Firing Costs and Flexibility: Evidence from Firms' Employment Responses to Shocks in India*

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Abstract

Canonical models of labor demand predict that firms' employment responses to demand fluctuations should be declining in the extent of job security provision. We provide the first direct empirical test of this prediction using data on industrial firms in India. We exploit the fact that fluctuation in rainfall within districts, through its effects on agricultural productivity, creates exogenous variation in the demand for local industry. Using a measure of labor regulation strictness, we compare factories' input and output responses to shocks in pro-worker and pro-employer districts. Our results confirm the theory's predictions: industrial employment adjustment to shocks is larger in areas where labor regulations are less restrictive. In areas with stricter regulations, we find that factories are able to achieve the same adjustment in output by adjusting capital and intermediate inputs more intensively than labor, with no additional loss in profit. Our results suggest that labor laws in India are effective at buffering the impact of shocks on industrial laborers, and that firms are able to adjust along non-labor margins so as to compensate for their lack of employment flexibility.

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1 Introduction

An old insight from labor economics is that firing costs reduce the extent of employment adjustment to economic shocks: during a downturn, firing costs reduce the number of layoffs, while during an upturn, hiring is curbed because of the possibility of having to lay off workers in the future. In terms of the level of employment induced by firing costs, therefore, economic theory yields ambiguous predictions - the average level of employment may be greater or lower in the presence of firing costs.[1] Further, Basu, Fields and Gupta (2009) argue that firing restrictions can either depress or raise wages, depending on parametric conditions. The fact that costs of termination provide job security is therefore to be weighed against the reduction in employment opportunities thereby induced. This reduction in employment flexibility also has implications for the profits of firms, and in turn, entry into and growth of the industrial sector. Because labor regulations usually apply only to formal sector firms, this tends to create a bias towards informality, which in turn may be worse for labor.

In this paper we provide the first (to our knowledge) direct test of the prediction that the magnitude of employment responses to shocks should vary negatively with the degree of employment protection. Obtaining a credible test of this prediction is difficult for a number of reasons. In the first place, we require a setting where there is variation across space and/or time in the extent of employment protection with the added requirement that this policy variation does not simply reflect variation in unobserved determinants of employment. Arguably, the latter condition does not obtain in cross-country or even within-country time-series variation in employment protection policies (see Bertola (2009)).

Of equal concern is the issue of measuring fluctuations. Because the source of fluctuations is typically not observable or quantifiable, previous empirical studies have inferred the magnitude of fluctuations from changes in observable quantities such as aggregate output or sales (see for exam-

[1] In fact, Bertola (1990) finds no statistically significant correlation between unemployment and the OECD's index of employment protection.

ple, Abraham and Houseman 1993, et al). This approach is problematic for at least two reasons. Firstly, fluctuations in aggregate output reflect unobserved demand as well as cost shocks, and the corresponding change in employment will be different depending on the source of the fluctuation. Secondly, this method cannot satisfactorily distinguish between fluctuations that are foreseeable and those that are inherently unpredictable. The distinction is potentially important because, depending on the structure of adjustment costs, it may be optimal to smooth foreseeable fluctuations in advance, so that the resulting variation in employment is of a different character than in the case of unpredictable shocks. More precisely, the relation between employment and leads and lags of aggregate output is likely to be very different in the two cases. The key innovation of this paper is its utilization of a well-defined and measurable source of fluctuations that are strictly unpredictable in nature - this is the precise sense in which we think of our test as being 'direct'.

Our setting is rural India, where agriculture exists alongside industry. Differences in employment protection laws across the states of India (and over time) provide variation in firing costs in the industrial sector. An institutional feature of employment protection laws in India is that they only apply to firms above a certain size threshold. As we discuss in more detail later, this provides us with a credible way to ascertain whether our results are due to labor regulation or are instead being driven by unobserved factors that happen to correlate with the extent of employment protection.

To obtain a plausible shock variable, we measure rainfall fluctuations that affect agricultural yield. In this particular context, rainfall shocks are ideal for a number of reasons: (1) They plausibly give rise to labor supply and/or output demand shifts for local industries via their effect on agricultural yields, (2) they are unpredictable in nature and therefore not likely to induce anticipatory smoothing of employment, (3) they are temporary and recurring and therefore factor into the forward looking decisions of firms and (3) they are not caused by employment changes in the industrial sector or by any other factors that may affect employment. We also present evidence that indicates that the measured rainfall fluctuations represent comparable shocks across labor regimes. The empirical strategy is then to test whether these shocks induce larger factory employment responses in states that have enacted pro-employer legislation.

Our results provide a confirmation of the prediction that industrial employment should be more flexible in pro-employer regions. We first confirm that rainfall fluctuations do indeed impact agricultural yields and incomes. We then document that high (low) rainfall increases (decreases) industrial employment, indicating the operation of a demand effect via agricultural incomes. Furthermore, as predicted by theory, the induced change in employment is indeed significantly greater in pro-employer states.[2] It also appears that the average change in output and profits is no greater for factories in pro-labor regions, suggesting that they are able to compensate for the lack of employment flexibility by adjusting along non-labor margins. Consistent with this hypothesis, we find that adjustment of non-labor inputs in the face of these shocks is indeed greater in pro-labor states.

