

Productivity Effects of Labour Regulations

Evidence from India

Sreyashi Sen *

Institute for International Economic Studies,
Stockholm University

December 10, 2018

Abstract

This study seeks to investigate if restrictive labour regulations depress aggregate productivity in the manufacturing sector in India, by lowering plant TFPs and by distorting the allocation of resources across establishments. The Industrial Disputes Act of 1947, which governs matters of industrial relations and dispute resolution, has been extensively amended by state governments since independence implicitly creating differential taxation regimes across the country. Using this variation and a structural model to quantify productivities, I determine a causal link or lack thereof between the two.

*I thank Jakob Svensson, Timo Boppart, Ingvild Almas, Maitreesh Ghatak, Konrad Burchardi, Jonathan de Quidt, Hannes Malmberg, Thomas Seiler and Has Van Vlokhoven for helpful comments and remarks. All errors are my own.
E-mail: sreyashi.sen@iies.su.se

1 Introduction

An influential school of thought holds that the institutions and government policies of countries go a long way in shaping their economic trajectories and outcomes (Hall and Jones 1999, Acemoglu et al 2004). Indeed, a society with institutions that foster human capital development or incentivize investment will likely see more growth. A primary goal of development economics is to identify the policies that create the right incentives for economic agents and remove distortions from relevant markets.

Labour laws in India are one such institution that have received a considerable amount of attention both in the academic literature and otherwise for their impact on India's manufacturing sector performance. A large amount of labour legislation has been enacted in India ostensibly for worker protection and welfare in the registered manufacturing sector. Indeed, there are about 200 labour laws, including 52 Central Acts (Bhagwati and Panagariya, 2013). However, a number of commentators have characterized the Indian labour market as rigid as it is difficult for firms to adjust labour in the face of demand or technology shocks. Several studies have concluded that labour laws have played a role in thwarting India's manufacturing sector growth, which unlike counterparts in East Asian economies, did not "take off" into sustained growth.

The interesting question is: what are the mechanisms through which labour regulations might have impacted manufacturing sector growth? Do they affect aggregate manufacturing sector productivity, or the aggregate stocks of labour or capital? If they do affect the aggregate productivity, what are the channels through which that effect is propagated? If we conceive an eco-system of a set of manufacturing sector firms, the productivity at an aggregate level would be a function of the individual firm productivities, the allocation of resources amongst them and the entry and exit of firms. Disentangling these channels is imperative for a clearer understanding of how various effects at a micro level interact to produce an aggregate affect. Furthermore, the implications for policy would differ for misallocation of resources compared to low plant productivities. *In this paper, I study the effect, if any, of a particular piece of labour legislation on aggregate manufacturing sector productivity and then endeavour to decompose the effects as those arising from resource allocation and those from higher or lower plant productivities.*

The labour legislation that is the focus of this paper is The Industrial Disputes Act, 1947 (IDA) that addresses industrial relations and outlines mechanisms for the conciliation, arbitration and resolvment of industrial

disputes for firms in the registered manufacturing sector¹. Essentially the IDA regulates labour laws so far as they are concerned with the rights of the worker and demands of trade unions. It has been argued that the Act has granted excessive bargaining power to workers, and this reduces investment incentives for firms as they fear problems of hold-up and expropriation. The relative price of labour also increases when firms' regulatory burden increases. Certain sections of the IDA have been cited as particularly restrictive as they make it difficult for firms to lay-off or retrench workers. Indeed, firms employing more than 100 workers require prior government approval for lay-offs or retrenchment which in practice is rarely granted.

The *key* aspect however is, that different states in the country have amended these laws in different ways since independence, with some of the amendments granting more rights and protection to workers with others reducing regulatory costs for firms and creating more favourable conditions for employers. Using the methodology outlined in Besley and Burgess (2004), I classify each amendment as pro-worker, neutral or pro-employer thus creating a regulatory index that varies by state and time. Using this variation, and a structural model to quantify the productivity terms as in Hsieh and Klenow (2009), I examine if labour regulations play a role in determining manufacturing sector TFP, and if so, through what channels.

Now, how can labour regulations affect plant level productivities or the allocation of resources amongst plants? We can envisage a pro-worker amendment as introducing an implicit tax on the use of labour, and this will increase a plant's labour costs and drive down its productivity. The same pro-worker amendment may affect two establishments very differently leading to a misallocation of resources. Say, we have two plants with different idiosyncratic productivities, but producing according to a common production function with decreasing returns (with a single factor of production (say, labour)).² An equilibrium is realized when the marginal products of labour of the two plants equalize. The more productive unit would hire more labour, and produce more output than the less productive one. Now, the government introduces a pro-worker amendment that affects plants above a certain size threshold, in this case, the more productive plant. We will then realize a situation where the implicit taxes faced by the two plants will be heterogeneous, and the before-tax marginal products of labour will not equalize in equilibrium. The more productive establishment will then not produce at its optimal level, and aggregate output will also be lower. This would be a classic case of misallocation of resources across plants.

¹The registered manufacturing sector comprises firms using either (i) ten or more employees and electric power or (ii) twenty or more employees and not using electric power

²The example is based on a simplified model of firm heterogeneity as in Hopenhayn (1992).

While the notion of misallocation is itself quite broad, a body of literature is specifically examining this question through the lens of the firm microstructure in developing countries. A recent paper by Hsieh and Klenow (2009) use microdata on manufacturing establishments in India, China and the United States to measure the extent of misallocation in narrowly defined industries in these countries. Not only do they find huge dispersion of marginal products of labour and capital within four digit manufacturing sectors in India and China, but their calculations indicate that misallocation can explain half of the TFP gap between China or India and the United States.³ A number of other studies suggest that there is ongoing reallocation of output and factors of production within narrowly defined manufacturing sectors and this has been a driving factor behind aggregate productivity gains (Foster, Haltiwanger and Krizan (2001), Bailey, Hulten and Campbell (1992)).

The questions I pose in this paper are the following: What is the causal effect of labour regulations on the productivity of a plant? Do labour regulations have an effect on the allocation of resources in narrowly defined industries, where a dispersion of marginal products is taken as indicative of misallocation? Finally, do these regulations affect the industry level productivities?

The following sections of the paper lay out the theoretical as well as empirical methodologies employed to address the afore-mentioned research questions. First the theoretical foundation underpinning this analysis is delineated. A brief description of the data followed by the empirical analysis and discussion of results comes next. The amendments that constitute the treatment are fully enumerated in the appendix. The paper concludes with a note on the way forward.

2 Measurement

2.1 Model

In this section, I outline the theoretical framework employed to derive the measures of productivities used for the purpose of the analysis. The section is based on the exposition in Hsieh and Klenow (2009), who use a model of monopolistic competition (essentially Melitz (2003)) in a setting where firms additionally face differing output and capital distortions.

³Indeed, within 4-digit manufacturing industries in India and China, the average TFP ratios of plants at the 90th percentile of the TFP distribution to those at the 10th percentile are in the range of 5:1.

We assume that there are S manufacturing industries, and industry output is aggregated using a constant elasticity of substitution (CES) production function of M_s differentiated products.

$$Y_s = \left(\sum_{i=1}^{M_s} Y_{si}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \quad (1)$$

We assume that a firm in each sector uses a Cobb-Douglas production function of firm TFP, capital and labour:

$$Y_{si} = A_{si} K_{si}^{\alpha_s} L_{si}^{1-\alpha_s} \quad (2)$$

The key idea here is that we introduce distortions that affect the marginal products of labour and capital. Distortions that affect both the marginal products of capital and labour by the same proportion are referred to as output distortions τ_Y (for example, output subsidies). Distortions that raise the marginal product of one factor relative to the other are capital or labour distortions (say, capital distortion τ_K).

