Labor Regulation and the Impact on Firm Behavior in India

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Abstract

This paper looks at the impact of Chapter 5B of the Industrial Disputes Act (IDA) in India on firm-level efficiency, capital productivity, and labor productivity using data from the Annual Survey of Industries. Chapter 5B of the IDA requires all firms with more than 100 workers to take government permission to make layoffs, retrenchments, and closures. In this paper, I employ a Regression Discontinuity (RD) to estimate localized treatment effects of the 100 worker threshold. I also employ an event study analysis to understand how firms react to different parts of Chapter 5B of the IDA. The RD estimates a 7.1% localized jump in the ratio of value-added to output for firms above the 100 worker threshold. Meanwhile, the event study analysis suggests that large firms have a higher ratio of value-added to output compared to small firms by 2.5% when the hundred worker threshold is in place. The RD found no significant impact of the threshold law on the average product of labor while the event study saw that the hundred worker threshold deferentially boosts large firms' labor productivity by 42%. Additionally, both our RD and event study finds negative impacts of the threshold law on the average product of capital. This behavior suggests that these laws are causing some form of interference in the market and causing firms to behave differently.

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1 Introduction

Since its independence in 1947, India has passed labor laws that address core standards of worker health, safety and protection from injustices specified by the International Labor Organization (Bajaj et al., 2018). There are 44 central labour laws governing 29 states and 7 union territories in India. The single labor regulation which seems to have received the greatest attention from economists and the press is Chapter 5B of the Industrial Disputes Act (IDA).

Chapter 5B of the IDA states that any industrial establishment which has more than a 100 workers needs government permission for layoffs, retrenchments and closures. A large body of literature has probed into the impact of the IDA on economic performance. Besley and Burgess (2004), henceforth referred to as BB, argue that Indian states which amended the IDA in a pro-worker direction experienced low output, employment, investment and productivity in the registered formal sector. I will refer to this as the BB hypothesis. Fallon and Lucas (1993) estimate dynamic labor demand functions for Indian manufacturing industries and argue that there is a large drop in labor demand in industries where coverage of legislation (IDA) is more extensive. Bhattacharjea (2006), however, discredits both of the above approaches and argues that the existing evidence on the detrimental impact of labor regulations is flawed. Bandhan (2014) further argues that the IDA is not likely to constrain any but the largest firms because of weak labor law enforcement and disregard of law in India.

On one hand, proponents of the BB hypothesis argue that permission for layoffs and retrenchments is difficult to obtain which causes employers to restrict their hiring practices (Hseigh and Klenow, 2009; Kochhar et al. 2006). Thus, job security laws like Chapter 5B of the IDA only benefit a small minority of workers while harming the mass majority. Further, they argue that such restrictions on retrenchments adversely affect workplace discipline, and the

threshold of 100 workers has discouraged factories from expanding to economic scales of production, thereby harming productivity. On the other hand, Bhattacharjea (2006) criticizes the evidence that backs these arguments based on their disregard of the Indian context and the narrative behind the IDA.

Strands of literature that rely on the Fallon and Lucas (1993) methodology illustrate mixed results on the impact of IDA on economic performance. Bhattacharjea (2006), however, points out flaws in both the BB methodology and the Fallon and Lucas methodology. This paper attempts to account for Bhattacharjea's criticisms in its methodology and empirical design.

The innovation of this paper is in its use of fuzzy RDD on the 100-worker threshold which has not yet been seen in the literature possibly because of the firm's ability to self select labor outcomes above and below the threshold. Additionally, this paper conducts an event study analysis based on high court rulings in different states regarding Chapter 5B of the IDA. Bhattacharjea (2009) suggested such an empirical test; however, he never showed the results. This paper weaves a narrative about labor regulation and it's impact on firm behavior using the RDD and event study analysis.

The rest of the paper is organized as follows . Section II summarizes the institutional background regarding Chapter VB of the IDA. Section III summarizes the arguments of the key players in the current literature pertaining to Chapter VB of the IDA. Section IV outlines the main idea and hypothesis of this paper. Section V describes the data present in the Annual Survey of Industries and explains the empirical strategy for using the Regression Discontinuity Design and Event Study.. Section VI contains the results and discussion. Section VII concludes.

2 Institutional Background

In this section, I provide an institutional background on Chapter 5B of the Industrial Disputes Act (IDA) which has been adapted from Bhattacharjea's 2009 paper titled "The Effects of Employment Protection Legislation on Indian Manufacturing."

Chapter 5B of the Industrial Disputes Act is an amendment to the IDA introduced in 1976 that requires government permission for layoff and retrenchment of workers and closures of industrial establishments. Specifically, a layoff is "the failure, refusal or inability of an employer on account of shortage of coal, power, or raw materials or the accumulation of stocks or the breakdown of machinery or natural calamity or any other connected reason to give employment to a workman whose name is borne on the muster rolls of his establishment" (IDA Section 2(kkk)). A retrenchment is the "permanent termination of a worker's service, other than because of retirement, ending of a contractual period, or continued ill-health" (IDA, section 2(o)).

Table 1 below illustrates the different sections of the IDA which covers the firm-size threshold law, lay-off law, retrenchments law and closures law. Section 25(K) which governs the firm size threshold sets the thresholds at which Sections 25(M), 25(N) and 25(O) come into play.

Table 1: Section of IDA and Corresponding Jurisdiction

Section of IDA	**Jurisdiction**
Section 25(K)	Firm-Size Threshold
Section 25(M)	Layoffs
Section 25(N)	Retrenchments
Section 25(O)	Closures

Even though Chapter 5B was added to the IDA in all states by the supreme court in 1976, there has been considerable variation at the state level regard-

ing its implementation. Separate state high courts passed laws which changed Sections 25(K), (M), (N) and (O) of the IDA. Figure 1 below has been adapted from Bhattacharjea (2009). In Bhattacharjea's table, the color yellow illustrates when section 25(O) or Section 25(N) were inoperative. Meanwhile, the different shades of blue illustrate the different thresholds at which Section 25 was operative in different states at different times.

