columns 1 and 2. Therefore, the study prefers not to merge Group 1 and Group 3, based on the results of column 2 of Table 3.

The robustness check for the state groups are carried out in columns 3 to 6 in Table 3. In columns 3 and 4, Groups 1 and 2 are combined. The results, however, show that the AR(1) coefficients broadly remain unchanged from the columns 1 and 2 in Table 3. In columns 5 and 6 in Table 3, Groups 2 and 3 are combined, also leaving the AR(1) coefficients broadly unchanged from columns 1 and 2 in Table 3. In addition, Table 3 shows that, both in the years of states' Assembly election and the year following the election, labour disputes generally increase in the range of 50-60%. One more year of a political party running the state government is generally associated with 5-6% increase in the industrial disputes.

The general conclusion from this section is: labour disputes in the states in India generally do not show any persistence. This means, in general, one cannot conclude with certainty that if a state had high instances of labour disputes in a year, it is likely to have the similar levels of labour disputes in the following years too. In fact, in states such as Haryana, Karnataka, Maharashtra, Punjab, Rajasthan and West Bengal; labour disputes have visibly declined between 2002 and 2015. Although any clear pattern was not visible for Assam, Uttar Pradesh and Tamil Nadu, the labour disputes show evidence of decline

over time once the state-specific shocks such as Assembly election and uncertainty over new governments and the year-specific unobserved effects are taken into account. Labour disputes in Andhra Pradesh, Kerala, Bihar, Chhattisgarh, Gujarat, Madhya Pradesh and Odisha do not display any clear pattern and are mostly random in nature. Labour disputes with the low persistence or high in randomness are not likely to have much influence over the steady-state equilibrium paths of the states' manufacturing sector output, as discussed in Section 2. However, labour disputes do affect output levels by affecting the total factor productivities of the firms. The objective of the following section is to test the hypothesis stated in above two lines and provide estimates of the impacts.

b. Labour Disputes, capital-labour ratios and TFP

Table 4.1 shows the estimated impacts of labour disputes on the states' aggregate capital-labour ratio in the manufacturing industries. These regressions are obtained for the aggregate capital-labour ratios in the states, taking into account all firms under the five manufacturing industries. Like most of the other variables, the aggregate capital-labour ratios are expressed in their natural logarithm in the regressions. The regressions in Table 4.1 controls for the group specific unobserved characteristics by introducing Group 1, 2 and 3 dummies. As before, Group 4 serves as the reference group in the regressions. Since it is not possible to incorporate state-specific dummies to account for the individual state-specific unobserved characteristics, the regressions use three additional controls which vary across states. First, the regressions control for the differences in physical infrastructure among the states. The definition of physical infrastructure is provided in Section 3. Second, the regressions use one period lagged value of the ratio of outstanding bank credit to the net domestic product from the states' industrial sector as proxy for the banking infrastructure in the states. To avoid possible endogeneity of banking infrastructure with the unobserved state-specific characteristics, the study uses the following variables as instruments: the number of years that the incumbent party had been running the government, a dummy variable for the years of the union elections in India, and dummy variables for one year preceding and following the union elections. The validity of these variables as instruments have been tested in the regression reported in column 2 of Table 6a in the Appendix. The coefficients of all these variables as regressor on the banking infrastructure are statistically significant. The regression in Table 4.1 use the one year lagged fitted values of the banking infrastructure from Table 6a in the Appendix. Third, the regressions control for the aggregate firm-level TFPs in the state. The estimation details of the firm-level TFPs are provided in Section 3. The aggregate firm-level TFPs control for the differences in the firm-level efficiencies, a part of which are likely to be directly impacted by the labour disputes. Higher labour disputes reduce the firm-TFPs by reducing working days, delayed operations, temporary shutdown etc. Therefore, using the labour disputes as additional explanatory variable even when firm-level TFPs are included in the regressions would account for any additional effects of industrial disputes on the variation of capital-labour ratios which are not explained by the variations in aggregate firm-level TFPs. Finally, to account for the differences in technology between industries, the regressions use industry-specific dummy variables.

Regressions in Table 4.1 use contemporaneous, one- and two-years lagged labour disputes as explanatory variables in separate regressions. The study does not include the lagged and contemporaneous labour disputes in the same regression to avoid possible issues of multicollinearity. It is difficult to assess if the labour disputes observed in a state during a year are the results of certain issues with the states' labour regulation, ongoing labour-industry relation, or some governance issue. In other words, the uncertainty levels might be correlated with the states' unobserved characteristics. In order to avoid such endogeneity, it may be desirable to identify certain 'exogenous' reasons that are not directly related to the states' characteristics but may affect labour disputes. The study uses the changes in labour disputes during the states' Assembly elections (see Table 5a in Appendix) as one such 'exogenous' movement. In the regression in Table 4.1, industrial disputes are instrumented by the number of years that the incumbent party had been running the government, and dummy variables for

both the years of states' Assembly election and the following one year. Column 1 of Table 6a in the Appendix shows the validity of these instruments where the contemporaneous labour disputes are regressed on these variables. All three dummy variables are statistically significant. Regressions in Table 4.1 use the fitted values of the labour disputes from Table 6a in Appendix as regressors. The lagged values of the labour disputes are particularly important, when labour disputes possess persistence. When labour disputes are persistent, contemporaneous labour disputes can be used by the economic agents as a proxy for the labour disputes in the future. In that case, high labour disputes may reduce the steady-state capital-labour ratios for the future. The lagged terms may be significant in that case.

Regressions reported in columns 1-3 in Table 4.1 do not include firm-level TFP. The coefficients of contemporaneous and the 2-years lagged industrial disputes are statistically significant, but only at 10% and 5%, respectively. The coefficients of industrial disputes become statistically insignificant when the firm-level TFPs are included the columns 4-6. The coefficients of firm-level TFPs are statistically significant and robust in alternative specifications. This means that the labour disputes generally do not have any effect on the equilibrium capital-labour ratios in the selected manufacturing industries, both contemporaneous as well as in futures. This is consistent with the results obtained in the previous section where labour disputes were found to have almost no 'persistence' over time. In 9 out of 16 states, the industrial disputes show declining trend while in other 7 states, industrial disputes were more random in nature. Under these scenarios, it may be unlikely for the decision maker to form their long-run investment behaviour much on industrial disputes, and thus causing little variation to the resulting capital-output ratios due to industrial disputes. These conclusions are robust in different sample of firms. Tables 4.2 and 4.3 report similar regressions for the aggregate capital-labour ratios after excluding both the top and bottom 10% and 20% firms from the distribution of gross sales values within each state-industry combination, respectively. The coefficients of labour disputes and their interactions are broadly similar in Tables 4.1, 4.2 and 4.3.

Labour disputes, however, affect the production and output from the manufacturing industries by introducing variations in the firm-level TFPs. Higher labour disputes reduce firm-TFP by reducing working days, delayed operations, temporary shutdown etc. These variations in output, however, take place around the equilibrium path, unaffected by the labour disputes. Table 5 provides estimates of the effects of industrial disputes on the firm-level TFPs in the states. To avoid endogeneity from the unobserved state-level characteristics, the banking infrastructure and labour disputes are instrumented in the similar way as in the regressions in Tables 4.1 to 4.3. Columns 1-3 in Table 5 show that, on average, in response to a 1% increase in the labour disputes, firm-level TFP declines by about 0.21% in the same period. The magnitude of decline in firm-level TFP in response to 1% increase in industrial disputes with lags of 1-year and 2-years are 0.18% and 0.22%, respectively. The effects are not significantly different for Groups 2 and 3, as the interaction terms of the labour disputes with the state-group dummies are statistically insignificant for both the groups. The coefficients for the interaction terms of the labour disputes with Group 1 dummy is similar in magnitude, but opposite in sign from the baseline estimates, and are statistically significant. This means that, while the baseline coefficient holds true in general, the decline in labour disputes in these states have generally resulted in improvement in the firm-level TFP during the sample period. Overall, the effects of labour disputes on the states' aggregate firm-level TFPs are greatly reduced for the states in Group 1. The conclusions are robust in different sample of firms, reported in columns 4-9 in Table 5.

c. Labour Disputes and Value Added in Manufacturing

The impacts of labour disputes on the states' aggregate output from the manufacturing industries are obtained in the indirect way. First, the states' aggregate production function is estimated and the impact of a 1% change in firm-level TFP on the states' aggregate output from the manufacturing industries are obtained. These estimated coefficients of firm-level TFP are multiplied with the estimated coefficients in Table 5 to obtain the effects of industrial disputes on the states' aggregate output from

the manufacturing industries. Table 6.1 provides the estimates for the states' aggregate production function for the manufacturing industries. In order to avoid the issues of non-stationarity or underlying trend in all variables, the regressions are estimated in the first difference of dependent variable and explanatory variables, where the natural logarithm of a variable in a year is taken net of the previous years' value of the same variable. These transformations are carried out for all state-industry combinations. In specifications 3, 6 and 9, the regressions use dummy variables for all combinations of state and industry. Columns 2 and 3 in Table 6.1 suggests that in response to a 1% increase in the firm-level TFP, value added from the manufacturing industries increase by about 0.42%. The magnitudes of this estimate become larger in smaller sample of firms in columns 6 and 9. The coefficients for labour and capital indicate, in response to a 1% increase in the factor input in the production process, by how much percentage do the value added increase in the manufacturing industries. These coefficients represent the factor elasticities in the production. Table 6.2 provides a robustness check for the estimated coefficients of aggregate production function in Table 6.1. In Table 6.2, first difference in value added per unit of labour in the manufacturing industries is regressed on the first difference of both firm-level TFP and the capital stock per unit of labour. The estimated coefficients of both firm-level TFP and the elasticity of value added with respect to the capital stock remain broadly similar with the estimates in Table 6.1. In estimating the impact of 1% change in industrial disputes on the value added from the manufacturing industries, the coefficients of firm-level TFP from Table 6.2 are used as it provide the sources of variation in value added per unit of labour, as the value added per workers are comparable across states.