Profits are given by⁴

$$\pi_{si} = (1 - \tau_{Y_{si}}) P_{si} Y_{si} - w L_{si} - (1 + \tau_{K_{si}}) R K_{si} \quad (3)$$

Profit Maximization yields:

$$P_{si} = \frac{\sigma}{\sigma-1} \left(\frac{R}{\alpha_s} \right)^{\alpha_s} \left(\frac{w}{1-\alpha_s} \right)^{1-\alpha_s} \frac{1 + \tau_{K_{si}}}{A_{si}(1 - \tau_{Y_{si}})} \quad (4)$$

The allocation of resources across firms will depend not just on the marginal products of labour and capital, but also on the distortions that the firms face. In the absence of distortions allocative efficiency would imply (with a Cobb-Douglas structure)

$$P_{si} A_{si} = P_{sj} A_{sj}$$

Now, as a result of distortions, the above condition will not hold. If allocation across firms is driven by the distortions as opposed to the marginal products, we have a case of misallocation of resources and a way to recover the magnitude of the same.

We now introduce the crucial concept of a firm's revenue productivity as distinct from its physical productivity.⁵ A firm's physical productivity ($TFPQ$) A_{si} is simply the efficiency of its production, while revenue productivity

⁴We assume that firms face the same wages and rental costs of capital.

⁵This has been highlighted to be an important distinction in the literature on productivity.

($TFPR$) is the product of physical productivity and the output price faced by the firm $P_{si}A_{si}$. Essentially, if there were no distortions, we would expect the revenue productivities to be equal across firms in a narrowly defined industry.⁶ A dispersion in revenue productivity across the firms in a sector would be an indication of misallocation of resources across firms in that sector.

Hsieh and Klenow (2009) derive that the total factor revenue productivity of a plant is the geometric average of the marginal revenue products of capital and labour. That is proportional to the distortions faced by the plant.⁷

$$TFPR_{si} \propto (MRPK_{si})^{\alpha_s} (MRPL_{si})^{1-\alpha_s} \propto \frac{(1 + \tau_{K_{si}})^{\alpha_s}}{1 - \tau_{Y_{si}}}$$

Algebra leads to the following expression of GDP:

$$Y = \Pi_{s=1}^S (TFP_s K_s^{\alpha_s} L_s^{1-\alpha_s})^{\theta_s}$$

The key equation, derived using previous, is the following which expresses industry TFP in terms of plant level $TFPR_s$.

$$TFP_s = \left(\sum_{i \in s} \left[A_{si} \frac{\overline{TFPR}_s}{TFPR_{si}} \right]^{\sigma-1} \right)^{\frac{1}{\sigma-1}} \quad (5)$$

where $\overline{TFPR}_s \propto (\overline{MRPK}_s)^{\alpha_s} (\overline{MRPL}_s)^{1-\alpha_s}$ is a geometric average of the

⁶We can calculate the revenue productivities as $P_{si}A_{si} = \frac{P_{si}Y_{si}}{K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}}$. Plant level data typically report nominal revenues, thus rendering a calculation of revenue productivity possible while a calculation of physical productivity would not be possible based on the plant-level observables.

⁷We can rewrite the two first order conditions as follows:

$$MRPL_{si} = (1 - \alpha_s) \frac{\sigma - 1}{\sigma} \frac{P_{si}Y_{si}}{L_{si}} = w \frac{1}{1 - \tau_{Y_{si}}}$$

$$MRPK_{si} = \alpha_s \frac{\sigma - 1}{\sigma} \frac{P_{si}Y_{si}}{K_{si}} = R \frac{1 + \tau_{K_{si}}}{1 - \tau_{Y_{si}}}$$

Using the above, plant $TFPR$ can be shown to be proportional to a geometric average of the marginal revenue products

$$\begin{aligned} (\overline{MRPK}_{si})^{\alpha_s} (\overline{MRPL}_{si})^{1-\alpha_s} &= \left(\alpha_s \frac{\sigma - 1}{\sigma} \frac{P_{si}Y_{si}}{K_{si}} \right)^{\alpha_s} \left((1 - \alpha_s) \frac{\sigma - 1}{\sigma} \frac{P_{si}Y_{si}}{L_{si}} \right)^{1-\alpha_s} \\ &= \alpha_s^{\alpha_s} (1 - \alpha_s)^{1-\alpha_s} \frac{\sigma - 1}{\sigma} \frac{P_{si}Y_{si}}{K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}} \end{aligned}$$

average marginal products of capital and labour in the sector. The key point to note is that in the absence of distortions, the geometric average will equal the plant $TFPR_{si}$. Hence to show that there is misallocation, it suffices to show that there is variation in $TFPR_{si}/\overline{TFPR_s}$.

Using this framework, I can compute the measures of productivity at the level of the plant, as well as at the level of industry. The revenue productivity of a plant ($TFPR_{si}$) forms a measure of how productive a plant is. Misallocation is captured by the variance of the revenue productivities (logged) in a 4 digit manufacturing industry in a given state in a given year. The difference in difference estimation framework will give us the causal effect of labour reform on the average dispersion of revenue productivities. As we construct the measure of misallocation at the level of a 4 digit industry in a state in a year, we also construct the industry level productivity TFP_s for the same. Following panel data estimation techniques, the productivity measures are then regressed on state and time fixed effects and the treatment variable, with standard errors clustered at the level of the state.

2.2 Regulatory Index

India has long been recognized as a country with one of the most restrictive labour regulation regimes worldwide. A wide range of labour legislation has been enacted to protect the rights of workers. Among other things, these laws increase costs of retrenchment or factory closure, protect rights of trade unions and essentially empower organized unions with high bargaining power. A number of studies have argued that this regulatory environment has been to the detriment of India's overall growth and efficiency (Lucas (1988) and Ahluwalia (1991)). India has fared poorly in country rankings of ease of doing business, and observers have cited unfavourable business conditions as a reason for the lacklustre performance of the manufacturing sector⁸. Indeed, manufacturing output constituted 13 percent of GDP in 1960 and it grew to around 16 percent of GDP in 2014, reflecting a fairly stagnant aggregate performance through all these years.

The legislation that is the focus of this paper are the state level amendments to The Industrial Disputes Act, 1947. The Industrial Disputes Act of 1947 outlines the conciliation, arbitration and adjudication procedures to be followed in case of an industrial dispute. The Act covers firms in the registered manufacturing sector in the country. India is a federal democracy, and industrial relations is an area over which both the central as well as state governments have authority to legislate. State governments have

⁸India ranked 130th out of 190 countries in the World Bank's 2017 ease of doing business index

amended this Act extensively since its enactment, and it is this variation in reforms that I exploit.

Let us first take the case of a central amendment to understand how the regulations may impose an implicit tax on labour. I will then go on to discuss the nature of the amendments, and how they create varying distortions in different states. In 1976, a central amendment introduced chapter V-B in the IDA which stipulated that firms employing 300 or more workers have to obtain government permission for layoffs, retrenchments and closures. Now, say there is a firm which in an unconstrained optimization problem would choose to employ 300 workers (or more). This firm now faces a higher cost on workers, if the number of workers employed exceed 300. Government permissions are rare and the transactional costs involved are high. Thus, this firm now faces an implicit tax on labour.