As we can see in Figure 1, Chapter 5B of the IDA (section 25(K)) was amended in 1976 to apply to industrial establishments employing an average of 300 or more workers per working day, excluding establishments "of a seasonal character or in which work is performed only intermittently." In 1982, an amendment was announced to reduce this threshold to 100 workers. In 1984, this amendment came into effect on a national level.

Bhattacharjea (2009) explains that sections of Chapter 5B were "inoperative for various periods in different states after being struck down by the Indian Supreme Court and some High Courts, and were restored–again at different times in different states–by legislative amendments and reversal of the High Court decisions on appeal." For example, Section 25(O) of Chapter 5B, the section which requires official permission for closures, was deemed unconstitutional by the Supreme Court in 1976 in the Excel Wear judgement. The 1982 amendment reduced the threshold to 100, and also incorporated several procedural changes in 25(O) so as to satisfy the Supreme Court. Thus, any studies that use the 1976 and 1982/84 amendment as a structural break would be invalid due to the mixed impacts on labor market flexibility (Bhattacharjea, 2009).

Further, some states implemented the 100 worker-threshold before 1984. Specifically, Maharashtra implemented the threshold in 1982 and Rajasthan implemented it in 1983. West Bengal implemented a threshold at the 50-worker mark in 1980. Figure 1 above showcases these state-level variations in detail.

FY Commencing →	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	<-->	2001	2002	2003
STATE																			
Karnataka			25(O)					25(O)		25(O)			25(O)						
	300							300	100				**						100
Maharashtra			25(O)			25(O)													
	300					300	100												100
Orissa			25(O)				25(O)												
	300						300	100											100
Rajasthan			25(O)					*25(O)											
	300							300	100										100
Tamil Nadu			25(O)		25(N)		25(N)/(O)												
	300							300	100										100
Uttar Pradesh			25(O)					25(O)							25(O)		25(O)		
	300																		300
West Bengal			25(O)					25(O)					25(O)				25(O)		
	300			300	50														50
OTHERS			25(O)					25(O)											
	300							300	100										100
	* 25(N) was also invalid for a few months in 1983-84																		
	** Amendment allowed 25(O) to be extended to establishments with seasonal or intermittent employment																		

NOTES: For explanation of the methodology and colour-coding, see the Appendix. The decade of the 1990s, when there were no changes affecting chapter V-B, has been elided in order to fit the chart onto a single page.

Figure 1: Color-Coded Map adapted from Bhattacharjea 2009 which shows state-time variation in the IDA

3 Literature Review

The IDA was passed at the central level, but there have been 113 state-level amendments to the act since it was passed in 1947 introducing state-level variation. Besley and Burgess (2004) developed an index (BB index) where they coded each amendment as either neutral (0), pro-worker (1) or pro-employer (-1). Besley and Burgess (2004) regressed their outcome variable in state s at time t on state fixed effects, year-fixed effects, exogenous controls such as political party controls and their key independent variable which was the BB index value of a certain state in time t - 1. They found that higher labor regulation was associated with lower manufacturing output, lower employment and higher urban poverty. Besley and Burgess (2004) point to two mechanisms for this phenomenon. A price mechanism which implies that the cost of employing laborers increases in the formal sector due to the pro-worker amendments. They also point to an expropriation effect that an increase in bargaining power holds up investment. Initially, Besley and Burgess (2004) received widespread media attention and spurred a movement against labor regulation. This paper was highly critiqued by Bhattacharjea. Bhattacharjea (2006) highlights the most famous critiques of the BB index: the sparseness and insignificance of underlying amendments which either pertain to obscure procedural matters or are infrequent, and the fact that the BB index focuses on only one labor law. I will focus on the first critique.

Bhattacharjea (2006) illustrated that BB misinterpreted state-level IDA amendments and "assigned identical scores to minor procedural amendments and major changes in job security rules" while ignoring many state laws which overlap with the IDA. For example, BB assigned Gujarat as a pro-worker state because of a "solitary amendment which it passed in 1973, allowing for a penalty of fifty rupees a day on employers for not nominating representatives to firm-level joint

management council." Other than this, Gujarat passed no other amendments to the IDA.

Additionally, BB coded states which changed the scope of Section 25-K of Chapter 5B of the IDA from 300 to 100 workers before 1981 with a '+1', effectively pushing them in the pro-worker direction. BB completely ignored the fact that there was a central amendment in 1982 which changed the scope of Chapter 5B on the national level. Bhattacharjea (2006) also critiqued literature that utilized and extended the BB index past 1990. Specifically, he noted that there has been no change in the BB index in 1990. Rather, there was a substantial change in the industrial relations scenario during 1990 which was not captured by the BB index at all. Thus, he convincingly discredits the methodology used by Besley and Burgess.

As a further critique, Besley and Burgess focused on the amendments to the IDA on paper, looking at de jure labor regulation. In the context of developing economics, there is a stark difference between de jure law and de facto outcomes (Chatterjee and Kanbur 2015). Discrepancies in de jure labor regulation and de facto labor outcomes point to a serious omitted variable bias in Besley and Burgess' study. Thus, I investigate the de facto impact of the IDA on firm-level behavior in the manufacturing sector using a regression discontinuity analysis.

Fallon and Lucas (1993) introduced a methodology which involved the estimation of different dynamic labour demand functions which attempt to "capture the cost of hiring, firing and training workers" (Bhattacharjea, 2009). Employment is regressed on its own lagged value and the current and lagged values of labor demand variables like output and wages. Fallon and Lucas (1993) use the 1976 central amendments as a structural break and look at the differential impact of this amendment on employment by adding a dummy which is unity after 1976 and 0 before. Fallon and Lucas found that the amendment did cause

a decline in employment in most industries and the effect was stronger for plants employing more than 300 workers, the threshold at which the IDA became applicable in 1976. Further literature and research by Bhaltora (1998) and Dutta Roy (2004) carry forward this methodology to observe the impact of not just the 1976 amendment but also the 1982/84 amendment which I am looking at. This methodology has yielded mixed results.