Because labor regulation is likely to be related to a host of factors, many of which are unobservable, it is possible that our results do not really reflect the effects of labor regulation at all. We attempt to deal with this in two ways: First, we verify the robustness of the results to the inclusion of a set of controls that may be plausibly correlated with labor regulation. Second, we use the institutional features of labor regulation in India: as set down by the Industrial Disputes and Resolution Act of 1947, laws regulating the retrenchment of workers only applied to formal sector establishments employing at least 50 workers. Consistent with this definition of the labor laws, we find that the employment responses to local rainfall shocks in the informal as well as the small-scale factory sector (i.e. factories employing fewer than 50 workers) do *not* vary by the strictness of the labor regime. We believe

[2] A potential complication in this exercise is that rainfall fluctuations create opposing effects on employment: on the one hand, good (bad) rainfall increases (decreases) agricultural incomes and hence demand for local industrial goods, but on the other hand good (bad) rainfall increases (decreases) agricultural demand for labor and represents a negative (positive) labor supply shock for local industry. However, we show in Section 2 that the testable prediction is that the *net* effect of price and wage changes on employment is magnified in lower firing cost regimes.

this is strong evidence that the differential responses across labor regimes for regulated factories is indeed due to differences in labor regulation.

If capital is mobile, there may be selection of firms into regions, raising a subtle issue of interpretation. It is not implausible that factories that need to be flexible in their employment may choose to locate in regions with weak employment protection - in this case, the results noted above would reflect this selection, rather than the effect of employment protection on employment responses of the "average" factory. While this interpretation is still consistent with an overall effect of labor regulations, it has different policy implications. Firstly, to the extent that there is indeed selection, we will be exaggerating the effect of firing costs on employment flexibility. Additionally, it may be erroneous to conclude from our results on profits that firms are indifferent to firing restrictions–the true interpretation may be that those firms that are not indifferent to firing restrictions have relocated to regions where these restrictions ar weaker. Assuming that the technological substitutability of other inputs for labor is uniform within each industry, one possible way to remove the selection effect may be to compare the employment responses of factories within the same industry that are located in different regions with different labor regimes. This is work in progress.

With these caveats in mind, our results appear to be a striking confirmation of the predictions of the theory. The significance of labor regulation in India was first brought to attention by Besley and Burgess (2004), who showed how employment and output varied with the rigidity of labor regulations. Our results also tie into a wider literature that seeks to understand the workings of the rural economy in India, by highlighting the close relation between agricultural and industrial sectors - in particular, our finding of the significance of local demand for the factory sector is surprising, and challenges the frequently-made assumption that the market for formal sector products can be treated as national rather than local. The issue of labor regulation also has particular welfare significance when factors are immobile, which is widely believed to be the case in rural India. For example, Jayachandran (2006) shows that productivity shocks create large changes in the wage when labor is immobile and incomes are near subsistence level.

Our results indicate that even though employment adjustment is differential across regimes, profits do not appear to be differentially affected, suggesting that firms may be indifferent to labor regulation.

The paper is organized as follows. Section 2 outlines a standard model of labor demand and firing costs; Section 3 describes the data; Section 4 describes the empirical strategy; Section 5 describes the results; and Section 6 concludes.

2 Model

We outline here a simple partial-equilibrium model based on Bertola (1990) and Cahuc and Zylberberg (2004) that formalizes the key intuition of the paper. The model is set in continuous time. Consider an infinitely-lived price-taking firm that uses only labor to produce its output according to an increasing, concave production function $f(L)$. The firm discounts the future at the constant rate r. There are two possible states of the world, denoted by G (good, or high, rainfall) and B (bad, or low, rainfall). The associated prices and wages in these states are given by p_G, w_G, p_B and p_B respectively.

Suppose that the state is currently B at time t. The transition to the G state follows a Poisson process with constant rate of arrival θ_G. Similarly the transition from state G to state B is a Poisson process with constant arrival rate θ_G. We model employment protection in terms of a simple firing cost: hiring workers is frictionless but firing workers is assumed to entail a cost of c per worker.

In what follows, we will consider a stationary policy for the firm such that the firm employs L_G workers whenever the state is G and L_B workers whenever the state is B. We will assume that $p_G > p_B$, corresponding to the assumption that high-rainfall tends to raise demand for the industrial good. The wage rates in the two states are unrestricted, although we may assume without loss of generality that $w_B < w_G$, reflecting the possibility that poor rainfall reduces the labor demand in agriculture, and thereby increases the labor supply to industry. For concreteness, we will assume that the price of output and the wage in the different states are such that $L_G > L_B$ (i.e. the demand effect outweighs the wage effect, as will turn out to be true in the data).

The choice of L is analogous to investment in an asset whose return is stochastic. Since the policy is stationary, we need only define the value of the asset in the two states of the world, G and B. Let V_G and V_B denote these two values. Given the assumptions on the transition probabilities, we can use the standard equation for the evolution of the price of an asset to write:

$$rV_G = p_G f(L_G) - w_G L_G + \theta_G[V_B - V_G - c(L_G - L_B)] \tag{1}$$

$$rV_B = p_B f(L_B) - w_B L_B + \theta_B[V_G - V_B] \tag{2}$$

Upon transitioning to state B from state G the firm chooses L_B to solve:

$$\max \quad V_B - c(L_G - L_B) \tag{3}$$

The first-order condition is simply $\frac{\partial V_B}{\partial L_B} = c$.

On transitioning to state G from state B the firm chooses L_G to solve:

$$\max \quad V_G \tag{4}$$

The first-order condition is $\frac{\partial V_G}{\partial L_G} = 0$.

Using the asset-pricing equations, we have:

$$\frac{\partial V_B}{\partial L_B} = \frac{1}{r + \theta_B}[p_B f'(L_B) - w_B + \frac{\partial V_G}{\partial L_B}] \tag{5}$$

$$\frac{\partial V_G}{\partial L_G} = \frac{1}{r + \theta_G}[p_G f'(L_G) - w_G - c\theta_B + \frac{\partial V_B}{\partial L_G}] \tag{6}$$

The first-order conditions, together with the fact that $\frac{\partial V_B}{\partial L_G} = \frac{\partial V_G}{\partial L_B} = 0$

then imply:

$$p_B f'(L_B) = w_B - (r + \theta_B)c \tag{7}$$

$$p_G f'(L_G) = w_G + c\theta_G \tag{8}$$

These equations capture the intuition that adjustment costs create a wedge between the firm's marginal revenue product and the wage. The effective wage is therefore higher than the actual wage during good times and lower during bad times. It is easy to see that an increase in the firing cost c reduces employment in the high-rainfall state G and increases employment in the low-rainfall state B. Put differently, fluctuations represented by rainfall shocks will induce smaller employment adjustments in more regulated environments. This is the hypothesis we will proceed to test.