To summarise the estimates obtained so far, a 1% increase in industrial disputes reduce firm-level TFP by about 0.21% in all sample of firms in Table 5. From Table 6.2, a 1% reduction in firm-level TFP reduces aggregate value added by the manufacturing industry by 0.39%, when all firms are taken into account. Therefore, a 1% increase in the labour disputes are associated with a fall in the aggregate value added per labour in the manufacturing industries by about 0.08% (21% of 0.39%). The estimated impacts are about 0.16% (21% of 0.74%) and about 0.18% (21% of 0.86%) when the top and bottom 10% and 20% firms are excluded from the sample, respectively. Table 6a shows that the year of states' Assembly election and the following year are both associated with an increase in labour disputes by 57% and 53%, respectively, from all other years. Taken together, states' elections are associated with almost 110% increase (i.e. more than doubling) in the labour disputes in the states. It follows from the estimates of the effects of 1% increase in labour disputes on the value added, deduced earlier in this paragraph that, in a representative scenario of increased labour disputes, the output from the states' manufacturing industries reduce by about 9% (110*0.08%). The reduction could be up to 20% when top and bottom firms are excluded.

V. Conclusion

This study estimates the possible impacts of labour disputes on the equilibrium output levels of five[3] manufacturing industries in 16 major states in India. Labour disputes are measured by the number of man-days lost in the industrial sector due to disputes such as strikes, lockouts, etc., divided by the number of workers (in '000) working in the states' industrial activities. First of all, the study finds that, between 2002 and 2015, labour disputes in the states show little sign of 'persistence'. In 6 out of 16 states, the labour disputes have fallen since 2002. Those states are Haryana, Maharashtra, Rajasthan, Karnataka, Punjab and West Bengal. In other states, labour disputes are characterised mostly as random events, displaying wide variations across years. The AR(1) coefficient of the regression of labour disputes on its own lag were in the range 0.54-0.60 for the 6 states mentioned above. For Assam, Uttar Pradesh and Tamil Nadu, the AR(1) coefficient was much lower whereas for the remaining states, the coefficient was close to 0 and statistically insignificant. With such low persistence, labour disputes are

[3] Leather-textile, chemical products, metal products, electronics-machinery and miscellaneous other industries excluding the agro-industries and petroleum refineries.

likely to have negligible impact on the forward-looking investment decisions of the agents. Evidences based on Annual Survey of Industry data between 2002 and 2015 for five broad industries in the 'registered' manufacturing sector suggest that labour disputes do not affect the equilibrium capital-labour ratios of the states' manufacturing sector, after the differences in the firm-level total factor productivities are taken into account. Labour disputes, however, reduce the firm-level TFP and thereby, affect the output levels. A 1% higher labour dispute is associated with about 0.21% reduction in the firm-level TFP. However, for the 6 states where the labour disputes have fallen since 2002, this effect is significantly lower. The estimates are robust in different sample of firms. Finally, the study suggests that a 1% higher labour dispute is associated with almost 0.08% lower value added per unit of labour in the manufacturing industries. When both top and bottom 10% and 20% firms are excluded, these impacts are about 0.16% and 0.18%, respectively. The study concludes that in a representative scenarios when disputes generally more than double, especially during the election cycles, the aggregate output from the states' manufacturing industries may reduce by almost 9%. The reduction could be up to 20% when top and bottom firms are excluded. Bloom (2014) argues that these effects can be large in developing countries due to the presence of low insurance for the firms. Low insurance often limits the Oi–Hartman–Abel effect (after Oi 1961; Hartman 1972; Abel 1983) in which firms can easily expand and contract in response to changes in uncertainty. However, Bloom (2014) admits that the Oi–Hartman–Abel effect might not work very well in the short-run. Also, Bloom (2014) notes that when the general *uncertainty* rises, the productivity growth drops as reallocation freezes.

The estimated impacts of labour disputes should be interpreted with some caution. The study earlier mentions that the average number of man-days lost per 1000 workers in the industrial sector due to disputes varies from over 503 for West Bengal, followed by Kerala (152) and Andhra Pradesh (112), to only 5.7 for Bihar, preceded by Uttar Pradesh and Madhya Pradesh, each at about 7.3. However, as labour disputes in the states are not quite stable (i.e. not 'persistent'), these average figures do not represent the true measure of *uncertainty* in the production process. Further, it is shown that the long-run average levels do not make any significant difference to the states' equilibria. The variation in labour disputes used in the study to derive the main results, therefore, do not refer to these inter-state variations in the average levels. The variation in labour disputes refer to only the short run fluctuations, instigated only by the exogenous events such as the states' Assembly elections and the duration of a political party in the state governments in a single span. These exogenous movements broadly affect production through changes in the firm-level total factor productivity.

The study broadly concludes that labour disputes do not affect the states' equilibria in manufacturing activities. However, this is not equivalent of saying that uncertainties do not affect the steady-state equilibria. The study is a special case where the selected measure of uncertainty, i.e. labour disputes do not affect the equilibria since labour disputes are not 'persistent'. To conclude about the role of uncertainty, one needs to see uncertainty in a broader context. In this regard, one can possibly use the methodology of Baker, Bloom and Davis (2012) for the states and its characteristics. This could be a possible future extension of the work.

Bibliography

Abel, Andrew B. 1983. “Optimal Investment under Uncertainty.” American Economic Review 73(1): 228 –33.

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

Baker, S. R., Bloom N. and Davis S. J., (2016), Measuring economic policy uncertainty, The Quarterly Journal of Economics, Volume 131, Issue 4, November 2016, Pages 1593–1636

Barrow, R.J. (1991), “Economic growth in a cross section of countries”, Quarterly Journal of Economics, CVI, 407-44.

Barrow, R.J. and Sala-I-Martin, X., (1992), “Convergence”, Journal of Political Economy, 100, 223-51.

Barrow, R.J. and Sala-I-Martin, X., (1995), Economic Growth, McGraw-Hill, New York, NY.

Bernanke, Ben S. 1983. “Irreversibility, Uncertainty, and Cyclical Investment.” Quarterly Journal of Economics 98(1): 85 –106

Besley T. and Burgess R. (2004), “Can Labor Regulation Hinder Economic Performance? Evidence from India”, The Quarterly Journal of Economics, Volume 119, Issue 1, February 2004, Pages 91–134.

Bhattacharjea, A. (2006), “Labour Market Regulation and Industrial Performance in India: A Critical Review of the Empirical Evidence”. Indian Journal of Labour Economics, Vol. 49, No. 2, pp. 211-232, April-June.

Bloom N., “The Impact of Uncertainty Shocks,” Econometrica , 77 (2009), 623–685.

Bloom N., “Fluctuations in Uncertainty,” Journal of Economic Perspectives, 28 (2014), 153–176

Brennan, Michael J., and Eduardo S. Schwartz. 1985. “Evaluating Natural Resource Investments.” Journal of Business 58(2): 135 –57.

Cass, D. (1965), “Optimum Growth in an Aggregative Model of Capital Accumulation”, The Review of Economic Studies, Vol. 32, No. 3 (Jul., 1965), pp. 233-240

Cooper, Russell W., and John C. Haltiwanger. 2006. “On the Nature of Capital Adjustment Costs.” Review of Economic Studies 73(3): 611–33.

Corvers F., (1997), “The impact of human capital on labour productivity in manufacturing sectors of the European Union”, Applied Economics, 29:8, 975-987.

Ghani E., Goswami A. G. and Kerr W. R., (2016), “Highway to Success: The Impact of the Golden Quadrilateral Project for the Location and Performance of Indian Manufacturing”, The Economic Journal, Volume126, Issue591, March. Pages 317-357

Hartman, Richard. 1972. “The Effects of Price and Cost Uncertainty on Investment.” Journal of Economic Theory 5(2): 258 – 66.

Koopmans, T. C. "On the Concept of Optimal Economic Growth ", Cowles Foundation Discussion Paper, December, 1963.

Knight, Frank H. 1921. Risk, Uncertainty, and Profit. Boston, MA: Hart, Schaffner & Marx; Houghton Miffl in Company.

McDonald, Rob, and Daniel Siegel. 1986. “The Value of Waiting to Invest.” Quarterly Journal of Economics 101(4): 707–728.

Nickell, Stephen J. 1986. “Dynamic Models of Labor Demand.” Chap 9 in Handbook of Labor Economics, Vol. 1, ed. by Orley C. Ashenfelter and Richard Layard. Amsterdam: North-Holland.

Oi, Walter Y. 1961 “The Desirability of Price Instability under Perfect Competition.” Econometrica 29(1): 58–64.

Ramey, Valerie, and Matthew Shapiro. 2001. “Displaced Capital: A Study of Aerospace Plant Closings.” Journal of Political Economy 109(5): 958 –92.