We can use this amendment to illustrate the two distinct microeconomic channels that drive the aggregate productivity dynamics in a manufacturing sector. We postulate that a plant produces output following a Cobb Douglas production function of firm TFP, capital and labour as given by $Y = AK^\alpha L^{1-\alpha}$. Firm TFP A can be thought of as the overall efficiency with which a plant uses its factors of production. If a plant with over three hundred workers has to incur an additional cost (either in expectation or in terms of regulatory burden), the implicit taxes are subsumed in the overall efficiency parameter A , and so a plant's overall productivity declines. This can drive further heterogeneity in plant productivity dynamics as cost differences can induce further employment and investment decisions among otherwise similar plants. What about the allocation of resources? We have a case of misallocation when resources are not allocated to their best or most efficient uses. Using the same example, a plant with over 300 workers now faces an implicit tax, while a plant with 50 workers does not face this tax. Both plants will not be producing at their optimal levels: one will over-produce and one will under-produce. This misallocation of resources will also drive down aggregate output. These two effects, plant productivity and allocation of resources within a sector, will play a role in determining the aggregate productivity level of a 4 digit industry in a state in a year.

The treatment in this study varies over time at the level of a state. The state amendments allow us to control for the effect of other common policies by removing the time trends. Furthermore, the panel structure allows us to address concerns of endogeneity by controlling for state fixed effects. A policy or an amendment is not random, but assuming that other state related factors correlated with policy decisions are invariant over the period of study, the econometric results can be given a causal interpretation.

Some more examples illustrating the nature of the amendments that have been introduced are outlined here.⁹ In 1980, the government of West Bengal introduced the following amendment:

“The rules for lay-off, retrenchment and closure may according to the discretion of the state government be applied to industrial establishments, which employ more than 50 workers. Under the central acts these rules only apply to establishments, which employ more than 300 workers.”

It is straightforward to see that this would disproportionately raise the cost of labour in the state of West Bengal compared to other states. Another example of an amendment introduced by the government of Karnataka in 1988 that lowers the cost of labour is as follows:

“If in the opinion of the state government it is necessary or expedient so to do for securing the public safety of the maintenance of public order or services or supplies essential to the life of the community or for maintaining employment or industrial peace in the industrial establishment it may issue an order which (i) requires employers and workers to observe the terms and conditions of the order (ii) prevents any public utility service from closing.”

To a degree of simplification, the distortions either raise the relative cost of labour, or lower it or impose a tax on final output or do not. Thus we may classify each amendment as either pro-worker, pro-employer or neutral. I follow an approach outlined in Besley and Burgess (2004) in their classification of Indian states as pro-worker or pro-employer based on state level amendments to the IDA. Essentially, they study the state-level amendments and each amendment gets a code of 1, 0 or -1 depending on whether the amendment is pro-worker, neutral or anti-worker. They discuss that though this involves a call of judgement, the amendments were of such a nature that an objective coding was possible¹⁰. In a year for which more than one amendment has been passed, the regulatory score reflects the net direction of the state’s leanings (i.e. if 4 pro worker and 3 anti worker reforms are passed, the net score is 1 reflecting a pro worker leaning). The regulatory scores are cumulated over time for each state and that is the regulatory measure of the state for the given year.

⁹The complete list of amendments enacted since independence is provided in the data appendix.

¹⁰For example, an amendment passed in Gujarat in 1973 reads “Imposes penalty on employer for not nominating representatives to councils within firms”. This can easily be categorized as a pro-worker amendment.

3 Data

In this section, I briefly discuss the data that has been used for the purpose of this study.

Data on manufacturing establishments was sourced from the Annual Survey of Industries (ASI). The ASI is a statutory survey conducted by the Ministry of Statistics and Programme Implementation, Government of India, designed to collect detailed industrial statistics on the organized manufacturing sector in the country comprising activities related to manufacturing processes, repair services, gas and water supply and cold storage. Its coverage includes:

- All factories registered under sections 2(m)(i) and 2(m)(ii) of the Factories Act, 1948, where the manufacturing process is defined under section 2(k) of the said Act
- All bidi and cigar manufacturing units registered under the Bidi and Cigar Workers (Conditions of Employment) Act 1966
- All electricity undertakings engaged in the generation, transmission and distribution of electricity registered with the Central Electricity Authority (CEA) were also covered by the ASI irrespective of their employment size till ASI 1997-98

As per the present sampling design, all units with more than 100 employees (the Census Sector) and a random sample of units with more than 10 workers (20 if without power) and not included in the Census Sector are covered as part of the survey. The unit-level information thus surveyed allows for in-depth studies on the growth, composition and structure of the organized manufacturing sector in the country. The variables covered include plant's industry (4-digit ISIC), labour compensation, value-added, age (based on reported birth year), ownership, fixed assets, working capital and loans, etc.

The data employed for this study is for the time period 1997-98 to 2013-14. Detailed unit level data with panel identifiers is available for this time period. Furthermore, the sample was restricted to plants in the manufacturing industries only.¹¹

The revenue productivities used to construct the measures of misallocation can be calculated as $P_{si}A_{si} = \frac{P_{si}Y_{si}}{K_{si}^{\alpha_s}L_{si}^{1-\alpha_s}}$. Capital is constructed as the average of the net book value of fixed assets as reported by the plant in the beginning and end of the accounting year. In keeping with Hsieh and

¹¹The ASI also covers plants in certain servicing sectors and activities like water supply, cold storage, etc.

Klenow (2009), the variable labour is constructed as the sum of the total wages, bonuses, workmen and staff welfare expenses as well as contributions to other social security benefits paid by the plant over the accounting year. The ASI also reports plant level variables that can be used to construct the nominal revenue earned by the plant. The author uses gross output measure to construct the same as opposed to a value added measure.

The regulatory index is created using the amendments to the Industrial Disputes Act, 1947. The Act along with amendments has been compiled in the book, “Industrial Law” by P. L. Malik. The author uses this book to study and classify the amendments to create the index.

4 Empirical Framework

4.1 Estimation Specification

Panel data estimation techniques are employed to examine the impact of restrictive labour laws on misallocation in plants in India. The period under study is 2000 - 2013/14. A total of sixteen amendments were enacted in this time period by eight states in the country.¹² However, the regulatory index is constructed using all the amendments passed since independence (in the manner discussed earlier). Thus the states already start off with initial values of the index depending on the state’s particular history of amendments.

The basic specifications employed to address the main research questions are outlined in this section. To investigate the impact of labour reform on the productivity of a plant, I run the following:

$$Y_{ijst} = \alpha_s + \beta_t + \delta R_{st} + \gamma_{jt} + \rho_j + \epsilon_{ijst}$$

where i, j, s, t index plants, industries, states and fiscal years respectively.

Y_{ijst} Productivity measure of plant i in industry j , state s in year t . The measures are revenue productivity $TFPR$ and the physical productivity A

R_{st} Regulatory index in state s in year t

α_s State fixed effects

γ_{jt} Time-industry fixed effects

β_t Time fixed effects

¹²The states that passed amendments in this time period are Andhra Pradesh, Assam, Delhi, Gujarat, Madhya Pradesh, Maharashtra, Punjab and West Bengal. The full list of amendments has been outlined in the Appendix.