As we noted earlier, shocks represented by rainfall fluctuations plausibly create opposing effects on industrial labor demand, through the demand and labor supply channels. The model outlined here clarifies that it is the *net* effect on labor demand of these wage and price shocks that is magnified in lower firing cost (i.e. more flexible) regimes. That is to say, if the net effect of good rainfall is to increase (decrease) industrial employment, then we should expect to observe a greater increase (decrease) in employment in regions where labor regulations are less stringent. However, this conclusion is conditional on rainfall shocks representing identical demand and labor supply fluctuations across different labor regimes, i.e. on whether the rainfall shocks are comparable across regions. We will present some evidence in Section 4 to argue that this restriction appears to hold in our setting.

3 Data

Our empirical analysis examines the effects of labor regulation and rainfall shocks on the industrial sector in 330 Indian districts, using data from three years: 1987, 1990 and 1994.[3] These districts constitute 16 major states which together account for nearly 95 percent of India's population. Below, we describe our data sources, and also give a brief institutional background on industrial labor regulation.

3.1 The Industrial Sector

Manufacturing establishments in India are broadly classified as either "factories" or informal enterprises, the distinction being based on a cutoff defined in terms of employment. Factories constitute the formal industrial sector, and unlike informal enterprises, they are subject to industrial entry and labor regulation laws. Hence, our main data set is on the factory sector.

According to the Factory Act, a "factory" is a manufacturing establishment that employs at least 10 workers if it uses power, and at least 20 workers if it does not. The source of our district-level data on factories is the Annual Survey of Industries (ASI), a cross-sectional, national survey/census of factories which is conducted annually by the Central Statistical Organization of India. The ASI has two parts, the first being a census of all factories employing 100 workers or more, and the second a survey which randomly samples about a quarter of all other registered factories. The combined data from the ASI census and survey sections are fully representative of all factories in India, and can be used to estimate industrial sector aggregates at regional levels by weighting the factory-level data by the inverse of the sampling probabilities. Following this procedure, we aggregated primary data from three rounds of the ASI to the level of districts, estimating total employment, fixed capital, output and expenditure in the factory sector of 330 districts for the years: 1987, 1990 and 1993. Tables 1a and 1b summarize characteristics of the districts in our sample and the industrial sector outcome variables we use, respectively. The summary statistics are grouped by pro-worker, pro-employer, and neutral states; the definitions of these terms are given by the strictness of the labor regulation measure described below.

[3] Please see Table 3 for a summary of data sources, years of data used, and relevant variables from each dataset.

3.2 Labor Regulation

The basis of industrial labor regulation in India is the Industrial Disputes Act (IDA) of 1947, which sets out the legal procedures to be followed in the case of labor disputes–such as lay offs, retrenchments and strikes–in a factory. The IDA was passed by the central government, and in its original form applied equally to all states. But since India is a federal democracy, with both the central and state governments having jurisdiction over labor legislation, the act has since been extensively amended by state governments. These amendments have caused the states to differ markedly in their labor regulations.

Besley and Burgess (2004) read all state level amendments made to the Industrial Disputes Act during 1958-1995 in 16 major Indian states (from Malik (1997)). Each amendment was coded as being either pro-worker, neutral, or pro-employer, depending on whether it lowered, left unchanged or increased an employer's flexibility in hiring and firing factory workers, respectively. A state's labor regulation regime in any year was then obtained as the sum of these scores over all preceding years. Based on this cumulative score, Besley and Burgess (2004) classified four states–Gujarat, Maharashtra, Orissa and West Bengal–as "pro-worker" in 1988. Six states–Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Rajasthan and Tamil Nadu–were categorized as "pro-employer", leaving six others–Assam, Bihar, Haryana, Jammu and Kashmir, Punjab and Uttar Pradesh–to be classified as "neutral" with respect to labor laws. These categorizations are summarized in Table 2.

We followed this scheme of cumulating the Besley-Burgess scores to categorize the states as *Pro-worker*, *Pro-employer* or *Neutral* in each year of our study. Since there were few labor law amendments after 1987, this classification remains identical to the original Besley-Burgess classification for 1988 throughout our study period. The only exception is Karnataka, which switched from being neutral to being pro-employer between 1987 and 1988.

While only formal establishments (factories) are subject to labor regulation, it is important to note that not all factories are subject to the provisions of the IDA and its amendments. In particular, laws which affect the cost of firing workers only apply to factories above a minimum threshold of employment. Specifically, the 1947 IDA requires firms that employ 50 or more workers to pay compensation to any worker who is to be retrenched. Subsequent amendments to parts regulating the firing of workers apply with similar employment cutoffs. By 1984, the IDA required establishments employing 50 or more workers to give a worker half-pay for 45 days in case of a lay-off, and thirty days' notice with 15 days' pay for every year of work in case of retrenchment. Factories employing more than 100 workers had to seek permission from the government before laying off workers, and this permission was often denied (Datta-Chaudhury, 1996).

3.3 Rainfall, Agricultural Yields and Household Expenditure

The rainfall data, Terrestrial Air Temperature and Precipitation: Monthly and Annual Time Series (1950-99), version 1.02, is from the Center for Climatic Research, University of Delaware. The rainfall measure for a latitude-longitude node (on a 0.5 ° latitude by 0.5° longitude grid) combines data from 20 nearby weather stations using an interpolation algorithm based on the spherical version of Shepard's distance-weighting method. We matched these rainfall data to districts by calculating the grid point nearest to the geographic center of a district.