Bhattacharjea (2009), however, points out that the 1976 and 1982 amendments cannot be used as structural breaks on the national level. As highlighted in the institutional background section of this paper, sections of Chapter 5B were inoperative in many states after the Excel Wear judgement in 1976. Table 1 in the appendix specifies the variability of this law according to different states. Since the Fallon and Lucas methodology relies completely on using the amendment as a structural break, their internal validity falls apart.

There is clearly a gap in the literature. I attempt to fill that gap by testing the BB hypothesis using a Regression Discontinuity around the 100 worker threshold, an empirical methodology not used in the IDA literature. Additionally, I run an event-study analysis exploiting the state-time variation in Sections 25(K), 25(M), 25(M) and 25(O) as illustrated in Figure 1, Bhattacharjea's map.

4 Main Idea and Hypothesis

To understand how a firm behaves under different regulatory environments, I conduct two empirical strategies: a Regression Discontinuity (RD) and an Event Study analysis. First, I observe the impact of Chapter 5B on firm-size distribution in India. Second, I look at the intent-to-treat impact of Chapter 5B of the Industrial Disputes Act on capital productivity, labor productivity and firm-level efficiency in the manufacturing sector. The intent-to-treat impact measures the impact of eligibility for the IDA on the dependent variable of

interest.

Third, I conduct my event study analysis. Based on his critiques of the empirical literature on the IDA, Bhattacharjea (2009) proposes an empirical methodology to test the impact of changes in IDA on the number of firms and firm-level efficiency. Gleaning insights from Figure 1, Bhattacharjea maps out events where one or more states diverge from the rest of the country and tighten or loosen labor regulation. For example, in 1985 Karnataka high court struck down Section 25(O), the law regarding closures. This means that Karnataka firms of any size would no longer require government permission in order to shut down operations.

Since different sections of the IDA are on or off at different points in time for different states, I run various empirical specifications to understand how firms are behaving in response to the different Sections of the Industrial Disputes Act. I believe such an analysis will provide a full narrative as to how firms react to the Industrial Disputes Act.

There are two possible hypotheses. The BB hypothesis implies that the price mechanism and expropriation effect will lead to lower firm-level efficiency for firms above the 100 worker threshold. Even though we are looking at the impact of eligibility of the law, the price of employing laborers above the 100-worker threshold should still increase because firms would have to deal with rent-seeking inspectors to avoid the law. According to the BB hypothesis, the existence of this law alone should increase the bargaining power of the workers as workers can report to the labor inspectorate when the law is not being followed. Therefore, the expropriation effect is supposedly significant. Thus, the BB hypothesis would suggest that firms above the 100-worker threshold should observe lower firm efficiency and lower labor productivity than firms below the 100-worker threshold. The BB hypothesis would also suggest that there will be changes in

the composition of the workforce as firms will try to bunch under 100-workers. Once the firms have adjusted to the law, BB hypothesis would suggest that we will see lower firm efficiency and labor productivity under the 100-worker threshold because firms are forcibly smaller.

The anti-thesis is that the labor system in India is broken and weakly enforced. Due to the rise of the vilified 'Inspector Raj' and disregard for common law in India, it can be argued that workers do not have an expropriation effect or any bargaining power because of the ease of collusion between businesses and inspectors. Additionally, it is argued that India does not have the institutional capacity to enforce such a law. Under this hypothesis, we will not notice any significant effects on labor productivity or capital productivity. However, we might still see some impacts on firm-level efficiency due to the cost related to rent-seeking practices.

If we do see low labor productivity as under the BB hypothesis, we might see higher capital productivity in firms. As labor and capital are considered substitutes in economics theory, we would expect there to be higher capital productivity if firms are restricted from freely laying off workers. This is because we will have more workers with respect to the same amount of capital. This might increase the average product of capital. On the other hand, it is also possible that average product of capital falls if firms have an excess amount workers working the same machines. There is also the possibility of seeing no impact on average product of capital if firms are able to easily avoid this regulation. However, there would still be a cost associated with avoiding the regulation.

5 Data and Empirical Strategy

5.1 Data

I rely on the Annual Survey of Industries (ASI) in order to analyze the impact of Chapter 5B of the IDA on firm-level behavior. The ASI is the principal source of industrial statistics in India and provides statistical information to assess growth, composition and structure in the organized manufacturing sector. I have access to repeated firm-level cross-sectional data for each year from 1980 - 2000 except for the year 1995.

Within this data set, my units of observation are firms in the manufacturing sector sampled across 28 states and union territories. The states and union territories not represented in the data set are Lakshadeep, Mizoram and Sikkim. There are a total of 1,106,877 observations in my repeated cross sectional data. Summary statistics are provided in the appendix.

5.2 Outcome Variables

Our three dependent variables of interest at the firm level are: capital productivity, labor efficiency and firm-level efficiency. I proxy for capital productivity using the average product of capital i.e. $\frac{Y}{K}$. I proxy for labor efficiency using the average product of labor i.e. $\frac{Y}{L}$.I proxy for firm-level efficiency by using the ratio of value added to gross value of output.

The average product of capital measures the output per unit of capital. It illustrates how efficiently capital is being used in the firm. The average product of labor measures the output per unit of labor which illustrates how efficiently labor is being used in the firm. The value added over output measures the proportion of contribution the firm has made i.e. the value that the firm has added as a proportion of its total output.

A fourth dependent variable of interest at the state level is the number of firms in a state at time period t. This will help us capture entry and exit of firms in response to changes in labor law.

5.3 Regression Discontinuity

In order to determine the causal impact of the law on firms that lie above the threshold, I will run a "localized" linear regression discontinuity specification with varying bandwidths to ensure robustness. Before running my analysis, I only look at firms in states where the 100-worker threshold is in place for all three Sections 25(M), 25(N) and 25(O). I use the repeated cross sectional data from every year to ensure statistical power for my analysis.