ϵ_{ijst} Error term

To examine the impact of the index on misallocation in a given four digit industry in a state in a year, I run the following:

$$Y_{jst} = \alpha_s + \beta_t + \delta R_{st} + \gamma_{jt} + \rho_j + \epsilon_{jst}$$

where j, s, t index industries, states and fiscal years respectively.

The dependent variable, capturing misallocation, is the variance of the logged *TFPRs* in an industry in a state in a year. Hence, the coefficient on the treatment gives us the causal effect of the treatment on average misallocation in a treatment state compared to a control state.¹³ The key hypothesis to be tested is whether the coefficient on the regulatory index differs significantly from zero.

The same specification is employed to study the effect of the index on the productivity of a 4 digit manufacturing industry, where Y_{jst} captures industry TFP in sector j , state s and time t , and industry *TFP* is computed using the model framework as discussed earlier.

Standard errors are clustered at the level of the state for all specifications employed. The treatment in this study is essentially a state level policy (as the amendments happen at the level of the state, and the regulatory index is constructed accordingly). Hence, it makes sense to assume that firms in a state are exposed to common state level shocks or unobserved characteristics. Thus the error terms could be correlated across observations in a state, and also be heteroskedastic. Taking this into account, I estimate the standard errors of the coefficients using the Liang-Zeger estimator ($\hat{V}_{LZ}(\hat{\beta}) = (X'X)^{-1}(\sum_c X'_c \hat{\epsilon}_c \hat{\epsilon}'_c X_c)(X'X)^{-1}$) that will take into account the block diagonal structure of the variance covariance matrix.

¹³The index is constructed such as that a positive increase in the index represents an increase in legislation in a pro-worker direction.

4.2 Results

Results for the impact of the regulatory index on industry TFP are presented here¹⁴.

Table: Summary Statistics of Industry TFP

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
TFP	11,843.00	7,798.44	44,760.76	0.00	519,720.22

Effect of Regulatory Index on Industry TFP

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
Regulatory Index	-1,465* (696.8)	-1,514* (780.9)	-1,456 (831.5)
Constant	5,450** (1,622)	-24,015** (8,363)	-205,845 (197,941)
Observations	11,843	11,843	11,843
R-squared	0.024	0.136	0.225
State FE	YES	YES	YES
Year FE	YES	YES	YES
Industry FE		YES	
Industry * Year FE			YES

Cluster robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results suggest that an increase in the regulatory index in a pro-worker direction is associated with a drop in average industry productivity. I find an increase in pro-worker leaning by one unit reduces average industry TFP of a 4 digit industry by 19.4 percentage.

¹⁴TFP is given by

$$TFP_s = \left(\sum_{i=1}^{M_s} \left(A_{si} \frac{\overline{TFPR}_s}{TFPR_{si}} \right)^{\sigma-1} \right)^{\frac{1}{\sigma-1}}$$

Plant $TFPR$ ($PA = \frac{PY}{K^\alpha L^{1-\alpha}}$) has been constructed using gross output measure of a plant instead of value added.

Impact of the regulatory index on the dispersion of TFPR is shown below.

Table: Summary Statistics for Misallocation

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
Var Log TFPR	11,965	2.875	6.366	0.0707	43.34

**Impact of Regulatory Index on Misallocation
(Variance of logged TFPRs)**

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
Regulatory Index	-0.251* (0.115)	-0.216 (0.116)	-0.311* (0.148)
Constant	1.097*** (0.0706)	2.042*** (0.317)	4.139** (1.668)
Observations	11,858	11,858	11,965
R-squared	0.637	0.654	0.723
Year FE	YES	YES	YES
State FE	YES	YES	YES
Industry FE		YES	
Industry * Year FE			YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

I find that an increase in pro-worker legislation is associated with a reduction in the dispersion of revenue products. The likely explanation for this is that pro-worker legislation decreases the marginal products for the larger and more productive firms. So the variance of the distribution of log *TFPR* falls.

Results for the impact of the regulatory index on the revenue productivity of plants is given below.

Table: Summary Statistics for Revenue Productivity of a Plant

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
TFPR	259,269	84.24	201.4	0	1,782

Effect of Regulatory Index on the TFPR of a Plant

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
Regulatory Index	2.767 (1.983)	-0.525 (3.062)	1.402 (2.052)
Constant	98.85*** (2.124)	65.27*** (6.515)	9.354 (10.02)
Observations	259,269	259,269	259,269
R-squared	0.032	0.192	0.212
State FE	YES	YES	YES
Year FE	YES	YES	YES
Industry FE		YES	
Industry * Year FE			YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

I find that the index has no effect on the average revenue productivity of a plant, suggesting substantial heterogeneity in treatment effects. It is possible here that on average some plants become more productive while some become less productive as a result of the treatment, and these effects cancel out when we estimate the average treatment effect on the treated.

Results for the impact of labour regulations on the physical productivity of a plant are given here.

Table: Summary Statistics for Physical Productivity of a Plant

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
A	243,559	0.0150	0.0356	0	0.441

Effect of Regulatory Index on Physical Productivity of a Plant

VARIABLES	(1) Model 1	(2) Model 2	(3) Model 3
Regulatory Index	-0.000143 (0.000417)	-6.09e-05 (0.000512)	-0.000567 (0.000661)
Constant	0.0167*** (0.000624)	0.0549*** (0.00172)	-0.585*** (0.0962)
Observations	243,559	243,559	243,559
R-squared	0.024	0.107	0.122
State FE	YES	YES	YES
Year FE	YES	YES	YES
Industry FE		YES	
Industry * Year FE			YES
State * Time FE			YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The index has no effect on the average physical productivity of a plant. Once again, similar to the previous results, this suggests a heterogeneity in the treatment effect. Some plants could be becoming more productive while others become less productive as a result of the treatment. Thus, we find no effect on average treatment effect on treated.

Robustness Similar results are obtained when all the productivity terms are computed using output measure of value added instead of gross output for a plant. To ensure, that results are not being driven by a particular state, different combinations of states are used for all the regression analyses. Once again, the results do not change much suggesting that they are not driven by particular states.

5 Conclusion

This paper sought to examine if labour regulations have any impact on the aggregate productivities of narrowly defined manufacturing sectors in the different states in India. It then attempted to provide evidence for the different microeconomic channels operating in these sectors through which aggregate effects could be realized.

The author finds that labour legislation that increases union power or regulatory burden for employers is associated with a significant drop in the aggregate productivity at the level of a 4 digit industry. Misallocation of resources plays an important part in explaining the aggregate productivity declines. At the level of a plant, the average effect is insignificant which suggests substantial heterogeneity in treatment effects.

Further work needs to be done to uncover heterogeneous treatment effects of these regulations. As the effects are likely different for larger plants or more productive plants compared to smaller or less productive plants, getting a quantitative sense of the magnitudes involved would be interesting both for academic as well as policy purposes.

This paper also lends credence to the view that by disproportionately increasing bargaining power and rights of workers, states suffer productivity declines. While welfare of workers is important, striking a balance with the needs of industry are also paramount to ensure that investments pour in and jobs are created. The importance of a certain degree of labour market flexibility to reap the benefits of *creative destruction* thus cannot be understated.

Bibliography

Aghion, Philippe, Robin Burgess, Stephen Redding, and Fabrizio Zilibotti (2008), The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India, *American Economic Review* 98 (September): 1397-1412.