Previous work in India suggests that while low rainfall is a bad shock to agriculture, excess rainfall is good.[4] Our primary measure of the rainfall shock (*Rainshock*) is constructed accordingly, with higher values indicating *lower* amounts of rainfall. *Rainshock* is equal to one when the annual district rainfall is less than the twentieth percentile of the district's historical average, zero when it is between the twentieth and eightieth percentiles, and minus one when it is above the eightieth percentile. In the Appendix, we also present our main results using an alternative, continuous measure of

[4] See Jayachandran (2006), who finds similar results for the effects of excess rainfall on agricultural yields.

the rainfall shock, which is the negative of the deviation of annual rainfall from the district's historical average, normalized by the historical standard deviation within the district.

Our data on agricultural yields is from an updated version of the India Agriculture and Climate Data Set, which originally contained district-level agricultural data- including area cultivated, output and prices of major crops-for the years 1957/58 to 1986/87. This data set was compiled by James Robert E. Evenson and James W. McKinsey Jr. using statistics published by the Directorate of Economics and Statistics within the Indian Ministry of Agriculture. These data have been updated to 1996 using more recent issues of these government publications.[5]

Our data on average household per capita expenditure in districts is based on Consumption Expenditure Surveys conducted by India's National Sample Survey Organization (NSSO) in 1987, 1993 and 1999. These cross-sectional, nationally representative household surveys are a key source of poverty measurement in India. In estimating district level averages, households were weighted by the inverse of the sampling probabilities.[6]

3.4 The Informal Industrial Sector

In addition to examining the effect of rainfall shocks on factories, we look at their effect on the informal manufacturing sector. Indian manufacturing enterprises with fewer than ten hired worker belong to the informal ("unorganized") sector, and are not subject to the same industrial entry or labor laws as factories. Our primary data sources on the informal manufacturing sector are National Sample Surveys (NSS) of Unorganized Manufacturing, which are conducted by NSSO in 1989 and 1994. These were nation-wide establishment-level surveys which covered both types of informal establishments - household enterprises, which are defined as establishments using only family labor, and "small business enterprises", or informal establishments employing hired workers. The sample frame for these NSSO surveys

[5] Yield data updates were compiled by Rohini Pande and Siddharth Sharma.

[6] We are grateful to Rohini Pande and Petia Topalova for sharing with us their district-level estimates based on the NSSO Consumption Expenditure Surveys.

is the Economic Census, a census of all manufacturing establishment which follows a block enumeration approach to ensure comprehensive coverage. Thus, the Surveys of Unorganized Establishments are fully representative of informal manufacturing activity. We aggregated these data to the district-level after weighting the establishment-level numbers by the inverse of the sampling probabilities.[7]

4 Empirical Strategy

Exploiting district-level variation in rainfall over time, we first measure the impact of rainfall shocks by regressing district outcomes on a rainfall shock measure ($Rainshock_{jt}$) for district j and year t. The regressions control for macro shocks with year fixed effects and for time-invariant regional variation with district fixed effects. For outcome x, our base specification is thus:

$$x_{jt} = \alpha Rainshock_{jt} + \sum_{j} \rho_j \mathbf{1}\left(village_j\right) + \sum_{t} \rho_t \mathbf{1}\left(village_t\right) + \epsilon_{jt}. \tag{9}$$

The coefficient α estimates the average affect of the rainfall shock on the district outcome x_{jt}. Since *Rainshock* is constructed to take on higher values the lower the amount of rainfall, a negative estimate of α would indicate that low rainfall has a negative effect on x_{jt}.

The theory suggests that the industrial sector's response to shocks depends on industrial labor regulation. Hence, our key regressions estimate how the effect of rainfall shocks varies across districts falling under different labor regulation regimes by interacting $Rainshock_{jt}$ with the labor law

[7] There are two gaps in our data on the informal sector. First, the 1989 NSS round was limited to household enterprises and to small business enterprises employing at most six hired workers, and did not cover small enterprises hiring 6-10 workers. Second, since we could not match urban establishments to their districts for lack of district identifiers in the 1989 survey, our district data on the unorganized sector cover only those establishments which were located in rural areas. Thus, our data on the informal sector are representative of rural household enterprises and small business enterprises hiring no more than 6 workers. The 1994 Survey of Unorganized Manufacturing indicates that such establishments account for about 85% of all unorganized manufacturing sector employment in rural areas.

dummies:

$$x_{jt} = \alpha Rainshock_{jt} + \beta\Big(Rainshock_{jt} \text{ x } Proworker_{jt}\Big) + \delta\Big(Rainshock_{jt} \text{ x } Proemployer_{jt}\Big) + \sum_j \rho_j \mathbf{1}\left(village_j\right) + \sum_t \rho_t \mathbf{1}\left(village_t\right) + \epsilon_{jt}. \quad (10)$$

Depending on the cumulated Besley-Burgess labor law index of their state, districts are either *Pro-worker*, *Pro-employer* or *Neutral.* Thus, β and δ measure how the effects of rainfall shocks in *Pro-worker* and *Pro-employer* districts, respectively, differ from that in *Neutral* districts. For example, suppose that the average effect of rainfall shocks, as measured by α in equation 9, is negative. Then a negative estimate of δ would imply that the decline in x_{jt} due to low rainfall is greater in *Pro-employer* districts as compared to *Neutral* districts. If α in equation 9 is estimated to be positive, then a negative estimate of δ would imply that relative to *Neutral* districts, the increase in x_{jt} due to low rainfall is lower in *Pro-employer* districts.