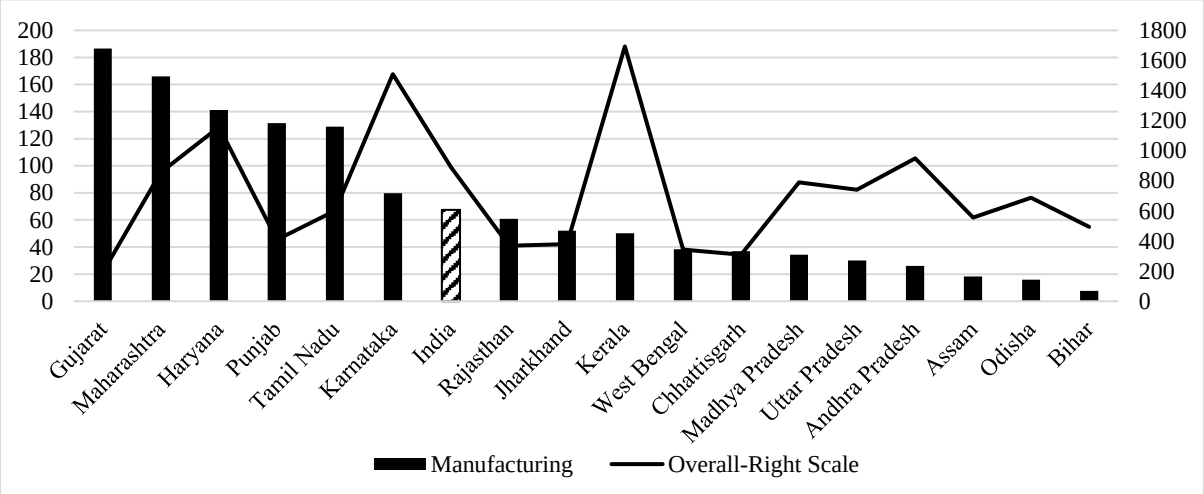
Ramsey, F. P. (1928) A mathematical theory of saving. The Economic Journal 38, 543-559.

Solow Robert M. (1956) A contribution to the theory of economic growth. Quarterly Journal of Economics 70, 65.94.

Veermani C. and Goldar B., (2005), “Manufacturing Productivity in Indian States: Does Investment Climate Matter?”, Economic and Political Weekly, Vol. 40, No. 24 (Jun. 11-17, 2005), pp. 2413-2420.

Topalova P. and Khandelwal A., (2011), “Trade Liberalization and Firm Productivity: The Case of India”, Review of Economics and Statistics, Volume 93, Issue 3, August 2011, p.995-1009

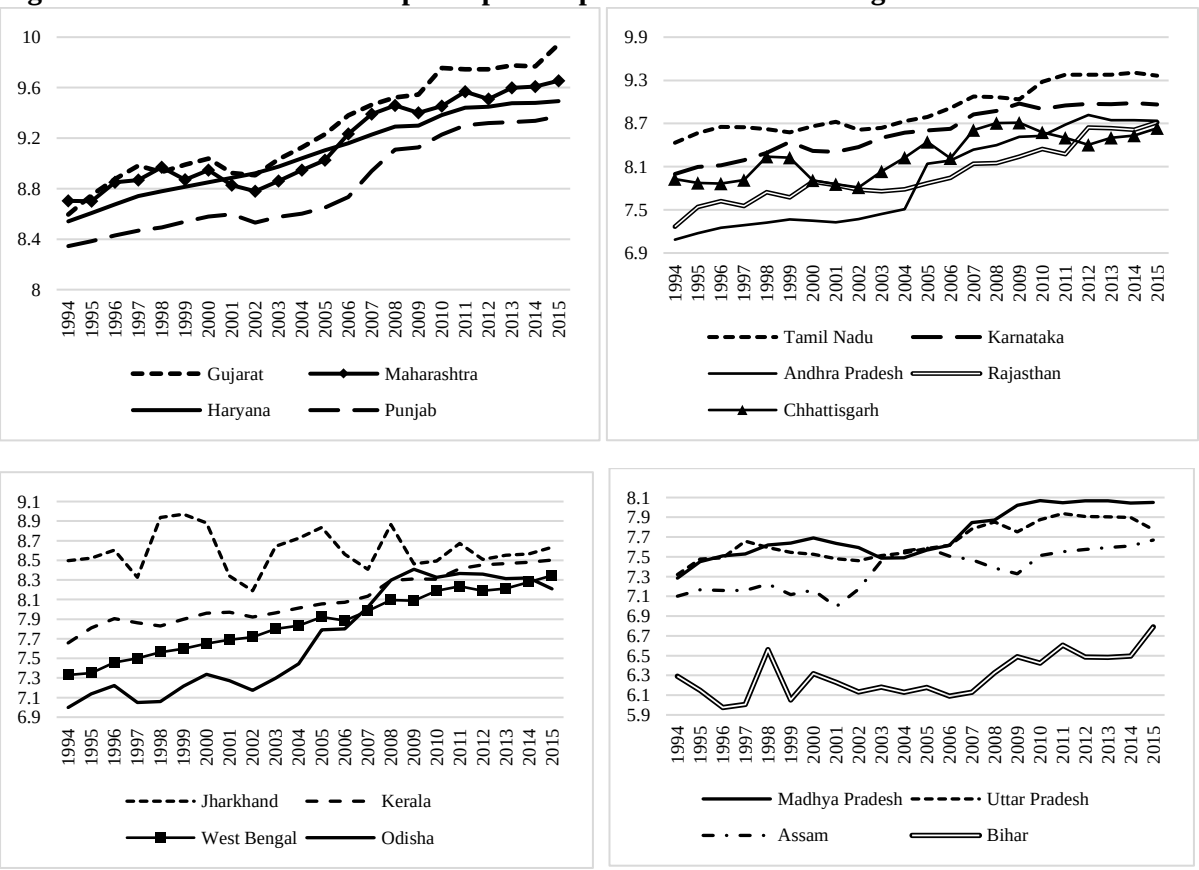
Figure 1: Per Capita Domestic Products (US$) in Indian states according to sector



Source: Handbook of Statistics on Indian States, Reserve Bank of India.

Note: The left scale of Figure 1 plots the net state domestic product (NSDP) from the manufacturing activities, for the major 17 states in India. The bar charts show the average NSDP from the manufacturing activities in the states between the fiscal years 2009-10 to 2014-15, divided by the total population of the states, according to the 2011 census. The NSDP figures are reported in the constant, 2004-05 prices and are converted to the US$ using the INR-US$ exchange rate as on May 2019. Manufacturing activities include both 'registered' and 'unregistered' activities. The right scale (line chart) shows the per-capita aggregate NSDP (2004-05 prices) for all sector of the states for the same period.

Figures 2.1 - 2.4: Growth in the per-capita output from manufacturing activities in Indian states

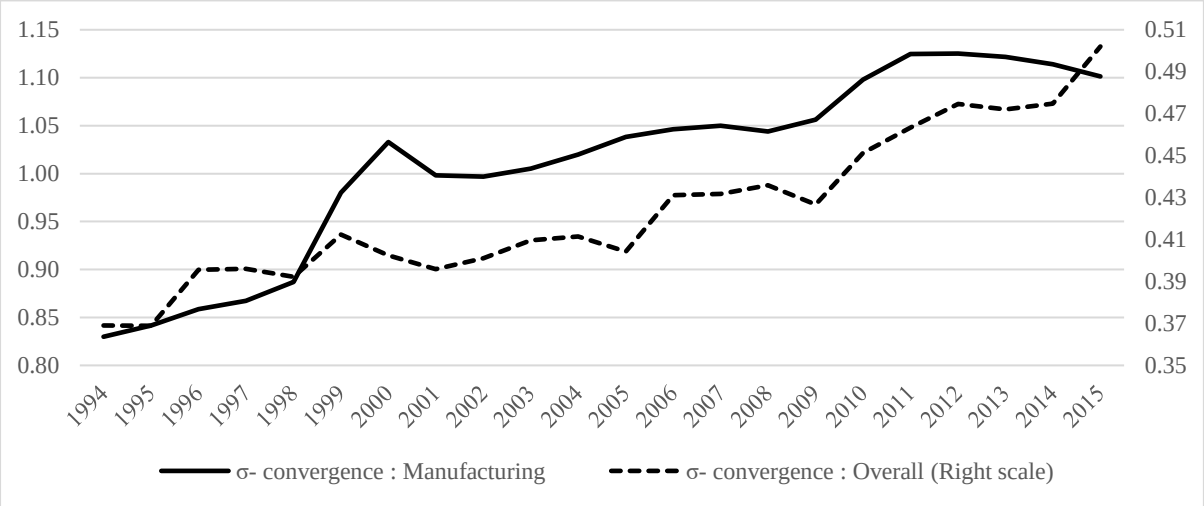


Source: Handbook of Statistics on Indian States, Reserve Bank of India.