My RDD specification is as follows:

$$Y_{it} = \alpha + \beta_1 D_{it} + \beta_2 (L_{it} - 100) + \beta_3 (L_{it} - 100) * D_{it} + \epsilon_{it} \qquad (1)$$

Y_{it} refers to my dependent variable of interest for firm i at time t. D_{it} is our variable of interest which refers to a dummy for whether firm i has more than or equal to a hundred workers at time t. L_{it} is the running variable which represents the number of non-managerial workers in firm i at time t. Third, we have an interaction term between $(L_{it} - 100)$ and D_{it}. Through the model, I am using $(L_{it} - 100)$ as it moves our threshold to 0 instead of 100 which helps with interpretability. In this model the coefficient β_1 will measure the "jump" in Y_{it} at the threshold of 100 workers. The slope of the line to the left of the hundred worker cutoff will be β_2 and the slope to the right will be $\beta_2 + \beta_3$.

This is a fuzzy regression discontinuity as we cannot guarantee perfect compliance since we cannot ensure that all firms with more than 100 workers will be treated. Thus, we are determining the intent to treat effects which is the impact of eligibility. In a regression discontinuity, the treatment assignment should be

"as good as random" and ideally firms should randomly fall above and below the 100-worker threshold. However, we are worried about self-selection of firms in this case. It would be expected behavior for firms to bunch around 99 in order to avoid labor regulations at the 100-worker threshold. This form of self-selection will invalidate the results of my Regression Discontinuity. I discuss this issue in depth in the RD section and illustrate why my results hold.

5.4 Event Study

My event study analysis is loosely based on the proposed empirical test provided by Bhattacharjea (2009) in his paper titled "The Effects of Employment Protection Legislation on Indian Manufacturing." I exploit the state and time variation of Sections 25(M), 25(N) and 25(O) to find out how tightening labor regulation with respect to Chapter 5B of the IDA impacts our dependent variables of interest.

As we can see in Figure 1, the figure provided in the institutional background section, there are many instances where Sections 25(O) and Sections 25(N) are inoperative in one or more states. There are also instances where the threshold set by Section 25(K) varies by state and time. Thus, my first empirical specification below attempts to look at the impact of these laws on the number of firms in state s at time t to capture exit and subdivision.

$$y_{st} = \alpha + \beta_1 r_{st} + \beta_2 c_{st} + \beta_3 h_{st} + \beta_4 f_{st} + \gamma_s + \gamma_t + \epsilon_{it} \qquad (2)$$

Y_{st} refers to the number of firms in state s at time t. r_{st} is a binary variable that encodes whether the retrenchments law is active in state s at time t or now. c_st is a binary variable that encodes whether the closures law is active in state s at time t. h_{st} is a binary variable that encodes whether the firm-size threshold

for IDA applicability is set at 100 or not for state s in time t. f_{st} is a binary variable that encodes whether the firm size threshold for IDA applicability is set at 50 or not for state s in time t. Note that if both of these binary variables are off, the firm size threshold is set at 500 as can be seen through Figure 1. Additionally, note that we do not have a variable turning on or off for the law regarding lay-offs. That is because Figure 1 shows no state-time variation for this law. All the states from 1980 - 2003 had the layoff law active.

Here β_1 signifies the change in the number of firms caused by Section 25(N), the law regarding retrenchments. β_2 signifies the change in number of firms caused by Section 25(O), the law regarding closures. β_3 and β_4 signify the change in number of firms caused by Section 25(K), the law regarding firm-size threshold. I have also added state and time fixed effects.

Additionally, I run the following specification

$$y_{it} = \alpha + \beta_1 r_{st} + \beta_2 c_{st} + \beta_3 h_{st} + \beta_4 f_{st} + \beta_5 l_{it} + \beta_6 l_{it} r_{st} + \beta_7 l_{it} c_{st} + \beta_8 l_{it} h_{st} + \beta_9 l_{it} f_{st} + \beta_{10} L_{it} + \gamma_s + \gamma_t + \epsilon_{it} \quad (3)$$

In equation 3, we have one new term l_{it} which is a dummy variable specifying with firm i is a large firm or not. We define a large firm to be any firm that has more than or equal to 50 workers. Additionally, we interact l_{it} with the rest of our dummy variables to find it out differential impact of the IDA on large firms vs. small firms. This is similar to a difference-in-difference analysis. I also control got the number of workers in the firm by using the L_{it} variable which represents the number of non-managerial workers in firm i at time t.

In equation 3, the interpretation of β_1, β_2 and β_3 and β_4 remain similar; however, now they represent the change in the dependent variable caused by the law being on or off only for small firms. β_5 represents the impact of being a large firm on the dependent variable. The coefficients of the interaction terms

represent the differential change in the dependent variable caused by the laws being on or off between small and large firms. Thus, they are the difference-in-difference coefficients.

6 Results and Discussion

6.1 Regression Discontinuity

First, we test for self-selection of firms around the 100-worker threshold using the density test (McCrary, 2008).

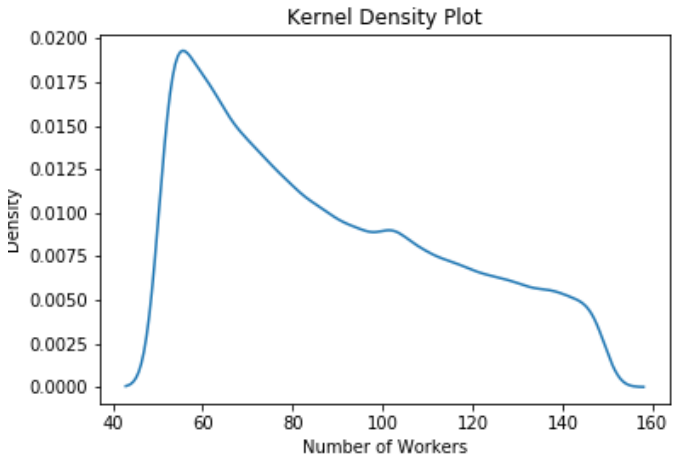

Figure 2: Kernel Density Plot

Figure 2 does show a bump at the 100-worker threshold. However, we counterintuitively see more firms above the 100-worker threshold rather than below. I am only looking at the subset of the data where the hundred worker threshold is at place. Given that firms above the hundred worker threshold have to face stricter labor regulation and there aren't any other laws in place at the 100-worker threshold, one would expect firms to bunch at the 99-worker mark.