We would like β and δ to capture how firms' responses to rainfall shocks vary across districts with different labor laws. One concern with this interpretation of the coefficients is that the impact of rainfall on the district economy depends on the composition of district employment, which might be related to labor regulation. For example, since workers might lobby the govt for pro-worker regulation, states with more non-agricultural employment (and thus presumably a larger blue-collar lobby) may have enacted more pro-worker legislation. But less agricultural districts are also less likely to be dependent on rainfall. Another possibility is that factories' response to shocks varies by their capital intensity, and that labor laws are correlated with the average labor intensity of the industrial sector. Jayachandran (2006) addresses such concerns by including relevant district characteristics and their interactions with rainfall shock as controls. Following this strategy, we add controls for interactions of $Rainshock_{jt}$ with baseline characteristics of the districts which may be correlated with the extent of labor regulation, such as the percent of total employment that is employed in the agrarian sector, the percent of total employment in food-based sectors, and the average capital to output ratio in industry. The main effects of these characteristics are absorbed by the district fixed effects. We find that our result are robust to these controls.

Our second strategy for dealing with this concern is unique to this study, and exploits the fact that the regulation of firing does not apply equally to all factories. As discussed earlier, the key provisions of the IDA and its amendments regarding lay offs only apply to factories with at least 50 workers. This implies that smaller factories–with employment between 10 and 50 workers–should adjust employment similarly across states with different labor laws, unless our results are being driven by unobservable district characteristics correlated with labor laws. To test this, we construct two datasets, the first aggregating *large* factory outcomes to the district level, and the second doing the same for *small* factory outcomes. We show that the employment response to rainfall shocks varies significantly by labor regulation among factories which meet the labor law threshold requirement, but not among smaller factories. The relationship between rainfall shocks, labor laws and other factory outcomes such as raw materials is the same above and below the threshold. This suggests that our regressions have identified the effect of labor laws.

Finally, another issue with interpreting the coefficient on rainfall shock is that poor rainfall may affect the industrial sector in more than one way. The mechanism we emphasize in this paper–a negative product demand shock–was discussed in the theory section. A rainfall shock may also induce a wage effect, as Jayachandran (2006) shows for rural Indian districts: since agricultural productivity declines during low rains, the agricultural wage should decline as well. This decline could trigger a labor supply effect, if costs to switching across the two sectors were low enough. Moreover, if a significant portion of raw inputs into production are supplied locally, a rainfall shock may induce declines in the supply of these inputs, and thus an increase in their price. If this were the case, we would find that the higher price of inputs would drive supply of factory goods down in the same way a demand shock would.

We argue that for the purpose of our study, what matters is the net effect. We assume that that this net effect itself does not vary systematically across pro-worker and pro-employer states, and our findings support this assumption. Firstly, we show that the way in which the factory response to rainfall shocks varies by labor laws depends on whether the outcome is employment, or other inputs. Secondly, we show that the differential employment response is limited to factories above the labor law cutoff. Neither of these can be explained by the net rainfall effect differing across states with different labor laws.

Interestingly, our result that the average relationship between rainfall shocks and the size of the factory sector is negative suggests that the demand channel predominates. In further support of the interpretation that poor rainfall shock is mainly a demand shock to factories, we show that agricultural yields and average household per capita expenditures decline in districts experiencing a rainfall shock.

5 Results

5.1 Rainfall shocks, agricultural yield and per capita expenditures

We begin by providing evidence for the premise that rainfall shocks induce shocks to local demand. As evidence, we show the effects of rainfall on district-level agricultural yields and per capita expenditures. The main rainfall shock variable we use is equal to 1 for very low rainfall (less than 20 percent of the historical distribution), 0 between the 20th and 80th percentiles, and -1 for very high rainfall (greater than 80 percent of the historical distribution). The unit of observation is district-by-year, and all our specifications include district and year fixed effects. Standard errors are clustered to account for correlation in the error term at the state-by-year level.

The results of these regressions are reported in Table 4. Columns 1 and 2 show the effect of rainfall shocks on agricultural yields. As has been established by Jayanchandran (2006) and others, we find (in Column 1) that a negative rainfall shocks significantly decreases yields. In Column 2, we verify that the yield response to rainfall shocks does not vary systematically with labor regulation. To implement this test, we interact the rainfall shock variable with dummies for pro-worker and pro-employer states; we also include other interactions with baseline characteristics of the districts which may be correlated with the extent of labor regulation, such as the percent of total employment that is employed in the agrarian sector, the percent of total employment in food-based sectors, etc. We find that yield does not respond differentially across extents of labor regulation.

In Columns 3 and 4, we carry out the same exercise with district-level per capita expenditure as the dependent variable. If rainfall shocks induce decreases in the local demand for factory goods, we should find that per capita expenditures decline. We indeed find evidence for this claim, as shown in Column 3. Column 4 reports results of a specification in which the rainfall shock measure is interacted with dummies for pro-worker and pro-employer states, and control interactions are included, as before. The results in Column 4 verify that the response of per capita expenditures to rainfall shock does not vary systematically across extents of labor regulation.

5.2 Effects of rainfall shock on industrial sector outcomes

Next, we study the main effects of rainfall shocks on industrial outcomes, divided broadly into labor, capital and output-related outcomes. Table 5 reports results of regressions of these various industrial sector outcomes on the rainfall shock measure defined earlier. Columns 1 and 2 show how the rainfall shock affects industrial labor: we find that the number of workers and total man-days employed decreases as a result of the shock. This finding is consistent with the predicted effects of a demand shock: when output demand decreases, labor and other inputs should decrease as well to accommodate the required reduction in output.

Columns 3-5 examine what happens to other inputs into production, namely capital, intermediate materials, and fuel. In Column 3, the dependent variable is the capital stock at close-of-year. In Column 4 and 5, we examine the effects of the rainfall shock on intermediate inputs, measured by the materials and fuel used in production. We find evidence for significant declines in the value of materials used in production during a rainfall shock, while the declines in capital stock and the value of fuel use are insignificantly different from 0.