Note: Figures 2.1 to 2.4 plot the natural logarithm of the net state domestic product (NSDP) from the manufacturing activities in the Indian states between fiscal years 1993-94 to 2014-15. For simplicity, fiscal years are converted to the calendar years where the calendar year represents the year on which a fiscal year ends (e.g. calendar year 2015 corresponds to the fiscal year

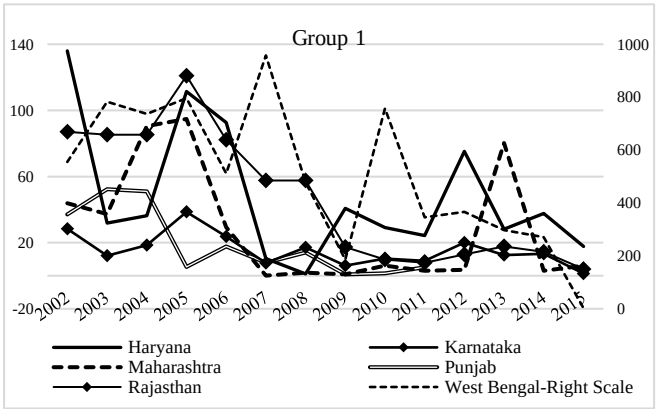
2014-15). The NSDP figures are reported in constant, 2004-05 prices. Manufacturing activities include both 'registered' and 'unregistered' activities.

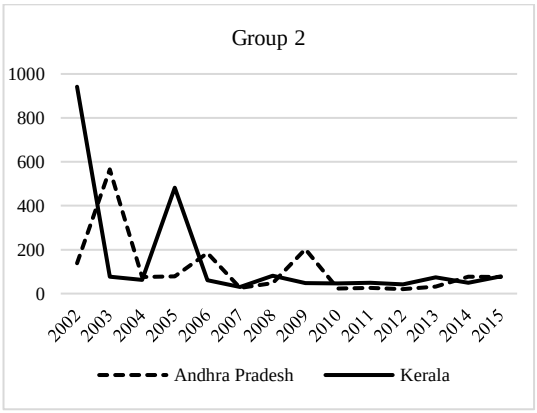
Figure 3: Coefficient of σ-divergence among the Indian states

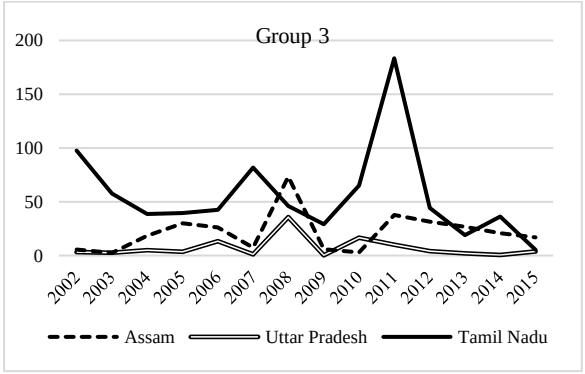


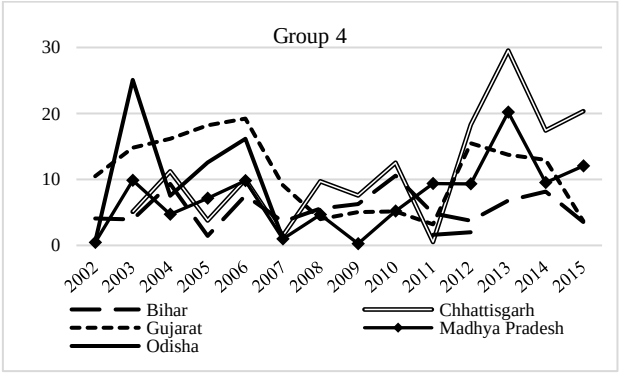
Source: Author's calculation based on the Handbook of Statistics on Indian States, Reserve Bank of India.
Note: Figure 3 plots the **standard deviation** of the natural logarithms of net state domestic product (NSDP) in the Indian states between fiscal years 1993-94 to 2014-15. For simplicity, fiscal years are converted to the calendar years where the calendar year represents the year on which a fiscal year ends (e.g. calendar year 2015 corresponds to the fiscal year 2014-15). The NSDP figures are reported in constant, 2004-05 prices. Manufacturing activities include both 'registered' and 'unregistered' activities. An increase in the standard deviation or the value of the coefficient of σ-divergence represents increasing variation (or divergence) among the states' output.

Figures 4.1 – 4.4: Labour disputes in the Indian states









Source: Labour Bureau, Government of India.
Note: Labour dispute represents the total number of man-days lost due to disputes in the industrial sector in the states, per 1000 workers in the industrial activities. Disputes include strikes and lockouts. Industry includes, apart from manufacturing, mining and construction activities, and electricity generation.

Table 1: β-convergence of manufacturing industries among Indian states

	Dependent Variable: Δ Capital-Labour Ratio			Dependent Variable: Δ VA-Labour Ratio		
	All Firms	**10-90 percentile Firms**	**20-80 percentile Firms**	**All Firms**	**10-90 percentile Firms**	**20-80 percentile Firms**
Explanatory Variables	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
Capital-Labour ratio at period t-1	-0.63*** (0.07)	-0.63*** (0.05)	-0.69*** (0.05)			
Value added per labour ratio at period t-1				-0.54*** (0.06)	-0.61*** (0.05)	-0.69*** (0.11)
Model Properties						
Number of observations	1,120	1,120	1,120	1,120	1,120	1,120
R-squared	0.42	0.40	0.42	0.33	0.36	0.40
Root MSE	0.29	0.30	0.36	0.21	0.20	0.22

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Regressions use dummy variables for each state-industry combination.

Standard errors are clustered within industries in each state.

All the variables are in their natural logarithm.

Δ indicates change from the previous year.

Regression includes a constant.

Table 2: Determinants of labour disputes in Indian states

Dependent Variable: Labour disputes	
Explanatory variables	**Coefficient (S.E.)**
Labour Disputes - 1 year lag	0.18 (0.3)
Year of state Assembly elections - Dummy	0.65*** (0.22)
Year before state Assembly elections - Dummy	0.28 (0.24)
Year after state Assembly elections - Dummy	0.53*** (0.19)
No. of years the incumbent part in the state government	0.06*** (0.02)
State is in coalition with the union government - Dummy	0.13 (0.17)
Labour Disputes - 1 year lag interacted with state dummies	
Assam	-0.07 (0.38)
Bihar	-0.20 (0.55)
Chattisgarh	-0.26 (0.35)
Gujarat	0.17 (0.42)
Haryana	-0.14 (0.45)
Karnataka	-0.16 (0.41)
Kerala	-0.36 (0.35)
Madhya Pradesh	-0.16 (0.32)
Maharashtra	0.09 (0.34)
Orissa	-0.34 (0.4)
Punjab	0.20 (0.34)
Rajasthan	0.67** (0.32)
Tamil Nadu	0.0 (0.43)
Uttar Pradesh	-0.69** (0.35)
West Bengal	0.09 (0.8)
Model properties	
Number of observation	196
F(48, 147)	14.2
Prob > F	0.0
R-squared	0.71
Root MSE	1.02

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Andhra Pradesh serves as the reference group. Regression uses dummy variables for years, a constant term and reports robust standard errors.

Table 3: Determinants of labour disputes in the Indian states groups

Dependent variable: Labour disputes						
Explanatory variables	All groups		Groups 1 and 2 combined		Groups 3 and 2 combined	
	(1)	(2)	(3)	(4)	(5)	(6)
Labour Disputes - 1 year lag	0.05 (0.12)	-0.02 (0.13)	0.05 (0.12)	0.01 (0.11)	0.05 (0.12)	0.0 (0.11)
Labour Disputes - 1 year lag interacted with dummy variables						
Group 1	**0.54*** **(0.15)**	**0.6*** **(0.16)**	**0.56*** **(0.14)**	**0.59*** **(0.14)**	**0.56*** **(0.15)**	**0.6*** **(0.15)**
Group 2	0.01 (0.21)	-0.36* (0.21)				
Group 3	**0.35*** **(0.19)**	**0.57*** **(0.19)**	**0.33*** **(0.19)**	**0.52*** **(0.18)**	**0.46*** **(0.16)**	**0.55*** **(0.16)**
Other explanatory variables						
Year of state Assembly elections - Dummy	0.61** (0.24)	0.55** (0.27)	0.54** (0.25)	0.46* (0.26)	0.59** (0.25)	0.59** (0.28)
Year before state Assembly elections - Dummy	0.3 (0.23)	0.16 (0.27)	0.36 (0.23)	0.3 (0.27)	0.36 (0.23)	0.32 (0.27)
Year after state Assembly elections - Dummy	0.5** (0.21)	0.6** (0.24)	0.47** (0.21)	0.51** (0.23)	0.5** (0.22)	0.6** (0.24)
No. of years the incumbent part in the state government	0.06*** (0.02)	0.06*** (0.02)	0.05*** (0.01)	0.05*** (0.01)	0.06*** (0.01)	0.06*** (0.02)
State is in coalition with the union government - Dummy	0.06 (0.19)	-0.04 (0.26)	0.18 (0.2)	0.0 (0.23)	0.12 (0.2)	0.03 (0.24)
Year Dummies and interaction with groups	NO	YES	NO	YES	NO	YES
Model Properties						
Number of observations	196	196	196	196	196	196
F-statistic	16.23	14.95	16	9.48	16.17	10.87
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.61	0.68	0.58	0.63	0.58	0.62
Root MSE	1.10	1.11	1.13	1.14	1.13	1.15

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Values in parentheses indicate the standard errors.

Regressions include dummy variables for state groups.

Group 4 is the reference group.