In order to carefully look at this phenomenon, the histogram below shows the binned labor distribution.

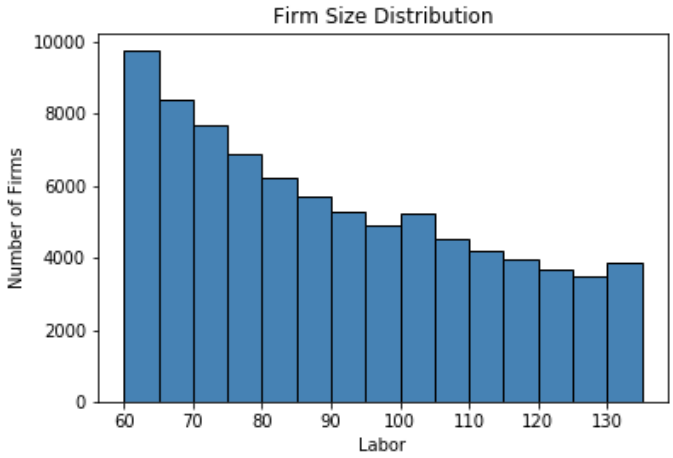

Figure 3: Binned Firm Size Distribution

One would assume that maybe this is a result of sampling error and that firms round the number of workers to a 100 for reporting. However, that is not the case because we would expect bunching at exactly the 100-worker threshold. The bar plot below proves this theory wrong as well.

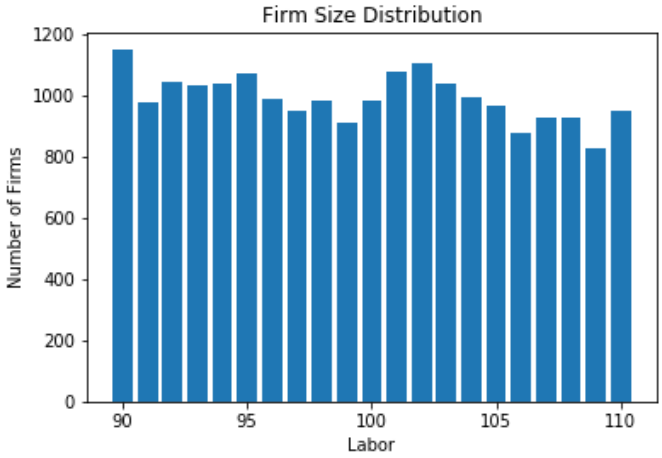

Figure 4: Firm Size Distribution Bar Plot

Since there is a bump at the 100-worker threshold, our RD might not be able to provide causal estimates. However, we don't really see self-selection of firms to avoid the threshold. The reason for a discontinuity is a mystery in this case. It might just be due to random chance. Since firms don't bunch below the threshold, however, it might be the case that my causal estimates in the RD are underestimates of the true impact of this threshold.

One possible explanation, which could be pursued in further literature and will be demonstrated in the event study analysis, is that the closures law at the 100-worker threshold prevents firms from exiting the market. Thus, we see more firms operating above the 100-worker threshold.

After this discussion regarding the assumptions behind RD, I will present the results for each of the three dependent variables I am looking at. For every RD, I apply the same specification mentioned in the empirical design with different bandwidths ranging from 10 to 45 at intervals of 5 each. The multiple bandwidths allow me to check for the robustness of my RD estimates.

6.1.1 Capital Efficiency

I proxy for capital efficiency using average product of capital. Table 2 below showcases the Regression Discontinuity specification The coefficient of interest are the coefficients on D. Across most of the bandwidths, we see no immediate "jumps" at the 100 worker threshold. Most of the coefficients are negative. However, we do see two statistically significant coefficients for bandwidths 40 and 45 respectively. We notice that being above the threshold decreases average product of capital by approximately 6.2%. However, this coefficient is not robust to the different bandwidth options. With a high enough bandwidth, it is likely that the linear specification will fit a curve that shows significant localized impacts. Thus, this table shows that there are no localized impacts of being above the 100 worker threshold on capital efficiency.

Additionally, we notice that the interaction term is negative and statistically significant for most of the bandwidths. Such negative coefficients for the interaction term signify a change in relationship between capital productivity and labor at the 100 worker threshold. As can be seen in Figure 5, we notice that right after the 100 worker threshold, the relationship between capital efficiency and labor changes. As the firms grow larger, we now see lower capital productivity. Overall, we see mostly statistically insignificant and economically insignificant localized impacts of the hundred worker threshold on capital efficiency around the 100 worker threshold. However, there is a clear statistically significant impact on the broader trend captured by the negative interaction term and showcased by Figure 5 and the coefficients on the interaction terms in Table 2.