In Columns 6 through 8, we examine the effect of a rainfall shock on value added, total output and profits. Value added is defined as the total value of production minus the value of intermediate inputs (not including labor or rental costs of capital). We find that value added, output and profits all decline significantly in response to a rainfall shock, again consistent with the premise that rainfall shocks induce exogenous decreases in demand for factory goods.

5.3 How does the impact of demand shocks vary by the extent of labor regulation?

We have now established that the effects of a rainfall shock are consistent with the predicted effects of a shock to demand for the goods that the industrial sector produces. In this section, we investigate how these effects vary with the strictness of labor regulation laws, to which the industrial sector is subject.

The theoretical model predicts that since labor regulations impose a cost on hiring and firing employees, firms who are subject to strict regulation should hire and fire fewer laborers in response to demand shocks than firms who face lax regulation. On the other hand, to achieve the necessary change in output, firms under stricter labor laws may adjust more on other margins, such as adjusting intermediate inputs.

We look for empirical evidence for these predictions through regressions that include the interaction of rainfall shocks with the dummies that represent the strictness of state labor regulation laws (and control for the main effects). As described in the previous section, we also include interactions of rainfall shock with other baseline characteristics of districts which may be correlated with the extent of labor regulation. In Table 6, we report coefficients of the main effect of rainfall shocks, and the effects of rainfall shocks interacted with the labor regulation dummies, for the same outcome variables used in the previous table. The main effect of the pro-worker dummy (as well as the various baseline characteristics of districts) is absorbed by the district fixed effects. The coefficient on the main effect of the pro-employer dummy is identified, because Karnataka changes from neutral to pro-employer during the period covered in our data, but not reported in the table.

In Columns 1 and 2, we examine the effects of the demand shock on labor outcomes in the industrial sector. For both the number of workers and man-days employed, the interaction coefficient for pro-employer states is significant and negative. Differences between the coefficients reported in the columns show that both differences across pro-worker and pro-employer are positive. These results indicate that, consistent with the predictions of theoretical model, we see a differentially larger decline in workers and man-days in response to a demand shock in pro-employer states. In addition, the decline in pro-worker states is not significantly different from zero. Both facts provide evidence that stricter labor regulation imposes greater costs to firing, which hamper the adjustment of labor to demand shocks for firms, but facilitate more stable employment for workers.

In Columns 3 through 5, we examine the effect of rainfall shocks on other inputs to production, namely capital and intermediate inputs. For inputs other than labor, we find that the pattern from Columns 1 and 2 is reversed: during times of rainfall shock, firms decrease capital inputs more intensively in pro-worker states. The difference in the interaction coefficients (pro-worker state dummy interacted with rainfall shock) is negative across the columns, and significantly different from 0 for capital stock and value of fuel used in production.

In Columns 6, 7 and 8, we show that while value added, total output and profits decline in response to rainfall shocks, that decline is not differential across pro-worker and pro-employer states. This result is consistent with the fact that a negative demand shock should induce the same decrease in production regardless of differential costs of adjustment for one input, if there are other margins on which firms can adjust.

5.4 Effect of rainfall shocks for large and small factories

To further isolate the impact of labor regulation on firms' abilities to adjust to shocks, we exploit a stipulation in state labor regulations which asserted that the regulations applied only to factories with more than 50 workers. Thus, we should see a wider gap in the employment responses to shocks across extents of labor regulation for the sample of factories with more than 50 workers, since these are the firms whose labor adjustments would be subject to the law.

We implement this test by splitting the ASI sample into small and large factories, and then aggregating to the district level, as before. We then run the same analysis on both datasets. The results of the regressions for large factories are reported in Table 7a. Columns 1 and 2 show the employment responses: for number of workers and man-days, the differences between the interaction coefficients are significant and positive, indicating that large firms in pro-employer states adjust their employment more intensively downwards in response to a demand shock compared to large firms in pro-worker states.

Again, the capital and intermediate input outcomes in Columns 3 through 5 show the opposite trend: inputs besides labor adjust downwards more intensively in pro-worker districts. The difference between the interaction coefficients is negative and significant for all three measures of capital inputs we use. Finally, we test whether the responses of value added, output and profits to shocks differ across pro-worker and pro-employer states, and find no evidence that they do (in concurrence with the previous table).

In Table 7b, we run the same analysis on the sample of small factories (fewer than 50 workers). Across the columns in this table, we observe that the main effect of the rainfall shock is negative and significant, while the interactions with pro-worker and pro-employer state dummies are not. In particular, in Columns 1 and 2, we observe that labor responses to shocks for small firms are not statistically different across pro-worker and pro-employer states. Similarly, in contrast to the results for large factories, we find that capital and intermediate inputs do not adjust differentially across the two labor regulation regimes (Columns 3-5). Finally, we find as in the previous tables that output, value added, and profits decline but not differentially across pro-worker and pro-employer districts.

6 Conclusion

Theoretical models of labor demand predict that firing costs have ambiguous effects on employment levels. In contrast, firing costs are predicted to unambiguously reduce the size of employment responses to wage and output price shocks. We provide the first direct test of this sharp prediction, exploiting a setting which exhibits variation in labor regulation as well as exogenous wage and price shocks. Our setting is rural India, where rainfall fluctuations create demand and wage shocks for local industries, and where labor regulation varies temporally as well as spatially. Preliminary results provide a striking confirmation of the theory - rainfall shocks change industrial employment by shifting the demand for industrial products, and the employment adjustment is more pronounced in regions where labor regulations are less restrictive. Furthermore, in areas with stricter labor regulations, the output change is achieved by adjusting non-labor inputs.