Ahluwalia, Isher Judge (1991), *Productivity and Growth In Indian Manufacturing*, Oxford University Press, New Delhi.

Banerjee, Abhijit and Esther Duflo (2005), Growth Theory Through the Lens of Development Economics, chapter 7 in the *Handbook of Economic Growth Vol. 1A*, P. Aghion and S. Durlauf, eds., North Holland.

Besley, Timothy, and Robin Burgess (2004), Can Labor Regulation Hinder Economic Performance? Evidence from India, *Quarterly Journal of Economics* 119 (1): 91-134.

Caselli, Francesco (2005), Accounting for Income Differences Across Countries, chapter 9 in the *Handbook of Economic Growth Vol. 1A*, P. Aghion and S. Durlauf, eds., North Holland.

Hall, Robert E. and Charles I. Jones (1999), Why Do Some Countries Produce So Much More Output Per Worker Than Others?, *Quarterly Journal of Economics* 114: 83-116.

Howitt, Peter (2000), Endogenous Growth and Cross-Country Income Differences, *American Economic Review* 90: 829-846.

Hsieh, Chang-Tai, and Peter J. Klenow (2009), Misallocation and Manufacturing TFP in China and India, *Quarterly Journal of Economics* 124 (4): 1403-48.

Klenow, Peter J. and Andrs Rodriguez-Clare (1997), The Neoclassical Revival in Growth Economics: Has It Gone Too Far? in B. Bernanke and J. Rotemberg, eds., *NBER Macroeconomics Annual* (MIT Press, Cambridge) 73-103.

Klenow, Peter J. and Andrs Rodriguez-Clare (2005), Externalities and Economic Growth, chapter 11 in the *Handbook of Economic Growth Vol. 1A*, P. Aghion and S. Durlauf, eds., North Holland.

Lucas, Robert E., Jr. (1978), On the Size Distribution of Business Firms,

Bell Journal of Economics 9 (Autumn): 508-523.

Lucas, Robert E. B. (1988), Indias Industrial Policy, in: Robert E. B. Lucas and Gustav F. Papanek, eds., The Indian Economy, Westview Press, Boulder, CO.

Mankiw, Gregory, David Romer, and David Weil (1992), A contribution to the empirics of economic growth, Quarterly Journal of Economics 107(2), 407-437

McKinsey Global Institute (1998), Productivity: The Key to an Accelerated Development Path for Brazil, Washington, DC: McKinsey Global Institute, 1998.

Melitz, Marc J. (2003), The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity, Econometrica 71: 1695-1725.

Restuccia, Diego, and Richard Rogerson (2008), Policy Distortions and Aggregate Productivity with Heterogeneous Plants, Review of Economic Dynamics 11 (October): 707-720.

Appendix I

Data Appendix Table

State	Year	Section	Description
Andhra Pradesh	1949	2	Allows the appropriate government to declare any industry as a public utility if a public emergency or public interest requires so. In the central act only industries in the First Schedule (public utilities) may be declared thus. Public utilities are more limited in having strikes and lock-outs and the government has greater power to refer industrial disputes in public utilities service to the appropriate court
Andhra Pradesh	1949	10	States that where a Tribunal has been constituted under this Act for the adjudication of disputes in any specified industry or industries and a dispute exists or is apprehended in any such industry then the employer or majority of workmen may refer the dispute to that Tribunal. This facilitates referral of disputes to Tribunals as the process does not need to be intermediated by government. In the central act both sides have to apply to the government so it can refer the dispute to a court.
Andhra Pradesh	1968	2	Any services in hospitals or dispensaries are classified as a public utility. Public utilities are more limited in having strikes and lock-outs and the government has greater power to refer industrial disputes in public utilities service to the appropriate court. In the central act these services are not classified as public utilities.
Andhra Pradesh	1982	11A-11D	A Labour Court or Tribunal is granted the power of a Civil Court to execute its award or any settlement as a decree of a Civil Court.
Andhra Pradesh	1987	10A-10K	If in the opinion of the state government it is necessary or expedient so to do for securing the public safety or the maintenance of public order or services or supplies essential to the life of the community or for maintaining employment or industrial peace in the industrial establishment it may issue an order which (i) requires employers and workers to observe the terms and conditions of an order. (ii) prohibits strikes and lockouts in connection with any industrial dispute.
Andhra Pradesh	1987	25FFF	Prior payment of compensation to the worker is a condition precedent to the closure of an undertaking. Under the central act payment of compensation does not need to be made prior to closure.

State	Year	Section	Description
Andhra Pradesh	1987	25H	Where a closed firm is re-opened, workers who were on the roll of a given unit should be given the opportunity to offer themselves for employment in preference to others. Under the central act retrenched workers are given preference but there is less specify as regards rehiring workers from the same unit.
Andhra Pradesh	1987	25HH	Where a worker is reinstated by an award of a Labour Court or Tribunal, his wages will be paid from the date specified in that award whether or not he has been reinstated by the employer.
Andhra Pradesh	1987	29A	Failure to comply an order by the state Government which constrains industrial dispute activity in the interests of the public is punishable with imprisonment for a period which is not less than six months and with a fine
Andhra Pradesh	1987	2A	In the case of an industrial dispute involving an individual worker he has the right to apply directly to the Labour Court for adjudication. No such right is specified in the central act.
Andhra Pradesh	1987	33C	In place of the Collector, the Chief Judicial Magistrate or the Chief Metropolitan Magistrate are given the power to recover from an employer money owing to a worker as the result of settlement of an industrial dispute.
Andhra Pradesh	1987	9A	If an employer wants to change the conditions of service applicable to any worker he has to give him a notice of 42 days (instead of 21)
Andhra Pradesh	2008	2	Workers involved in sales promotion are included in the definition of workers. This category of employment is not specified in the central act.
Andhra Pradesh	2011	2	Allows for extension of status of public utility for units located in Export Processing Zones/ Special Economic Zones if the appropriate government deems such an extension necessary for public emergency or public interest.
Assam	1962	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Assam	1962	7C	The presiding officer serving in a labour court, tribunal or national tribunal who has attained the age of 65 is allowed to serve for a further six months.
Assam	2007	2	Workers involved in sales promotion are included in the definition of workers. This category of employment is not specified in the central act.

State	Year	Section	Description
Assam	2007	33C	Widens judicial powers to recover money owed to workers by employer.
Bihar	1959	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Delhi	2003	10	Individual workers can apply to Labour Courts for adjudication.
Gujarat	1962	7D	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Gujarat	1973	2	Insertion of exact definition of council as being a Joint Management Council.
Gujarat	1973	30-30A	Failure of the employer to nominate his representatives to Councils within firms is punishable by a fine of 50 rupees and in the case of continuing failure to do so the employer will pay an additional fine which may extend to 50 rupees per day for every day that such failure continues.
Gujarat	1977	7	Reduction of the qualifications of judge to serve on a Labour Court. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Gujarat	1977	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Gujarat	1984	2	Insertion of definition of closure which was repealed in the same year when the amendment was incorporated into the wording of the central act.
Gujarat	1984	25S	Declaration that notwithstanding anything contained in any other law being in force in the state providing for the settlement of industrial disputes, the rights and liabilities of employers and workers in relation to closure will be determined in accordance with the provisions of this law.
Gujarat	2004	Ch V-D	Increases compensation to workman working in special economic zones in case of termination of services.
Gujarat	2004	2	Retrenchment does not include the termination of the service of a workman in an industrial establishment situated in the Special Economic Zone declared as such by the Government of India.
Gujarat	2004	2	Termination of the service of a workman in a Special Economic Zone does not qualify as an industrial dispute.
Gujarat	2004	2	Defines what would constitute a termination in a Special Economic Zone.