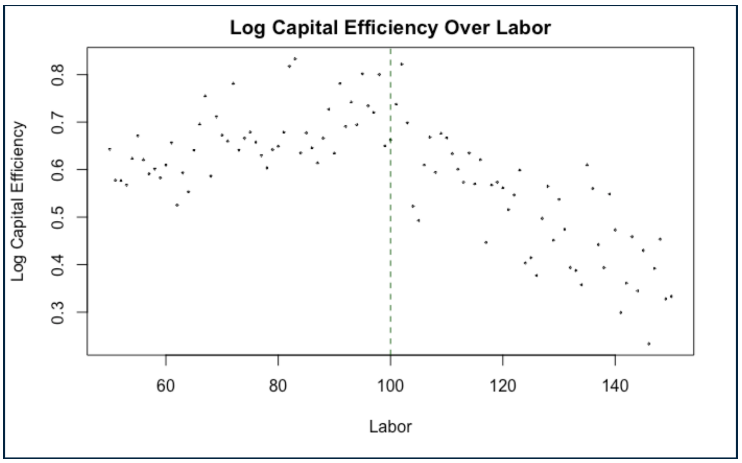

Figure 5: Log Capital Efficiency Over Labor

Table 2: Regression Discontinuity with Different Bandwidths

	Dependent variable:							
	log_capital_efficiency							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D	−0.010	−0.081	−0.032	−0.053	−0.033	−0.022	−0.061*	−0.062**
	(0.075)	(0.058)	(0.050)	(0.044)	(0.039)	(0.036)	(0.033)	(0.030)
Labor	−0.003	0.009*	0.001	0.004*	0.002	0.001	0.003***	0.003***
	(0.010)	(0.005)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
r_d	−0.010	−0.016**	−0.009**	−0.012***	−0.011***	−0.010***	−0.010***	−0.010***
	(0.014)	(0.007)	(0.004)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)
Constant	0.719***	0.770***	0.725***	0.746***	0.729***	0.719***	0.740***	0.743***
	(0.059)	(0.044)	(0.037)	(0.032)	(0.028)	(0.025)	(0.023)	(0.021)
Observations	16,215	24,715	33,201	42,266	51,690	61,630	72,472	84,038
R^2	0.0005	0.0004	0.001	0.001	0.001	0.001	0.001	0.001

Note: *p<0.1; **p<0.05; ***p<0.01

6.1.2 Labor Efficiency

We see consistently statistically insignificant results for the RD specification on Labor Efficiency. There are no localized impacts of being above the hundred worker threshold on labor efficiency. There are some statistically significant results on the interaction terms; however, these results are not robust to different bandwidth choices. The regression table and corresponding graph is attached to the appendix. Overall, there are negligible impacts of the hundred worker threshold on labor efficiency.

6.1.3 Ratio of Value Added to Output

In Table 3, we notice consistently statistically significant impacts of being above the hundred worker threshold on the ratio of value added to output. We notice that being above the threshold is associated with an approximately 7.1% increase in the ratio of value added to output. We also see some non-localized changes in trend as we see consistently negative albeit small coefficients on the interaction term. This trend is evidenced by the scatter plot below.

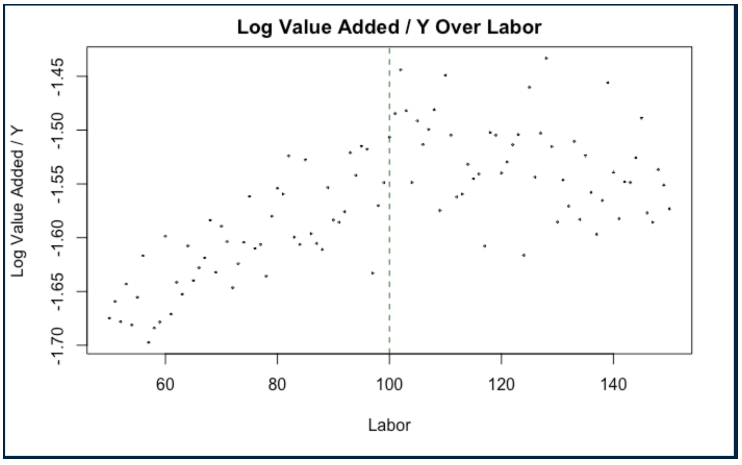

Figure 6: Log Value Added Over Labor

This is quite counter intuitive since one would expect being above the 100 worker threshold to cause firms to be less efficient. However, in this case we find that being above the threshold leads to firms having greater efficiency.

However, Figure 6 showcases that even though we might see an immediate localized jump in the log ratio of value added to output returns back to normal levels. There is quite a lot of noise in this data after the 100 worker threshold. The negative interaction coefficient suggest that the jump represented by the strong positive coefficient for D, the dummy for 100 worker threshold, is temporary and does not last.

Table 3: Regression Discontinuity with Different Bandwidths

	Dependent variable:							
	log_val_over_y							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D	0.081^{**}	0.060^{**}	0.073^{***}	0.061^{***}	0.044^{**}	0.050^{**}	0.042^{**}	0.039^{**}
	(0.038)	(0.031)	(0.026)	(0.023)	(0.021)	(0.019)	(0.018)	(0.017)
Labor	−0.001	0.004	0.001	0.002^{*}	0.002^{***}	0.002^{***}	0.002^{***}	0.003^{***}
	(0.005)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.0005)	(0.0004)
r_d	−0.005	-0.008^{**}	-0.004^{*}	-0.005^{***}	-0.003^{***}	-0.004^{***}	-0.004^{***}	-0.004^{***}
	(0.007)	(0.004)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Constant	-1.559^{***}	-1.540^{***}	-1.557^{***}	-1.549^{***}	-1.545^{***}	-1.547^{***}	-1.541^{***}	-1.539^{***}
	(0.030)	(0.023)	(0.019)	(0.017)	(0.015)	(0.013)	(0.012)	(0.011)
Observations	10,841	16,495	22,244	28,248	34,559	41,299	48,540	56,367
R^2	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003

Note: *p<0.1; **p<0.05; ***p<0.01

6.2 Event Study

For the event study specification, I will first look at first look at how the number of firms react to changes in retrenchment, closure and threshold laws. Then, I will analyze the impact of these labor regulations on labor efficiency, capital efficiency and firm-level efficiency.