Understanding firms' abilities to adjust to shocks, and the effects that these adjustments have on workers, is crucial to forming appropriate labor regulation policy. Our results show that labor regulation laws significantly change the way in which the industrial sector adjusts to shocks. In turn, these changes affect the vulnerability of workers to demand shocks: we find that where labor regulation is stricter, workers are more protected from the effects of the shocks. Moreover, we find that factories cope with stricter labor regulation by adjusting more on other margins in response to shocks, and suffer no greater loss in output and profits than firms in places with less strict regulation. This finding suggests that when adjustment along other margins is possible, labor regulation, at least in its role with regard to adjusting to shocks, may be Pareto-improving. Workers are more protected from the adverse affects of the shock, and firms are no worse off if they are able to adjust on other margins.

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A Effect of rainfall shocks on informal sector employment

We have shown that the effects of a rainfall shock are consistent with the predictions of our theoretical model with regard to the effects of a shock to demand for industrial sector goods. Further, our results show that the demand shock response varies across states with stricter or laxer labor regulation laws, in a way that is consistent with the fact that the regulation imposes an adjustment cost on firms.

In this section, we address the fact that the rainfall shock may induce labor supply effects alongside the demand-side effects we have focused on so far. In particular, Jayachandran (2006) provides evidence that rainfall shocks decrease the agricultural wage through their effect on crop yields. This wage decrease in the agricultural sector should increase the labor supply in other sectors to which agricultural laborers have access.

We have provided evidence in Tables 5 and 6 that even if agricultural laborers could switch into industrial sector labor following a drop in the agricultural wage, this supply-side effect is dominated by the demand-side effect generated by the decrease in demand. In Appendix Table 1, we show that the opposite is the case for the informal sector, comprised of household enterprises and small enterprises (definitions of these sub-sectors are provided in the Data section). Columns 1 and 3 examine the effects of a rainfall shock on the number of workers in these two sectors. We find a large and significant positive effect of a rainfall shock for household enterprises, and similar positive but insignificant effect for small enterprises.

These findings are consistent with the explanation that switching from farming to household enterprise in response to a wage shock likely involves the least cost to the worker; searching for work in a small enterprise or a factory would likely involve a greater cost.

In Columns 2 and 4, we look for differences in the labor responses in the informal sector by strictness of industrial sector labor regulation. We find little evidence of significant differences: the F-test for the difference between the two interaction coefficients is insignificant for household enterprises and marginally significant for small enterprises at the 5 percent level. The argument that more lax industrial sector labor regulation, which leads to more firing in the face of demand shocks, could induce a number of those workers to migrate to the informal sector, does not appear to hold empirically. This, together with the fact that the demand response dominates any labor supply effect in the industrial sector, leads us to speculate that switching into and out of the industrial sector in response to shocks is limited by the costs of job search or migration.

Table 1a: SUMMARY STATISTICS

Characteristics of pro-worker, neutral and pro-employer states

	Pro-worker	*Neutral*	*Pro-employer*
Number of districts (1988)	78	186	80
Labor regulation strictness measure	1.95	0	-1.46
(see Besley and Burgess 2004)	(1.03)	(0)	(0.50)
Industrial sector outcomes:			
% workers in district who are	31.59	23.90	26.57
landed	(13.87)	(11.96)	(14.14)
% workers in district who are	15.89	21.37	20.74
landless	(11.62)	(10.25)	(12.99)
Average capital-to-output ratio in	1.56	1.56	1.33
district	(4.84)	(2.74)	(2.91)
% empl. in industries linked to	44.63	43.37	46.61
agriculture	(33.34)	(30.77)	(31.35)

Notes: state classifications are based on adding the number of pro-worker laws and subtracting the number of pro-employer laws passed in each state; for details, please refer to the Data section; please also refer to the Data section for data sources and more detailed definitions

Table 1b: SUMMARY STATISTICS

Outcome variables by pro-worker, neutral and pro-employer states

	Pro-worker	*Neutral*	*Pro-employer*
Agricultural yield	268.77	269.72	324.70
	(157.96)	(119.63)	(201.97)
Industrial sector outcomes:			
Number of workers	18656.91	8806.28	17365.11
	(25237.00)	(14086.25)	(21899.32)
Man-days (thousands)	7453.67	3429.88	6373.00
	(10254.04)	(5836.59)	(8036.04)
Capital stock	284.19	110.94	174.66
	(455.53)	(243.12)	(262.65)
Materials (intermediate input)	528.57	253.60	388.78
	(775.39)	(463.95)	(571.72)
Fuel	59.87	25.12	44.09
	(86.03)	(44.06)	(58.77)
Value added	150.07	71.51	110.20
	(250.17)	(146.71)	(171.78)
Profits	27.48	20.57	28.74
	(96.05)	(58.38)	(82.05)
Informal sector outcomes:			
Number of workers in household	43268.08	23640.54	32710.76
enterprises	(48009.69)	(28046.24)	(31398.57)
Number of workers in small	4861.61	2427.58	5386.67
enterprises	(6508.92)	(3836.21)	(6570.22)

Notes: state classifications are based on adding the number of pro-worker laws and subtracting the number of pro-employer laws passed in each state; for details, please refer to the Data section; please also refer to the Data section for data sources and more detailed definitions; capital stock, materials, fuel, value added and profits have been converted to thousands of 2009 US dollars

Table 2

Pro-worker, pro-employer and neutral states in our sample

Pro-worker	*Pro-employer*	*Neutral*
Gujarat	Andhra Pradesh	Bihar
Maharashtra	Karnataka*	Haryana
Orissa	Rajasthan	Karnataka*
West Bengal	Tamil Nadu	Madhya Pradesh
		Punjab
		Uttar Pradesh

Notes: (*) Karnataka switches from neutral to pro-employer in 1987-88; classifications are based on adding the number of pro-worker laws and subtracting the number of pro-employer laws passed in each state; for details, please refer to the Data section