State	Year	Section	Description
Haryana	1976	7	Reduction of the qualifications of judge to serve on a Labour Court. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Haryana	1976	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Karnataka	1949	10	Pertains to the fact that Karnataka broke away from the state of Madras.
Karnataka	1963	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Karnataka	1988	10	In the case of an industrial dispute involving an individual worker he may within a six months period have the right to apply directly to the Labour Court for adjudication. No such right is specified in the central act.
Karnataka	1988	11	Increases the power of the conciliation officer in terms of enforcing attendance at hearings regarding industrial disputes, compelling the production of documents and issuing commissions for the examination of witnesses. Also makes clear what the penalties are for non-attendance or failure to produce relevant documents.
Karnataka	1988	10A-10K	The state government obtains the power to transfer any industrial dispute pending before a tribunal to any other tribunal constituted by the state government for adjudication.
Karnataka	1988	10A-10K	If in the opinion of the state government it is necessary or expedient so to do for securing the public safety or the maintenance of public order or services or supplies essential to the life of the community or for maintaining employment or industrial peace in the industrial establishment it may issue an order which (i) requires employers and workers to observe the terms and conditions of the order (ii) prevents any public utility service from closing.
Karnataka	1988	25K	The rules for lay-off, retrenchment and closure may according to the discretion of the state government be applied to industrial establishments of a seasonal character and which employ more than 100 but less than 300 workers. Under the central act these rules only apply to permanent establishments, which employ more than 300 workers.

State	Year	Section	Description
Kerala	1971	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Kerala	1979	10A-10K	If in the opinion of the state government it is necessary or expedient so to do for securing the public safety or the maintenance of public order or services or supplies essential to the life of the community or for maintaining employment or industrial peace in the industrial establishment it may issue an order which (i) requires employers and workers to observe the terms and conditions of the order (ii) prevents any public utility service from closing.
Kerala	1979	29A	Failure to comply an order by the state Government, which constrains industrial dispute activity in the interests of the public is punishable with imprisonment for a period, which is not less than six months and with a fine.
Madhya Pradesh	1982	7	Increases the power of the labour court to try offences covered both under the Industrial Disputes Act as well as offences covered under a range of other Acts pertaining to labour (which are specified in the Second Schedule of the Industrial Disputes Act).
Madhya Pradesh	1982	10	This amendment refers to part A of the second schedule instead of the whole second schedule. Second schedule describes matters within the jurisdiction of labour courts. The schedule for Madya Pradesh is renumbered so actually the change is only technical.
Madhya Pradesh	1982	34	Labour court is given the power to deal with every offence punishable under the Labour Disputes Act as well as under a range of other central acts dealing with labour issues.
Madhya Pradesh	1982	11A-11D	In the case of criminal cases the Labour Court shall have all the powers under the Code of Criminal Procedure of a Judicial Magistrate of the First Class.
Madhya Pradesh	1983	25O	(i) Undertakings dealing with construction of buildings, bridges, roads, canals, dams or other construction work are no longer exempted from procedures for closing down undertakings. (ii) State government as opposed to central government is deemed the appropriate government in dealing with negotiations regarding procedures for closing down undertakings.
Madhya Pradesh	1983	25R	Amendment is required given that the section of the central act referring to procedures for closing down undertakings has been amended. Effectively no change.

State	Year	Section	Description
Madhya Pradesh	1989	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Madhya Pradesh	2003	2nd Sch	Decreases the power of the labour court by removing from its jurisdiction offences committed under central acts.
Madhya Pradesh	2003	34	Reduces the power of the labour courts.
Maharashtra	1974	7	Reduction of the qualifications of judge to serve on a Labour Court. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Maharashtra	1974	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Maharashtra	1981	2	Discontinuation or reduction of power supply to an industrial establishment can be used a reason for lay-off (for which workers will receive compensation). Under the central act only shortage of coal, power or raw materials or the accumulation of stocks or the breakdown of machinery are listed as valid reasons for lay-offs.
Maharashtra	1981	25C	If being laid off is not due to electricity problems then the workers receive 100 percent of their wages as compared to the normal 50 percent.
Maharashtra	1981	25K	The rules for lay-off, retrenchment and closure may according to the discretion of the state government be applied to industrial establishments of a seasonal character and which employ more than 100 but less than 300 workers. Under the central act these rules only apply to permanent establishments which employ more than 300 workers.
Maharashtra	1983	25O	Any employer or worker affected by the decision to close down an enterprise is permitted for 30 days from the date of permission to close being granted appeal to an Industrial Tribunal to overturn the decision.
Maharashtra	1983	25R	Amendment is required given that the section of the central act referring to procedures for closing down undertakings has been amended. Effectively no change.
Maharashtra	2006	9A	No notice of changes in conditions of service required to be served to workmen under certain conditions.
Maharashtra	2006	2	Increases the wage threshold to be defined as a 'workman' for those involved in supervisory activities.

State	Year	Section	Description
Orissa	1960	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Orissa	1983	25K	The rules for lay-off, retrenchment and closure may according to the discretion of the state government be applied to industrial establishments, which employ more than 100 workers. Under the central act these rules only apply to establishments, which employ more than 300 workers.
Orissa	1983	25O	Any employer or worker affected by the decision to close down an enterprise is permitted for 30 days from the date of permission to close being granted appeal to an Industrial Tribunal to overturn the decision.
Orissa	1983	25R	Amendment is required given that the section of the central act referring to procedures for closing down undertakings has been amended. Effectively no change.
Punjab	1957	7	Reduction of the qualifications of judge to serve on a Labour Court. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
Punjab	1957	7C	The retirement age of the presiding officer serving in a labour court, tribunal or national tribunal is changed from 65 to 67.
Punjab	2009	2	Workers involved in sales promotion are included in the definition of workers. This category of employment is not specified in the central act.
Rajasthan	1960	2	Arbitration proceeding is exactly defined
Rajasthan	1960	2	Renumbering of sections to take into account precise definition of arbitration proceedings.
Rajasthan	1960	2	Member is defined as someone who is an ordinary member of a Union and who has paid a subscription of not less than four annas per month and who is not in arrears as regards these payments. Such an exact definition does not exist under the central act.
Rajasthan	1960	2	The definition of employer in the context of an industrial dispute also includes owners who have contracted with persons for the execution of work as part of the industry.
Rajasthan	1960	2	Registrar is defined as the person appointed to be the Registrar of Unions. This makes it clear who is involved in the bargaining process on behalf of the unions. This definition does not appear in the central act and hence might be subject to interpretation.