6.2.1 Number of Firms

Table 4: Impact of Labor Regulation on Number of Firms

	Dependent variable:				
	log_num_firms				
	(1)	(2)	(3)	(4)	(5)
retrenchments	−0.067				−0.112
	(0.193)				(0.193)
closures		0.196**			0.092
		(0.095)			(0.112)
threshold_hundred			0.347***		0.287*
			(0.134)		(0.157)
threshold_fifty				4.644***	4.933***
				(0.114)	(0.159)
Constant	3.290***	3.217***	3.204***	3.225***	3.312***
	(0.217)	(0.110)	(0.110)	(0.111)	(0.216)
Observations	636	636	636	636	636
R^2	0.950	0.950	0.951	0.950	0.951

Note: *p<0.1; **p<0.05; ***p<0.01

The above regression in Table 4 exploit state and time variation with respect to retrenchments and closures law applicability in order to understand the impact of the Sections 25(N), Section 25(O) and Section 25(K) of the IDA. We see five statistically significant results. In regression 2, we notice that if the closures law is active in a certain state, there are more number of firms. This is to be expected as the closures law restricts firms above the threshold to shut down easily. This would lead to more number of less efficient firms continuing to operate. We also notice a positive coefficient for the hundred worker and fifty worker threshold. In specification 5, the significance of the closure law is absorbed by the thresholds. This means that the hundred worker and fifty worker threshold that restricts firms to close is the true determinant which restricts the exit of firms from industry. Note that the coefficients on the threshold laws are extremely significant and large.

This compliments our analysis at the begging of the Regression Discontinuity section. In Figure 3, we had noticed more firms bunching above the 100-worker threshold. This might be a result of firms not being allowed to close when they are sub-optimally operating.

6.2.2 Capital Efficiency

Table 5: Event Study for Capital Efficiency

	Dependent variable:					
	log_capital_efficiency					
	(1)	(2)	(3)	(4)	(5)	(6)
retrenchments	0.034* (0.021)				0.110*** (0.021)	−0.007 (0.024)
closures		−0.096*** (0.012)			0.014 (0.014)	−0.005 (0.016)
threshold_hundred			−0.258*** (0.016)		−0.285*** (0.019)	−0.184*** (0.021)
threshold_fifty				−0.189 (0.123)	−0.402*** (0.123)	−0.227* (0.123)
Lblue_round						0.00002*** (0.00001)
large						0.388*** (0.038)
large_retrenchments						0.383*** (0.040)
large_closures						0.044* (0.026)
large_threshold_hundred						−0.436*** (0.026)
large_threshold_fifty						−0.607*** (0.027)
Lblue	0.0001*** (0.00000)	0.0001*** (0.00000)	0.0001*** (0.00000)	0.0001*** (0.00000)	0.0001*** (0.00000)	
Constant	0.582*** (0.124)	0.620*** (0.123)	0.641*** (0.123)	0.613*** (0.123)	0.543*** (0.124)	0.430*** (0.124)
Observations	886,223	886,223	886,223	886,223	886,223	886,223
R^2	0.023	0.023	0.023	0.023	0.023	0.030

Note: *p<0.1; **p<0.05; ***p<0.01

I will focus on the 6th specification of this event study since that is the most interesting. We see that the retrenchments and closures law by themselves do not really impact average capital productivity of small firms. We notice that both the hundred worker and 50 worker threshold negatively impact capital productivity for small firms. We notice, however, that these two thresholds deferentially impact large firms even more. Specifically, large firms are 35% less efficient with respect to capital productivity than small firms because of the hundred worker threshold. Surprisingly large firms see an increase in capital productivity in the presence of the retrenchments and closures law. However, these numbers are smaller in magnitude compared to the negative impact of the size-based thresholds. Thus, we notice that the size based threshold deferentially impact large firms capital efficiency negative vs. small firms.

6.2.3 Labor Efficiency

Table 6: Event Study for Labor Efficiency

	Dependent variable:					
	log_labor_efficiency					
	(1)	(2)	(3)	(4)	(5)	(6)
retrenchments	−0.166*** (0.014)				−0.164*** (0.015)	−0.120*** (0.017)
closures		0.011 (0.009)			0.040*** (0.010)	0.086*** (0.012)
threshold_hundred			−0.038*** (0.011)		−0.039*** (0.014)	−0.169*** (0.015)
threshold_fifty				0.057 (0.087)	0.048 (0.087)	−0.049 (0.087)
Lblue_round						0.0001*** (0.00000)
large						0.417*** (0.026)
large_retrenchments						−0.235*** (0.028)
large_closures						−0.156*** (0.018)
large_threshold_hundred						0.425*** (0.018)
large_threshold_fifty						0.294*** (0.019)
Lblue	0.0002*** (0.00000)	0.0002*** (0.00000)	0.0002*** (0.00000)	0.0002*** (0.00000)	0.0002*** (0.00000)	
Constant	8.697*** (0.088)	8.546*** (0.087)	8.551*** (0.087)	8.547*** (0.087)	8.697*** (0.088)	8.593*** (0.088)
Observations	894,685	894,685	894,685	894,685	894,685	894,685
R^2	0.219	0.218	0.218	0.218	0.219	0.226

Note: *p<0.1; **p<0.05; ***p<0.01

Above, we notice that the retrenchments and closures law deferentially impact the larger firms much more. Larger firms tend to see approximately 23% less labor productivity as against small firms due to retrenchments law being active. Additionally, larger firms tend to see approximately 15% less labor productivity as against small firms due to the closures law being active. Surprisingly, however, the threshold interaction terms are very positive and statistically significant. Larger firms see an approximate boost of 42% in labor efficiency when the 100 worker threshold is in place as against smaller firms. This is counter intuitive because one would expect such restrictive regulation to force larger firms to keep workers despite bad performance of the firm.

6.2.4 Ratio of Value Added to Output

Table 7: Event Study for Ratio of Value Added to Output

	Dependent variable:					
	log_val_over_y					
	(1)	(2)	(3)	(4)	(5)	(6)
retrenchments	0.127^{***} (0.008)				0.141^{***} (0.008)	0.177^{***} (0.009)
closures		-0.001 (0.005)			0.016^{***} (0.006)	0.007 (0.007)
threshold_hundred			-0.031^{***} (0.006)		-0.066^{***} (0.008)	-0.074^{***} (0.008)
threshold_fifty				-0.509^{***} (0.055)	-0.549^{***} (0.055)	-0.544^{***} (0.055)
Lblue_round						0.00004^{***} (0.00000)
large						0.161^{***} (0.014)
large_retrenchments						-0.131^{***} (0.015)
large_closures						0.025^{**} (0.011)
large_threshold_hundred						0.034^{***} (0.011)
large_threshold_fifty						-0.001 (0.012)
Lblue	0.0001^{***} (0.00000)	0.0001^{***} (0.00000)	0.0001^{***} (0.00000)	0.0001^{***} (0.00000)	0.0001^{***} (0.00000)	
Constant	-1.309^{***} (0.055)	-1.194^{***} (0.055)	-1.191^{***} (0.055)	-1.194^{***} (0.055)	-1.318^{***} (0.055)	-1.367^{***} (0.055)
Observations	670,270	670,270	670,270	670,270	670,270	670,270
R^2	0.039	0.039	0.039	0.039	0.040	0.041