Table 4.1: Impact of Labour Disputes on Steady-state K/L (All Firms)

Dependent Variable: log(Capital-Labour Ratio)						
	Without Firm TFP			**With Firm TFP**		
	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
	(1)	(2)	(3)	(4)	(5)	(6)
Firm TFP				0.74*** (0.12)	0.74*** (0.12)	0.71*** (0.13)
Physical Infrastructure	0.86*** (0.12)	0.88*** (0.12)	0.85*** (0.13)	0.67*** (0.14)	0.69*** (0.15)	0.69*** (0.15)
Banking Infrastructure	0.9*** (0.2)	0.91*** (0.2)	0.9*** (0.19)	0.71*** (0.19)	0.73*** (0.19)	0.74*** (0.19)
Labour Disputes	-0.12* (0.07)			0.04 (0.06)		
Labour Disputes-1 Year Lag		-0.13 (0.08)			0.01 (0.08)	
Labour Disputes-2 Years Lag			-0.22** (0.09)			-0.07 (0.09)
Labour Dispute Interacted with Group Dummies						
Group 1	0.21* (0.11)	0.23* (0.12)	0.3** (0.12)	0.04 (0.1)	0.08 (0.12)	0.14 (0.12)
Group 2	-0.06 (0.09)	-0.09 (0.11)	-0.03 (0.11)	0.0 (0.09)	-0.05 (0.1)	-0.03 (0.11)
Group 3	-0.38*** (0.11)	-0.37*** (0.12)	-0.25** (0.13)	-0.39*** (0.11)	-0.37*** (0.11)	-0.28** (0.12)
Model Properties						
Number of observations	1,075	1,005	930	1,075	1,005	930
F-statistic	31	28	29.4	42.0	38.0	37.87
Prob > F	0.0	0.0	0.0	0.0	0.0	0.0
R-squared	0.56	0.56	0.56	0.63	0.63	0.62
Root MSE	0.76	0.75	0.74	0.69	0.69	0.69

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Standard errors are clustered within industries in each state.

Regressions include constant term, state-group and industry-dummies.

Table 4.2: Impact of Labour Disputes on Steady-state K/L (10-90th Percentile Firms)

Dependent Variable: log(Capital-Labour Ratio)						
	Without Firm TFP			**With Firm TFP**		
	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
	(1)	(2)	(3)	(4)	(5)	(6)
Firm TFP				0.95*** (0.11)	0.96*** (0.11)	0.93*** (0.11)
Physical Infrastructure	0.84*** (0.14)	0.84*** (0.14)	0.8*** (0.15)	0.59*** (0.16)	0.6*** (0.16)	0.58*** (0.17)
Banking Infrastructure	0.82*** (0.15)	0.84*** (0.15)	0.84*** (0.15)	0.58*** (0.14)	0.61*** (0.14)	0.63*** (0.15)
Labour Disputes	-0.21*** (0.07)			-0.01 (0.06)		
Labour Disputes-1 Year Lag		-0.16** (0.06)			0.02 (0.06)	
Labour Disputes-2 Years Lag			-0.24*** (0.06)			-0.03 (0.05)
Labour Dispute Interacted with Group Dummies						
Group 1	0.27*** (0.08)	0.25*** (0.08)	0.31*** (0.08)	0.05 (0.08)	0.04 (0.08)	0.09 (0.08)
Group 2	-0.1 (0.09)	-0.17* (0.09)	-0.14 (0.09)	-0.02 (0.09)	-0.13 (0.09)	-0.14 (0.08)
Group 3	-0.25 (0.15)	-0.29* (0.15)	-0.19 (0.14)	-0.26** (0.12)	-0.29** (0.12)	-0.23* (0.12)
Model Properties						
Number of	1,075	1,005	930	1,075	1,005	930
F-statistic	30.8	25.2	25.5	59.9	45.9	39.0
Prob > F	0.0	0.0	0.0	0.0	0.0	0.0
R-squared	0.5	0.5	0.5	0.6	0.6	0.6
Root MSE	0.8	0.8	0.8	0.6	0.6	0.7

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Standard errors are clustered within industries in each state.

Regressions include constant term, state-group and industry-dummies.

Table 4.3: Impact of Labour Disputes on Steady-state K/L (20-80th Percentile Firms)

Dependent Variable: log(Capital-Labour Ratio)						
	Without Firm TFP			**With Firm TFP**		
	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
	(1)	(2)	(3)	(4)	(5)	(6)
Firm TFP				0.99*** (0.11)	0.98*** (0.12)	0.93*** (0.12)
Physical Infrastructure	0.79*** (0.15)	0.79*** (0.15)	0.76*** (0.16)	0.53*** (0.17)	0.53*** (0.17)	0.54*** (0.17)
Banking Infrastructure	0.84*** (0.16)	0.86*** (0.15)	0.86*** (0.15)	0.59*** (0.15)	0.62*** (0.15)	0.65*** (0.15)
Labour Disputes	-0.22** (0.09)			0.0 (0.1)		
Labour Disputes-1 Year Lag		-0.14* (0.07)			0.05 (0.08)	
Labour Disputes-2 Years Lag			-0.26*** (0.06)			-0.05 (0.05)
Labour Dispute Interacted with Group Dummies						
Group 1	0.29*** (0.1)	0.24** (0.09)	0.35*** (0.08)	0.06 (0.12)	0.02 (0.11)	0.12 (0.08)
Group 2	-0.09 (0.11)	-0.27*** (0.1)	-0.13 (0.08)	0.0 (0.12)	-0.23** (0.11)	-0.13 (0.08)
Group 3	-0.27 (0.18)	-0.34* (0.18)	-0.19 (0.17)	-0.29* (0.16)	-0.36** (0.16)	-0.24* (0.15)
Model Properties						
Number of	1,075	1,005	930	1,075	1,005	930
F-statistic	34.9	25.9	27.7	52.4	39.9	33.3
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.41	0.41	0.41	0.57	0.56	0.54
Root MSE	0.83	0.83	0.82	0.71	0.72	0.73

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Standard errors are clustered within industries in each state.

Regressions include constant term, state-group and industry-dummies.

Table 5: Impact of Labour Disputes on Aggregate Firm-level TFP

Dependent Variable: Aggregate Firm-level TFP									
	All Firms			**10-90 percentile Firms**			**20-80 percentile Firms**		
	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Physical Infrastructure	0.26*** (0.05)	0.25*** (0.05)	0.23*** (0.06)	0.26*** (0.06)	0.26*** (0.06)	0.24*** (0.06)	0.26*** (0.06)	0.26*** (0.06)	0.24*** (0.06)
Banking Infrastructure	0.26*** (0.09)	0.24*** (0.09)	0.23** (0.09)	0.26** (0.1)	0.24** (0.09)	0.23** (0.09)	0.25** (0.1)	0.24** (0.09)	0.23** (0.09)
Labour Disputes	**-0.21*** (0.04)**			**-0.21*** (0.04)**			**-0.21*** (0.04)**		
Labour Disputes-1 Year Lag		**-0.18*** (0.04)**			**-0.19*** (0.04)**			**-0.2*** (0.04)**	
Labour Disputes-2 Years Lag			**-0.22*** (0.03)**			**-0.22*** (0.04)**			**-0.23*** (0.04)**
Labour Dispute Interacted with Group Dummies									
Group 1	**0.22*** (0.04)**	**0.2*** (0.04)**	**0.23*** (0.04)**	**0.23*** (0.05)**	**0.21*** (0.05)**	**0.23*** (0.05)**	**0.23*** (0.05)**	**0.22*** (0.05)**	**0.24*** (0.05)**
Group 2	-0.09 (0.06)	-0.05 (0.05)	-0.01 (0.05)	-0.08 (0.07)	-0.04 (0.06)	0.0 (0.06)	-0.09 (0.07)	-0.04 (0.07)	0.0 (0.06)
Group 3	0.01 (0.06)	0.0 (0.06)	0.04 (0.05)	0.01 (0.06)	0.01 (0.06)	0.04 (0.06)	0.02 (0.06)	0.02 (0.06)	0.06 (0.06)
Model Properties									
Number of observations	1,075	1,005	930	1,075	1,005	930	1,075	1,005	930
F-statistic	18.33	15.53	17.08	13.66	11.31	12.81	12.93	10.46	11.39
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.24	0.22	0.22	0.23	0.21	0.21	0.23	0.20	0.21
Root MSE	0.42	0.41	0.39	0.43	0.43	0.41	0.44	0.44	0.42

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Standard errors are clustered within industries in each state.

Regressions include constant term, state-group and industry-dummies.

Table 6.1: Aggregate Production Function for Manufacturing Industries in Indian states

Dependent Variable: ΔVA in Manufacturing: Indian states									
		All Firms			**10-90 percentile Firms**			**20-80 percentile Firms**	
Explanatory Variables	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
△ Aggregate Firm-level TFP	0.61*** (0.04)	**0.42*** (0.06)**	**0.42*** (0.07)**	0.92*** (0.03)	**0.79*** (0.05)**	**0.8*** (0.05)**	1.03*** (0.05)	**0.94*** (0.07)**	**0.94*** (0.07)**
Δ Labour	0.47*** (0.11)	0.44*** (0.12)	0.43*** (0.13)	0.56*** (0.06)	0.58*** (0.05)	0.59*** (0.06)	0.39*** (0.07)	0.4*** (0.08)	0.4*** (0.08)
ΔCapital stock	0.31*** (0.05)	0.25*** (0.06)	0.26*** (0.06)	0.22*** (0.03)	0.17*** (0.03)	0.15*** (0.04)	0.22*** (0.03)	0.18*** (0.03)	0.16*** (0.03)
Year FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
State x Industry FE	NO	NO	YES	NO	NO	YES	NO	NO	YES
Model Properties									
Number of observations	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120
Prob > F	0.0	0.0	.	0.0	0.0	.	0.0	0.0	.
R-squared	0.53	0.59	0.60	0.70	0.72	0.73	0.74	0.77	0.78
Root MSE	0.22	0.21	0.22	0.19	0.18	0.19	0.18	0.17	0.18

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Regressions use dummy variables for each state-industry combination.