State	Year	Section	Description
Rajasthan	1960	2	Union is defined to be a trade union of employees registered under the Indian Trade Unions Act, 1926. This makes it clear who is involved in the bargaining process on behalf of the unions. This definition does not appear in the central act and hence might be subject to interpretation.
Rajasthan	1960	2	The definition of worker in the context of an industrial dispute also includes workers who have contracted with employers for the execution of work as part of the industry.
Rajasthan	1960	3	The state government has to appoint a Registrar of Unions and may also appoint Assistant Registrars of Unions to work in local areas. This makes it clear who can represent unions within Work Committees.
Rajasthan	1970	10A-10K	The state government has the right to refer an industrial dispute to an Industrial Tribunal if it is satisfied that (i) public peace or safety is threatened, serious or prolonged hardship of part of the community is likely to be caused or the industry concerned is likely to be seriously damaged, (ii) the industrial dispute is unlikely to be settled by other means or (iii) it is in the public interest to do so.
Rajasthan	1970	10A-10K	If in the opinion of the state government it is necessary or expedient so to do for securing the public safety or the maintenance of public order or services or supplies essential to the life of the community or for maintaining employment or industrial peace in the industrial establishment it may issue an order which (i) requires employers and workers to observe the terms and conditions of the order. (ii) prevents any public utility service from closing.
Rajasthan	1970	30-30A	Failure to comply an order by the state Government, which constrains industrial dispute activity in the interests of the public is punishable with imprisonment for a period, which may extend to one year or with a fine, which may extend to two thousand rupees or with both.
Rajasthan	1970	33C	Widens the scope of awards for which the worker can obtain judicial help with securing money owed by a employer to include awards made as the result of an order issued by the state Government to constrain industrial dispute activity in the interests of the public.
Rajasthan	1970	9C	This describes the supervisory duties of the Registrar of Unions and the rules for registration of unions (which is obligatory). One duty of the Registrar is to ensure that only one union (that with the largest employment) represents a single unit within an industry.

State	Year	Section	Description
Rajasthan	1984	25K	The rules for lay-off, retrenchment and closure may according to the discretion of the state government be applied to industrial establishments of a seasonal character and which employ more than 100 but less than 300 workers. Under the central act these rules only apply to permanent establishments, which employ more than 300 workers.
Rajasthan	1984	25L	Under the central act the central government is deemed as the "appropriate government" for dealing with rules for lay-off, retrenchment and closure. This amendment changes this definition to read "the state government shall have no powers"
Rajasthan	1984	25M	(i) Substitutes "state government" for "appropriate government" as being the government, which has the power to grant permission to lay-off workers. (ii) The expression "(Amendment) Act 1976" should be substituted with "(Rajasthan Amendment) Act 1984". (iii) The state government (as opposed to central government) has the right to refer lay-off matters to a labour court.
Rajasthan	1984	25M	Under the central act where workers in a mine have been laid off for reasons of fire, flood or gas explosion the employer doesn't have to receive prior consent. However, the employer has to apply for permission to continue the lay-off beyond 30 days. Here that condition is removed.
Rajasthan	1984	25N	Union representatives have to be involved in any negotiations concerning retrenchment of workers. Their involvement is not stipulated under the central act.
Rajasthan	1984	25N	(i) State government as opposed to central government is deemed the appropriate government in dealing with negotiations regarding retrenchment of workers. (ii) The expression "(Amendment) Act 1976" should be substituted with "(Rajasthan Ammendment) Act 1984".
Rajasthan	1984	25O	Undertakings dealing with construction of buildings, bridges, roads, canals, dams or other construction work are no longer exempted from procedures for closing down undertakings.
Rajasthan	1984	25P	In the central act government can order undertakings closed down before the commencement of the Industrial Dispute (Ammendment) Act 1976 to reopen. This amendment stipulates that such decisions can be referred to an Industrial Tribunal for adjudication.
Rajasthan	1984	25PP	Special provisions were put in place to reinstate workers who had been retrenched in the six months prior to passing the Industrial Disputes (Rajasthan Amendment) Act 1984. This section was only in force for six months hence unlikely to have long-term effects.

State	Year	Section	Description
Rajasthan	1984	25Q	The maximum penalty for lay-off and retrenchment of workers without permission is increased to imprisonment for three months or a fine of two thousand rupees or both (from the one month imprisonment or a fine of one thousand rupees or both) which are the terms stipulated in the central act.
Rajasthan	1984	25R	Amendment is required given that the section of the central act referring to procedures for closing down undertakings has been amended. Effectively no change.
Rajasthan	1984	25S	The procedures for lay-off and retrenchment specified in Chapter V-A of the central act are deemed to be applicable to industrial establishments of a seasonal character and which employ more than 100 but less than 300 workers. Under the central act these rules only apply to permanent establishments which employ more than 300 workers.
Rajasthan	2014	2	Definition of worker for industrial disputes purposes no longer extends to those subcontracted with an industry
Rajasthan	2014	2A	Extends the time period in cases of sufficient cause within which a dispute related to dismissal or retrenchment can be raised in conciliation proceedings to deemed to be an industrial dispute.
Rajasthan	2014	25K	Reserves rules for lay-off, retrenchment and closure to larger firms unless specific conditions apply.
Rajasthan	2014	25N	a. <i>The existing expression "or the workman has been paid in lieu of such notice, wages for the period" shall be deleted (original act had it that either 3 months notice or wages for that time period must be paid as a condition necessary for retrenchment of a workman) b. in sub-section (9), after the words "in excess of six months", the words "and an amount equivalent to his three months average pay" shall be inserted</i>
Tamil Nadu	1949	2	Allows the appropriate government to declare any industry as a public utility if a public emergency or public interest requires so. In the central act only industries in the First Schedule (public utilities) may be declared thus. Public utilities are more limited in having strikes and lock-outs and the government has greater power to refer industrial disputes in public utilities service to the appropriate court.

State	Year	Section	Description
Tamil Nadu	1949	10	States where a Tribunal has been constituted under this Act for the adjudication of disputes in any specified industry or industries and a dispute exists or is apprehended in any such industry then the employer or majority of workmen may refer the dispute to that Tribunal. This facilitates referral of disputes to Tribunals as the process does not need to be intermediated by government. In the central act both sides have to apply to the government so it can refer the dispute to a court.
Tamil Nadu	1982	10A-10K	If in the opinion of the state government it is necessary or expedient so to do for securing the public safety or the maintenance of public order or services or supplies essential to the life of the community or for maintaining employment or industrial peace in the industrial establishment it may issue an order which (i) requires employers and workers to observe the terms and conditions of the order and (ii) prevents any public utility service from closing.
Tamil Nadu	1982	29A	Failure to comply an order by the state government, which constrains industrial dispute activity in the interests of the public is punishable with imprisonment for a period which is not less than six months and with a fine.
Tamil Nadu	1988	11	Increases the power of the conciliation officer in terms of enforcing attendance, compelling the production of documents and issuing commissions for the examination of witnesses.
Tamil Nadu	1988	2A	In the case of an industrial dispute involving an individual worker he has the right to apply directly to the Labour Court for adjudication. No such right is specified in the central act.
Uttar Pradesh	1951	7	Reduction of the qualifications of judge to serve on a Labour Court. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
West Bengal	1958	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
West Bengal	1959	7C	The presiding officer serving in a labour court, tribunal or national tribunal who has attained the age of 65 is allowed to serve for a further six months.
West Bengal	1974	2	Any worker who presents himself and is given employment for that day cannot be laid off for that day. However, if he didn't receive a work within 2 hours he is deemed as being laid off. Under the central act only the second condition holds.