Note: *p<0.1; **p<0.05; ***p<0.01

Specification 6 of the above event study shows that large firms above the threshold are deferentially impacted by the hundred worker threshold and the closures law in a positive manner as against small firms. Specifically large firms tend to see a 3.4% increase in the ratio of value added to output as against small firms when the hundred worker threshold is in place. Additionally, large firms tens to see a 2.5% increase in the ratio of value added to output as against small firms when the closures law is active.

On the other hand, the retrenchments law impacts large firms negatively. We find that large firms tend to see a 13.1% decrease in the ratio of value added to output as against small firms when the retrenchments law is active.

7 Conclusion

The current economic literature on the impact of labor regulations on economic performance and firm productivity is divided. Besley and Burgess, and Fallon and Lucas developed sophisticated methods to test the impact of labor regulations on economic performance. However, both papers did not account for the Indian context and the complex narrative behind labor regulations and the IDA, with several flaws in the use of their methodologies.

Both of the Regression Discontinuity and Event Study analysis show a positive impact of the 100-worker threshold on larger firms ratio of value added to output. This disproves the BB theory and suggests that the expropriation and price mechanism are not in play. The Regression Discontinuity estimate a 7.1% localized jump in the ratio of value added to output for firms above the 100 worker threshold. Meanwhile, the event study analysis suggests that large firms have a higher ratio of value added to output compared to small firms by 2.5% when the hundred worker threshold is in place. These estimates suggest that somehow larger firms have higher firm-level efficiency when they are restricted

by labor law. Qualitative analysis and the author's own fieldwork experience (Bajaj et. al, 2018) suggests that India's labor laws are not strongly enforced. So, it is worth conducting in-depth difference-in-difference analysis to find out why large firms have higher value added to output ratio compared to smaller firms despite the higher labor regulation.

It is also interesting to note that the RD found no significant impact of the threshold law on average product of labor while the event study saw that the hundred worker threshold boosts large firms labor productivity by 42%. Additionally, both our RD and event study find negative impacts of the threshold law on average product of capital. This behavior suggests that these laws are in fact causing some form of interference in the market and causing firms to behave differently. However, it is not as clear cut as BB suggested. We have to look at the separate impacts of Sections 25(K), 25(M), 25(N) and 25(O) to realize how Chapter VB of the IDA impacts firm-level efficiency and capital and labor productivity.

This paper also finds that firms are counter-intuitively bunching above the 100 worker threshold rather than below. Our event study analysis suggests that this might be because of the closures law in place. The closures law would restrict firms with more than a 100 workers to shut down. Another alternate explanation is that firms do not pay heed to the IDA at all and have no need to bunch at 99 worker threshold to avoid the law since it is not enforced strongly. It would be interesting to see further research done in this area.

Indian manufacturing firms do react to Chapter 5B of the Industrial Disputes Act. The labor regulation environment in India, however, is much more complex than is illustrated in Besley and Burgess' paper. This topic requires thorough on-ground research and sophisticated empirical methods to understand how firms react to labor laws.

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9 Appendix

Table 8: Summary Statistics

Statistic	N	Mean	St. Dev.	Min	Max
L	1,060,949	125.450	686.720	0.000	177,368.000
K	1,061,224	30,863,777.000	676,749,497.000	−6,914,104,300.000	233,353,360,000.000
Lblue	1,055,654	97.564	526.239	0.000	58,516.000
Y	1,011,583	16,003,590.000	279,469,668.000	−43,524,387,000.000	80,504,455,000.000
inputs	1,056,031	57,547,349.000	944,276,045.000	−22,000,664.000	463,217,900,000.000
output	1,013,077	75,206,129.000	1,144,421,645.000	−5,937,502,000.000	514,980,450,000.000
valad	783,600	5,833,445.000	77,729,882.000	−6,985,232,400.000	13,750,913,000.000
Lblue_round	1,055,654	97.557	526.240	0.000	58,516.000
closures	1,106,877	0.738	0.440	0	1
retrenchments	1,106,877	0.976	0.154	0	1
threshold_hundred	1,106,877	0.700	0.458	0	1
threshold_fifty	1,106,877	0.055	0.229	0	1
val_over_y	727,080	−0.899	493.268	−139,323.700	309,720.000
log_val_over_y	670,274	−1.662	0.993	−16.118	12.643

Table 9: Regression Discontinuity with Different Bandwidths

	Dependent variable:							
	log_labor_efficiency							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
D	0.038	0.047	0.046	0.044	0.017	0.012	0.018	0.014
	(0.048)	(0.038)	(0.033)	(0.029)	(0.027)	(0.025)	(0.023)	(0.021)
Labor	−0.002	−0.003	−0.002	0.0002	0.003***	0.004***	0.004***	0.004***
	(0.007)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
r_d	0.012	0.011**	0.008***	0.005**	0.003	0.001	−0.0002	−0.0002
	(0.009)	(0.005)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)
Constant	10.493***	10.489***	10.496***	10.510***	10.536***	10.547***	10.550***	10.552***
	(0.038)	(0.029)	(0.024)	(0.021)	(0.019)	(0.017)	(0.016)	(0.015)
Observations	16,519	25,187	33,848	43,071	52,684	62,818	73,873	85,657
R^2	0.001	0.001	0.001	0.001	0.002	0.003	0.004	0.005

Note: *p<0.1; **p<0.05; ***p<0.01

Figure 7: Log Labor Efficiency Over Labor