Standard errors are clustered within industries in each state.

All the variables are in their natural logarithm.

Δ indicates change from the previous year.

Table 6.2: Aggregate Production Function for Manufacturing Industries in Indian states– Alternative Specification

Dependent Variable: Δ (VA/Labour) in Manufacturing: Indian states									
	All Firms			**10-90 percentile Firms**			**20-80 percentile Firms**		
Explanatory Variables	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)	Coefficient (S.E.)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Δ Aggregate Firm-TFP	0.56*** (0.04)	**0.39*** (0.07)**	**0.39*** (0.08)**	0.85*** (0.04)	**0.73*** (0.06)**	**0.74*** (0.07)**	0.92*** (0.09)	**0.85*** (0.14)**	**0.86*** (0.14)**
Δ(Capital/ Labour)	0.31*** (0.05)	0.26*** (0.06)	0.27*** (0.06)	0.24*** (0.03)	0.2*** (0.03)	0.18*** (0.03)	0.23*** (0.04)	0.2*** (0.04)	0.19*** (0.05)
Year FE	NO	YES	YES	NO	YES	YES	NO	YES	YES
State x Industry FE	NO	NO	YES	NO	NO	YES	NO	NO	YES
Model Properties									
Number of observations	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120
Prob > F	0.0	0.0	.	0.0	0.0	.	0.0	0.0	.
R-squared	0.36	0.42	0.43	0.50	0.53	0.54	0.52	0.55	0.56
Root MSE	0.23	0.22	0.22	0.20	0.19	0.20	0.21	0.21	0.21

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Regressions use dummy variables for each state-industry combination.

Standard errors are clustered within industries in each state.

All the variables are in their natural logarithm.

Δ indicates change from the previous year.

Appendix

Table 1.a: Share of registered firms in manufacturing GSDP

States	Average: 2000-2008	Average: 2009-2015
Andhra Pradesh	71%	77%
Assam	75%	66%
Bihar	22%	46%
Chhattisgarh	84%	86%
Gujarat	74%	81%
Haryana	72%	71%
Jharkhand	85%	79%
Karnataka	73%	79%
Kerala	51%	45%
Madhya Pradesh	66%	70%
Maharashtra	72%	71%
Odisha	77%	87%
Punjab	55%	58%
Rajasthan	58%	60%
Tamil Nadu	64%	71%
Uttar Pradesh	55%	57%
West Bengal	49%	54%
All states	**65%**	**68%**

Source: Ministry of Statistics and Program Implementation, Government of India.

Note: GSDP=Gross State Domestic Product.

Table 2.a: NIC 2-digit codes for the Industry groups

Industry	NIC 2008 Code	NIC 1998-2004 Code
Leather-textile	13, 14, 15	17, 18, 19
Chemical Products	20, 21	24
Metal Products	24, 25	27, 28
Electronics and Machinery	26-30	29-35
Miscellaneous	16, 17, 18, 22, 23, 31, 32	20, 21, 22, 25, 26, 36, 37

Table 3.1a: Means, Standard Deviations of Firm-level Gross Sales (Rs. mn) and Number of Firms: All years

Industry	Leather and Textiles			Chemical Products			Metal Products			Electronics and Machinery			Miscellaneous			Total Manufacturing		
	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms
Andhra Pradesh	556	365	295	1661	607	374	1420	322	204	864	235	157	510	70	27	865	241	152
	1080	527	368	5784	1177	570	11437	598	323	4963	425	250	2795	183	50	5538	597	321
	2524	2019	1512	3303	2640	1980	3182	2547	1910	4099	3280	2459	10199	8160	6117	23307	18646	13978
Assam	84	57	49	750	173	105	163	80	52	67	48	37	120	15	10	194	46	30
	134	73	53	2660	361	147	399	150	78	99	61	39	732	24	8	1121	147	68
	290	233	174	600	483	360	486	389	295	429	346	256	3154	2527	1891	4959	3978	2976
Bihar	199	69	35	100	30	22	171	77	49	92	30	20	45	7	7	68	19	14
	420	120	63	539	52	33	440	143	85	512	61	33	358	7	7	401	57	33
	177	140	104	421	342	255	475	384	285	472	379	284	4068	3257	2441	5613	4502	3369
Chattisgarh	128	50	21	166	69	46	3959	845	656	217	88	64	729	76	37	1901	393	297
	309	153	38	414	113	61	22970	1283	806	632	138	83	3077	158	59	14939	913	600
	204	163	120	539	430	322	2287	1830	1372	885	710	533	1637	1312	981	5552	4445	3328
Gujarat	1105	391	279	2828	684	421	1713	264	156	638	196	121	689	174	111	1284	314	198
	4395	635	357	21312	1357	684	14104	519	250	2619	388	186	3580	345	192	11169	739	383
	4095	3280	2460	7051	5638	4227	5463	4370	3278	9007	7206	5404	11253	9004	6751	36869	29498	22120
Haryana	513	316	266	724	268	179	1957	402	264	2660	697	530	342	97	55	1452	412	308
	1144	389	270	2957	485	255	15292	736	376	24882	1063	675	1454	191	87	16020	769	489
	4014	3209	2404	1357	1086	813	2414	1933	1449	6851	5482	4110	4270	3417	2563	18906	15127	11339

Source: Annual Survey of Industries rounds between 2002 and 2015.

Note: The first, second and the third rows under each state represent mean, standard deviation and number of firms, respectively. Some firms may repeat between years.

Table 3.1a: Means, Standard Deviations of Firm-level Gross Sales (Rs. mn) and Number of Firms: All years (Contd.)

Industry	Leather and Textiles			Chemical Products			Metal Products			Electronics and Machinery			Miscellaneous			Total Manufacturing		
	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms
Karnataka	750	289	215	933	319	206	2072	286	186	1156	349	239	1011	132	79	1158	269	181
	8000	486	271	3364	563	282	24783	492	250	7689	630	347	16153	271	132	13674	512	278
	3360	2689	2014	2213	1768	1330	3028	2427	1819	7308	5851	4384	5957	4766	3576	21866	17501	13123
Kerala	231	122	84	890	263	132	419	175	102	328	99	60	237	38	21	334	96	56
	616	221	124	2929	511	195	1067	348	174	1462	180	91	1834	78	32	1750	243	111
	1799	1440	1078	1107	890	665	933	748	559	1580	1267	951	5239	4194	3146	10658	8539	6399
Madhya Pradesh	1339	632	402	1178	318	183	899	309	206	1105	227	128	1058	161	77	1099	277	162
	3447	1279	534	4481	570	261	3331	540	297	5753	446	180	4083	359	124	4518	624	279
	1138	911	681	1609	1290	966	1450	1161	871	2815	2252	1688	3223	2576	1935	10235	8190	6141
Maharashtra	800	362	276	1898	696	472	1862	511	348	1828	498	342	802	244	149	1460	446	303
	3416	535	310	7087	1214	656	8592	870	468	9801	844	471	3577	453	221	7408	817	449
	5102	4081	3060	6439	5152	3860	7824	6259	4693	14664	11735	8800	12196	9759	7316	46225	36986	27729
Orissa	113	71	43	2088	95	42	4440	1197	693	372	62	36	576	65	27	1970	443	251
	226	149	74	11863	262	60	17737	2686	1124	2552	112	42	2504	173	46	11222	1639	719
	318	255	192	613	494	366	1861	1492	1117	673	544	404	2154	1727	1292	5619	4512	3371
Punjab	841	409	280	1367	378	160	468	202	136	466	118	74	222	19	12	509	172	110
	2327	823	469	4247	980	265	1399	384	213	2717	222	112	1440	37	12	2251	484	255
	4240	3393	2545	1095	878	654	4250	3401	2549	6655	5328	3993	6565	5254	3938	22805	18254	13679

Source: Annual Survey of Industries rounds between 2002 and 2015.

Note: The first, second and the third rows under each state represent mean, standard deviation and number of firms, respectively. Some firms may repeat between years.

Table 3.1a: Means, Standard Deviations of Firm-level Gross Sales (Rs. mn) and Number of Firms: All years (Contd.)