State	Year	Section	Description
West Bengal	1980	2	Workers involved in sales promotion are included in the definition of workers. This category of employment is not specified in the central act.
West Bengal	1980	2	Retrenchment, which means termination of employment of a worker, does include workers terminated on grounds of continued ill-health. In the central act termination for these workers is excluded from the definition of retrenchment.
West Bengal	1980	12	A report of the outcome of conciliation proceedings must be submitted within 60 days of the commencement of conciliation proceedings. In the central act the same report must be produced within 14 days.
West Bengal	1980	20	In the case of public utility service, the conciliation proceeding is deemed to start on the day, the notice of a strike or lockout is received by a conciliation officer. In the case of other industries the conciliation proceeding is deemed to start on the date conciliation officer asked the parties to join a conference. Under the central act the conciliation proceeding in all industries have to start on the day that notice of a strike or lockout is received by a conciliation officer.
West Bengal	1980	11A-11D	A Labour Court or Tribunal is granted the power of a Civil Court to execute its award or any settlement as a decree of a Civil Court.
West Bengal	1980	17A	(i) Provides greater detail on the procedures for making awards from Labour Courts or Tribunals including necessary signatories and the timing of awards. (ii) The state government also retains the right to reject, modify any award made by a Labour Court or Tribunal.
West Bengal	1980	25C	The limit of 45 days for workers receiving 50 percent of their wages upon being laid off (if they worked more than a year) is removed.
West Bengal	1980	25E	Where a lay-off extends for more than seven days then the worker only has to present himself once a week at the plant in order to be entitled to compensation as opposed to daily as stipulated under the central act.
West Bengal	1980	25FFF	Prior payment of compensation to the worker is a condition precedent to the closure of an undertaking. Under the central act payment of compensation does not need to be made prior to closure.

State	Year	Section	Description
West Bengal	1980	25H	Where a closed firm is re-opened, workers who were on the roll of a given unit should be given the opportunity to offer themselves for employment in preference to others. Under the central act retrenched workers are given preference but there is less specify as regards rehiring workers from the same unit.
West Bengal	1980	25HH	Where a worker is reinstated by an award of a Labour Court or Tribunal, his wages will be paid from the date specified in that award whether or not he has been reinstated by the employer.
West Bengal	1980	25K	The rules for lay-off, retrenchment and closure may according to the discretion of the state government be applied to industrial establishments, which employ more than 50 workers. Under the central act these rules only apply to establishments, which employ more than 300 workers.
West Bengal	1980	25M	The period after which, if the appropriate government has not responded, the employer can commence layoffs (i.e. treat his application as granted) is extended from 2 to 3 months.
West Bengal	1980	33C	In place of the Collector, the Chief Judicial Magistrate or the Chief Metropolitan Magistrate are given the power to recover from an employer money owing to a worker as the result of settlement of an industrial dispute.
West Bengal	1980	9A	If an employer wants to change in the conditions of service applicable to any worker he has to give him a notice of 42 days (instead of 21)
West Bengal	1981	19	Refers to a section of the central act which was added as the result of an amendment introduced by this state.
West Bengal	1986	15	Provides greater detail on the duties of Labour Courts, Tribunals and National Tribunals with respect to procedure, hearings, commencement of award and the amount of interim relief admissible to workers that have been discharged, dismissed or retrenched.
West Bengal	1989	7	Reduction of the qualifications of judge to serve on a Labour Court. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
West Bengal	1989	10	In the case of an industrial dispute involving an individual worker if no settlement is arrived at within 60 days the party raising the dispute can apply directly to a conciliation officer. Within 60 days from the conciliation officer's certificate they can apply to refer the dispute to labour court. No such right is specified in the central act

State	Year	Section	Description
West Bengal	1989	38	Change needed as the result of another amendment being made by this state.
West Bengal	1989	25O	In their application to close down an undertaking the employers have to demonstrate their ability to discharge their liability for payment of compensation to workers.
West Bengal	1989	25P	In the central act government can order undertakings closed down before the commencement of the Industrial Dispute (Amendment) Act 1976 to reopen. This amendment stipulates that such decisions can be referred to an Industrial Tribunal for adjudication.
West Bengal	1989	2A	Refusal of employment is added as grounds for an individual worker to enter into an industrial dispute with his/her employer. Only discharge, dismissal, retrenchment or other termination of employment, are mentioned as grounds in the central act.
West Bengal	1990	7A	Reduction of the qualifications of presiding officer to serve on an Industrial Tribunal. Involves both a reduction in the years of experience and judges from lower levels of the judicial system being allowed to serve.
West Bengal	2007	29	Increases the penalty for breach of settlement or award.
West Bengal	2007	33C	Outlines procedure to be followed for recovery of money owed to workers by employers when the appropriate Government in question is the State Government.

Appendix II: Bringing the Model to the Data

\overline{MRPL}_s (the weighted average of the value of the marginal product of labour in a sector) is defined as

$$\overline{MRPL}_s = \frac{w}{\sum_{i=1}^{M_s} (1 - \tau_{Y_{si}}) \frac{P_{si} Y_{si}}{P_s Y_s}}$$

For the sake of computation, the following is used

$$\sum_{i=1}^{M_s} \frac{1}{wt} (1 - \alpha_s) \frac{\sigma - 1}{\sigma} \frac{P_{si} Y_{si}}{L_{si}} = \frac{w}{\sum_{i=1}^{M_s} (1 - \tau_{Y_{si}}) \frac{P_{si} Y_{si}}{P_s Y_s}}$$

where $wt = \frac{P_{si} Y_{si}}{P_s Y_s}$

Similarly \overline{MRPK}_s (the weighted average of the value of the marginal product of capital in a sector) is defined as:

$$\overline{MRPK}_s = \frac{R}{\sum_{i=1}^{M_s} \frac{1 - \tau_{Y_{si}}}{1 + \tau_{K_{si}}} \frac{P_{si} Y_{si}}{P_s Y_s}}$$

For the sake of computation, the following is used

$$\sum_{i=1}^{M_s} \frac{1}{wt} \alpha_s \frac{\sigma - 1}{\sigma} \frac{P_{si} Y_{si}}{K_{si}} = \frac{R}{\sum_{i=1}^{M_s} \frac{1 - \tau_{Y_{si}}}{1 + \tau_{K_{si}}} \frac{P_{si} Y_{si}}{P_s Y_s}}$$

where $wt = \frac{P_{si} Y_{si}}{P_s Y_s}$

\overline{TFPR}_s is a geometric average of the average marginal revenue products of capital and labour in a sector.

$$\overline{TFPR}_s = \frac{\sigma}{\sigma - 1} \left(\frac{\overline{MRPK}_s}{\alpha_s} \right)^{\alpha_s} \left(\frac{\overline{MRPL}_s}{1 - \alpha_s} \right)^{1 - \alpha_s}$$

Algebra leads to the following expression of GDP:

$$Y = \prod_{s=1}^S (TFP_s K_s^{\alpha_s} L_s^{1 - \alpha_s})^{\theta_s}$$

where,

$$TFP_s = \left(\sum_{i=1}^{M_s} \left(A_{si} \frac{\overline{TFPR}_s}{TFPR_{si}} \right)^{\sigma-1} \right)^{\frac{1}{\sigma-1}}$$

The challenge lies in the computation of A_{si} which is not observed in the data. It is backed out using the following:

$A_{si} = \kappa_s \frac{(P_{si} Y_{si})^{\frac{\sigma}{\sigma-1}}}{K_{si}^{\alpha_s} L_{si}^{1-\alpha_s}}$, where $\kappa_s = (P_s Y_s)^{\frac{-1}{\sigma-1}} / P_s$ is a sector specific constant. κ_s is computed by deflating nominal industry revenue with the Wholesale Price Index for the corresponding 2 digit industrial classification of the National Industrial Classification.