Industry	Leather and Textiles			Chemical Products			Metal Products			Electronics and Machinery			Miscellaneous			Total Manufacturing		
	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms
Rajasthan	648	280	204	1141	334	217	910	412	259	990	252	159	575	63	36	754	203	131
	2002	501	272	5177	682	354	2621	758	384	5920	527	272	3777	137	57	4056	480	254
	3116	2495	1872	1463	1174	879	2093	1670	1253	3181	2544	1908	7378	5903	4428	17231	13786	10340
Tamil Nadu	442	286	234	429	91	50	1706	307	210	2306	577	365	652	120	71	936	278	194
	1004	397	259	2196	232	89	13734	481	270	16111	1026	512	4752	232	111	8395	566	310
	17686	14149	10609	7442	5953	4465	4016	3213	2410	8913	7134	5347	9788	7835	5873	47845	38284	28704
Uttar Pradesh	365	227	185	1208	274	156	696	156	111	1225	237	144	361	111	64	709	188	125
	833	287	189	5296	510	238	5162	254	138	8742	434	211	1649	224	107	5136	342	179
	5958	4771	3575	3040	2435	1822	4902	3919	2942	6816	5455	4092	8397	6714	5037	29113	23294	17468
West Bengal	693	437	329	2010	249	150	1655	577	375	424	135	79	395	128	84	911	299	199
	1571	577	338	12311	453	203	7017	1068	568	1572	273	120	1493	244	135	5397	638	350
	2803	2244	1683	1692	1355	1017	3654	2925	2192	4039	3230	2423	3876	3103	2325	16064	12857	9640
All states	601	314	241	1472	406	253	1631	393	259	1324	347	233	549	112	65	1023	283	189
	2795	522	306	10333	930	479	12414	889	458	10947	704	400	4939	268	132	8629	656	357
	56824	45472	34083	39984	32008	23981	48318	38668	28994	78387	62743	47036	99354	79508	59610	322867	258399	193704

Source: Annual Survey of Industries rounds between 2002 and 2015.

Note: The first, second and the third rows under each state represent mean, standard deviation and number of firms, respectively. Some firms may repeat between years.

Table 3.2a: Means, Standard Deviations of Firm-level Value Added per Labour (Rs.) and Number of Firms: All years

Industry	Leather and Textiles			Chemical Products			Metal Products			Electronics and Machinery			Miscellaneous			Total Manufacturing		
	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms
Andhra Pradesh	1773	1726	1773	9154	7897	8126	5167	4355	4086	5143	4266	4063	3421	2342	1835	4596	3675	3419
	4906	5093	5753	79218	85497	97413	16017	11144	10141	23698	12971	11151	19231	18189	3614	34523	35108	37329
	2524	2019	1512	3303	2640	1980	3182	2547	1910	4099	3280	2459	10199	8160	6117	23307	18646	13978
Assam	1424	1430	1585	8909	5796	4574	4016	3090	2795	2840	2523	2691	1868	1233	942	2989	2092	1753
	2411	2487	2697	21432	13840	9386	8365	5583	5327	4488	4245	4740	5970	3077	2790	9611	6039	4722
	290	233	174	600	483	360	486	389	295	429	346	256	3154	2527	1891	4959	3978	2976
Bihar	1185	1300	1537	2890	2601	2442	2928	2063	1962	1742	1409	1317	875	442	399	1283	852	798
	2151	2378	2675	4274	3902	3304	7453	5253	5190	3673	2198	1776	3775	558	520	4269	2195	2061
	177	140	104	421	342	255	475	384	285	472	379	284	4068	3257	2441	5613	4502	3369
Chattisgarh	1143	1031	952	6130	4672	3684	5696	5402	5661	2644	2403	2274	4277	2159	2079	4666	3735	3702
	1657	1661	1613	34288	11034	5769	14649	14502	16273	4680	3987	3221	13362	3747	3660	16135	10373	10999
	204	163	120	539	430	322	2287	1830	1372	885	710	533	1637	1312	981	5552	4445	3328
Gujarat	2765	2546	2535	7866	6536	6404	4297	3544	3427	4577	4210	4200	3618	2896	2831	4671	3970	3904
	5480	4555	4604	21970	19971	21956	10199	7177	7079	9683	8395	7818	11758	5376	5409	13374	10680	11294
	4095	3280	2460	7051	5638	4227	5463	4370	3278	9007	7206	5404	11253	9004	6751	36869	29498	22120
Haryana	3651	3672	3794	8643	7645	6859	6142	4467	4362	6277	5564	5508	3459	2680	2353	5235	4520	4382
	8331	6404	6291	19264	17182	10720	24895	7355	7346	13747	11069	11340	9474	5435	4510	14552	9480	8753
	4014	3209	2404	1357	1086	813	2414	1933	1449	6851	5482	4110	4270	3417	2563	18906	15127	11339

Note: Value added represents the gross sales (Rs.) minus value of inputs (Rs.) purchased during the year. Labour represents the total number of man-days worked by the workers. The first, second and the third rows under each state represent mean, standard deviation and number of firms, respectively. Some firms may repeat between years.

Table 3.2a: Means, Standard Deviations of Firm-level Value Added per Labour (Rs.) and Number of Firms: All years (Contd.)

Industry	Leather and Textiles			Chemical Products			Metal Products			Electronics and Machinery			Miscellaneous			Total Manufacturing		
	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms
Karnataka	1989	1887	1759	9740	7662	6425	5801	4406	4471	7548	5826	5386	4500	3650	3469	5843	4617	4285
	5140	5123	4368	22729	16339	12383	23799	9409	10110	30012	16603	11966	18496	13868	14867	23113	13806	11945
	3360	2689	2014	2213	1768	1330	3028	2427	1819	7308	5851	4384	5957	4766	3576	21866	17501	13123
Kerala	1908	1707	1803	5517	5236	4830	3703	3182	2676	3143	2731	2328	2470	1949	1641	2899	2475	2192
	4848	4104	4235	9193	9251	6976	7859	7158	4868	11644	9753	3177	7718	4710	3228	8279	6505	4205
	1799	1440	1078	1107	890	665	933	748	559	1580	1267	951	5239	4194	3146	10658	8539	6399
Madhya Pradesh	2802	2693	2926	6540	5151	5042	4677	3876	3826	4823	4017	3510	5909	2990	2697	5190	3705	3475
	6351	6686	7544	12066	7791	7648	11417	6194	6346	10154	8686	5354	43024	9838	4648	25654	8471	6043
	1138	911	681	1609	1290	966	1450	1161	871	2815	2252	1688	3223	2576	1935	10235	8190	6141
Maharashtra	4756	4690	4977	13265	10335	9557	6855	5935	5628	8584	7009	6976	5858	4400	4151	7802	6346	6141
	17469	17761	19092	42101	23791	23255	17742	15666	8687	60389	15308	14327	25311	9592	7777	40819	16046	14575
	5102	4081	3060	6439	5152	3860	7824	6259	4693	14664	11735	8800	12196	9759	7316	46225	36986	27729
Orissa	1439	1557	1670	4556	3793	2747	4723	4091	4030	3265	2194	1960	2595	1633	1450	3529	2746	2520
	3736	4081	4467	11624	8955	4168	9272	7032	6782	7271	3543	3487	11169	2894	2400	9964	5663	4815
	318	255	192	613	494	366	1861	1492	1117	673	544	404	2154	1727	1292	5619	4512	3371
Punjab	2151	2136	2077	4844	4014	3523	2977	2732	2563	2128	1746	1728	1593	943	754	2267	1880	1754
	3085	3033	2693	7517	5665	4560	5620	4914	4240	5830	2750	2621	7111	1945	1545	5949	3416	2994
	4240	3393	2545	1095	878	654	4250	3401	2549	6655	5328	3993	6565	5254	3938	22805	18254	13679

Source: Annual Survey of Industries rounds between 2002 and 2015.

Table 3.2a: Means, Standard Deviations of Firm-level Value Added per Labour (Rs.) and Number of Firms: All years (Contd.)

Industry	Leather and Textiles			Chemical Products			Metal Products			Electronics and Machinery			Miscellaneous			Total Manufacturing		
	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms	All Firms	10-90th percentile Firms	20-80th percentile Firms
Rajasthan	2923	3107	3116	9616	7602	6931	5901	4729	4647	4933	3956	3608	3610	2438	2410	4518	3556	3414
	5299	5076	4304	27743	21345	15787	19252	7837	7937	11994	7935	7027	13986	12067	13561	15132	11269	11031
	3116	2495	1872	1463	1174	879	2093	1670	1253	3181	2544	1908	7378	5903	4428	17231	13786	10340
Tamil Nadu	2091	2083	2065	3322	1869	1434	5129	4023	3889	8493	7049	6108	4111	2701	2480	4143	3264	2958
	5405	5483	4922	14954	5512	4436	28284	7936	6796	89976	79884	46705	21443	7864	7894	41473	35020	20917
	17686	14149	10609	7442	5953	4465	4016	3213	2410	8913	7134	5347	9788	7835	5873	47845	38284	28704
Uttar Pradesh	3046	3121	3089	7319	5957	5553	4177	2842	2248	4825	3847	3525	3449	2621	2481	4215	3396	3131
	6974	7412	6272	20002	13604	12481	12751	7100	4125	11024	8473	6623	11493	8920	9814	12132	8932	8130
	5958	4771	3575	3040	2435	1822	4902	3919	2942	6816	5455	4092	8397	6714	5037	29113	23294	17468
West Bengal	2854	3098	3434	8524	6009	5811	4738	4312	4300	4066	3577	3362	3763	2862	2760	4404	3744	3701
	7648	8146	8796	19175	10722	9236	13134	11695	11829	10086	8255	6466	11197	5982	5660	12096	9024	8564
	2803	2244	1683	1692	1355	1017	3654	2925	2192	4039	3230	2423	3876	3103	2325	16064	12857	9640
All states	2652	2642	2684	7865	6182	5735	5065	4184	4006	5949	4944	4689	3659	2613	2404	4769	3861	3660
	7669	7629	7711	33021	29136	31766	16793	10154	8481	42187	29044	18366	17550	9622	7640	26780	19127	15732
	56824	45472	34083	39984	32008	23981	48318	38668	28994	78387	62743	47036	99354	79508	59610	322867	258399	193704

Source: Annual Survey of Industries rounds between 2002 and 2015.

Note: Value added represents the gross sales (Rs.) minus value of inputs (Rs.) purchased during the year. Labour represents the total number of man-days worked by the workers. The first, second and the third rows under each state represent mean, standard deviation and number of firms, respectively. Some firms may repeat between years.

Table 4.1a: Determinants of the firm-level value added

Dependent Variable: Value added

Explanatory Variables	All Firms	10-90 percentile firms	20-80 percentile firms
Labour	0.88***	0.81***	0.79***
	(0.01)	(0.01)	(0.02)
Labour interacted with the dummy variables			
Leather-textiles	-0.17***	-0.18***	-0.18***
	(0.01)	(0.01)	(0.01)
Chemicals	-0.19***	-0.22***	-0.25***
	(0.01)	(0.01)	(0.01)
Metal Products	-0.1***	-0.12***	-0.12***
	(0.01)	(0.01)	(0.01)
Electrical and machinery	-0.15***	-0.16***	-0.16***
	(0.01)	(0.01)	(0.01)
Public limited companies	0.03***	0.03***	0.02***
	(0.01)	(0.01)	(0.01)
Self-employment	-0.06***	-0.06***	-0.05***
	(0.0)	(0.0)	(0.01)
Labour interacted with the dummy for gross sales percentile of the firms			
Above 10th	-0.39***	-0.29***	-0.21***
	(0.01)	(0.01)	(0.01)
Above 20th	0.04***	0.02**	-0.01
	(0.01)	(0.01)	(0.01)
Above 30th	0.0	0.0	0.0
	(0.01)	(0.01)	(0.01)
Above 40th	-0.01	-0.01	0.0
	(0.01)	(0.01)	(0.01)
Above 50th	-0.02**	-0.02**	-0.01
	(0.01)	(0.01)	(0.01)
Above 60th	-0.02**	-0.01	0.0
	(0.01)	(0.01)	(0.01)
Above 70th	-0.03***	-0.03***	-0.01
	(0.01)	(0.01)	(0.01)
Above 80th	-0.01*	-0.02**	-0.03**
	(0.01)	(0.01)	(0.01)
Above 90th	-0.01	0.0	0.0
	(0.01)	(0.01)	(0.01)

Continued on the next page.

Table 4.1a: Determinants of the firm-level value added (Contd.)

Dependent Variable: Value added

Explanatory Variables	All Firms	10-90 percentile firms	20-80 percentile firms
Capital stock	0.41***	0.48***	0.5***
	(0.01)	(0.01)	(0.01)
Capital stock interacted with the dummy variables			
Leather-textiles	-0.07***	-0.06***	-0.07***
	(0.0)	(0.01)	(0.01)
Chemicals	0.07***	0.09***	0.09***
	(0.0)	(0.01)	(0.01)
Metal Products	0.02***	0.05***	0.05***
	(0.0)	(0.01)	(0.01)
Electrical and machinery	0.07***	0.08***	0.08***
	(0.0)	(0.0)	(0.01)
Public limited companies	-0.06***	-0.11***	-0.14***
	(0.01)	(0.01)	(0.01)
Self employment	-0.02***	-0.02***	-0.01**
	(0.0)	(0.0)	(0.0)
Capital stock interacted with the dummy for gross sales percentile of the firms			
Above 10th	-0.07***	-0.09***	-0.12***
	(0.01)	(0.01)	(0.01)
Above 20th	0.05***	0.02***	0.03***
	(0.01)	(0.01)	(0.01)
Above 30th	0.04***	0.03***	0.02***
	(0.01)	(0.01)	(0.01)
Above 40th	0.02***	0.02***	0.01
	(0.01)	(0.01)	(0.01)
Above 50th	0.03***	0.03***	0.03***
	(0.01)	(0.01)	(0.01)
Above 60th	0.02***	0.02**	0.02*
	(0.01)	(0.01)	(0.01)
Above 70th	0.01**	0.03***	0.02**
	(0.01)	(0.01)	(0.01)
Above 80th	0.01	0.01	0.02**
	(0.01)	(0.01)	(0.01)
Above 90th	0.09***	0.01	0.0
	(0.01)	(0.01)	(0.01)
Model Properties			
Number of observations	322,867	258,399	193,704
Root MSE	0.95	0.92	0.92

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Values in parentheses indicate the standard errors.

Miscellaneous industries act as the reference industry

Regressions use log of gross sales as the weight

Regressions use robust standard error

Regressions use dummy variables for industries, gross sales percentile sales and the interactions of labour and capital with state dummies.

Value added, labour and capital stocks are in natural logarithms.

Value added and the capital stocks are deflated by the all-India CPI for the industrial workers (2001=100)

Table 4.2a: Determinants of the firm-level efficiency

Dependent Variable: Estimated residuals from Table 4.1a			
	All Firms	**10-90 percentile firms**	**20-80 percentile firms**
Human Capital	1.73***	1.85***	1.82***
	(0.02)	(0.03)	(0.03)
Human capital interacted with the industry dummies			
Leather-textiles	-0.47***	-0.55***	-0.6***
	(0.02)	(0.02)	(0.02)
Chemicals	-0.47***	-0.53***	-0.54***
	(0.02)	(0.02)	(0.02)
Metal Products	-0.57***	-0.62***	-0.61***
	(0.02)	(0.02)	(0.03)
Electrical and machinery	-0.58***	-0.68***	-0.71***
	(0.02)	(0.02)	(0.02)
Human capital percentiles			
Above 50th	0.17***	0.17***	0.18***
	(0.01)	(0.01)	(0.01)
Above 75th	0.09***	0.07***	0.06***
	(0.01)	(0.02)	(0.02)
Above 90th	0.08***	0.07***	0.1***
	(0.02)	(0.03)	(0.03)
Above 95th	0.07**	0.09***	0.08**
	(0.03)	(0.03)	(0.03)
Technology	0.54***	0.54***	0.53***
	(0.0)	(0.0)	(0.0)
Technology interacted with the industry dummies			
Leather-textiles	0.15***	0.16***	0.16***
	(0.01)	(0.01)	(0.01)
Chemicals	0.07***	0.07***	0.07***
	(0.01)	(0.01)	(0.01)
Metal Products	0.06***	0.05***	0.06***
	(0.01)	(0.01)	(0.01)
Electrical and machinery	0.08***	0.07***	0.07***
	(0.01)	(0.01)	(0.01)
Technology above 50th percentile	-0.11***	-0.12***	-0.12***
	(0.0)	(0.0)	(0.01)
Model Properties			
Number of observations	322,867	258,399	193,704
R-squared	0.33	0.34	0.34
Root MSE	0.78	0.75	0.74

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Values in parentheses indicate the standard errors.

Miscellaneous industries act as the reference industry

Regressions use robust standard error

Human capital is the inverse of the share of workers in total man-days worked by all employees in the firm in a year.

Technology is the ratio of the value added (Rs.) to the value of inputs purchased (Rs.) by the firms.

Both technology and human capital are in their natural logarithm.

Regressions use log of gross sales as the weight.

Regressions use dummy variables for industries.

Table 5a: Years of Assembly elections in Indian states

States	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Andhra Pradesh				Yes					Yes					Yes	
Assam	Yes					Yes					Yes				
Bihar					Yes					Yes					Yes
Chhattisgarh			Yes					Yes					Yes		
Gujarat		Yes					Yes					Yes			
Haryana					Yes				Yes					Yes	
Jharkhand					Yes				Yes					Yes	
Karnataka				Yes				Yes					Yes		
Kerala	Yes					Yes					Yes				
Madhya Pradesh			Yes					Yes					Yes		
Maharashtra				Yes					Yes					Yes	
Odisha				Yes					Yes					Yes	
Punjab		Yes					Yes					Yes			
Rajasthan			Yes					Yes					Yes		
Tamil Nadu	Yes					Yes					Yes				
Uttar Pradesh		Yes					Yes					Yes			
West Bengal	Yes					Yes					Yes				

Table 6a: Validity of instruments for states' labour disputes and banking infrastructure

Explanatory variables	Dependent variable: Labour disputes	Dependent variable: Banking infrastructure
	Coefficient (S.E.)	Coefficient (S.E.)
Year of state Assembly elections - Dummy	0.57*** (0.14)	
Year after state Assembly elections - Dummy	0.53*** (0.14)	
No. of years the incumbent part in the state government	0.06*** (0.02)	-0.01** (0.0)
Year of the union election - Dummy		0.39*** (0.07)
Year before the union election - Dummy		0.4*** (0.08)
Year after the union election - Dummy		0.4*** (0.08)
Model Properties		
Number of observations	215	240
R-squared	0.67	0.90
Root MSE	1.05	0.14

Notes:

***, ** and * indicate statistical significance of the coefficients at 1, 5 and 10%, respectively.

Regressions include dummy variables for states and years, and a constant term.

Standard errors are clustered within states.

Banking infrastructure is proxied by the outstanding bank credit at % of NSDP in industrial sector.