Table 3

Data sources

Source	*Years*	*Variables*
Annual Survey of Industries (conducted by the Central Statistical Organization of India)	1988, 1991, 1994	Employment, Fixed Capital, Output, Raw Material and Fuel Expenditures in factories (the formal industrial sector)
Terrestrial Air Temperature and Precipitation: Monthly and Annual Time Series, version 1.02 (Center for Climatic Research, University of Delaware)	1950-1999	Rainfall Shock
Besley and Burgess (2004) (based on state level amendments to the Industrial Disputes Act of India)	1949-1995	Labor Regulation
India Agriculture and Climate Data Set (updated using statistics published by the Directorate of Economics and Statistics, Ministry of Agriculture, India)	1957-1996	Agricultural Yields
Consumer Expenditure Survey (conducted by the National Sample Survey Organization of India)	1987, 1993, 1999	Household Per Capita Expenditure
Survey of Unorganized Manufacturing (conducted by the National Sample Survey Organization of India)	1989, 1994	Employment in the informal industrial sector

Table 4

Effect of rainfall shock on yields and per capita expenditures

	Yield		Per capita expenditures	
Rainfall shock	-16.69**	-13.751	-14.28***	-21.168*
	(7.205)	(11.805)	(4.292)	(11.199)
Rainfall shock interacted with				
Dummy for pro-worker state		-28.080**		2.677
		(12.345)		(9.179)
Dummy for pro-employer state		-22.353**		14.963
		(8.594)		(9.581)
Difference between interaction coefficients		-5.727		-12.29
		(15.65)		(9.204)
Fixed effects	District and year		District and year	
Number of obs.	751	743	1071	1071

Notes: *** p<0.01; ** p<0.05; * p<0.1; robust standard errors are reported in parentheses below the coefficient estimates and allow for clustering within state-year; "Rainfall shock" = 1 if annual rainfall is less than 20th percentile of district's historical average; = 0 if between 20th and 80th percentiles; and = -1 if above 80th percentile; all dependent variables are trimmed at the 99th percentile of their distributions to remove outliers; dummy for pro-worker state (main effect) is absorbed by district FE; coefficient on dummy for pro-employer state is identified as Karnataka has variation in labor strictness over time (coefficient not reported).

Table 5

Effect of rainfall shock on industrial sector outcomes

	Labor		*Capital and intermediate inputs*			*Output and profits*		
	Number of workers	Man-days (thousands)	Capital	Materials	Fuel	Value added	Profits	Output
Rainfall shock	-436.22	-198.82*	-16.76	-21.31*	-1.67	-42.25**	-8.19***	-35.14**
	(279.23)	(108.38)	(10.68)	(11.01)	(1.50)	(20.44)	(2.68)	(16.64)
Fixed effects	District and year		District and year			District and year		
Number of obs.	1,032	1,031	1,032	1,031	1,031	1,032	1,031	1,031

Notes: *** p<0.01; ** p<0.05; * p<0.1; robust standard errors are reported in parentheses below the coefficient estimates and allow for clustering within state-year; "Yield" is output per area cropped (see Data section for details); "Rainfall shock" = 1 if annual rainfall is less than 20th percentile of district's historical average; = 0 if between 20th and 80th percentiles; and = -1 if above 80th percentile; "Capital" is the value of fixed capital stock at close of business year; "Materials" and "Fuel" are annual values of intermediate inputs used; "Value added" is the pecuniary value of total output minus intermediate inputs; all dependent variables are trimmed at the 99th percentile of their distributions to remove outliers; all pecuniary values have been converted to thousands of 2009 US dollars.

Table 6

Effect of rainfall shock on industrial sector outcomes by labor regulation strictness

	Labor		*Capital and intermediate inputs*			*Output and profits*		
	Number of workers	Man-days (thousands)	Capital	Materials	Fuel	Value added	Profits	Output
Rainfall shock	-55.39	-144.64	-42.67*	-78.62**	0.95	-17.47	-14.65**	-83.365*
	(810.91)	(321.01)	(21.43)	(36.17)	(4.08)	(11.37)	(6.18)	(42.164)
Rainfall shock interacted with								
Pro-worker state	628.10	219.64	-4.88	-21.27	-4.44	21.42**	0.90	-2.209
	(536.01)	(212.71)	(14.34)	(28.95)	(2.71)	(8.26)	(7.10)	(37.710)
Pro-employer state	-1,516.02**	-441.54*	34.49***	31.36	4.03	9.58	0.37	49.927*
	(644.47)	(239.12)	(11.44)	(19.67)	(3.39)	(5.89)	(5.28)	(26.384)
Difference between interaction coefficients	2144	661.2	-39.37	-52.62	-8.471	11.83	0.525	-52.14
	(750.20)***	(298.40)**	(17.37)**	(32.27)	(4.37)*	(9.87)	(9.52)	(38.65)
Fixed effects	District and year		District and year			District and year		
Number of obs.	1,008	1,007	1,008	1,007	1,007	1,007	1,007	1,007

Notes: *** p<0.01; ** p<0.05; * p<0.1; robust standard errors are reported in parentheses below the coefficient estimates and allow for clustering within state-year; "Yield" is output per area cropped (see Data section for details); "Rainfall shock" = 1 if annual rainfall is less than 20th percentile of district's historical average; = 0 if between 20th and 80th percentiles; and = -1 if above 80th percentile; "Capital" is the value of fixed capital stock at close of business year; "Materials" and "Fuel" are annual values of intermediate inputs used; "Value added" is the pecuniary value of total output minus intermediate inputs; all dependent variables are trimmed at the 99th percentile of their distributions to remove outliers; all pecuniary values have been converted to thousands of 2009 US dollars; dummy for pro-worker state (main effect) is absorbed by district FE; coefficient on dummy for pro-employer state is identified as Karnataka has variation in labor strictness over time (coefficient not reported).

Table 7a: LARGE FACTORIES

Effect of rainfall shock on industrial sector outcomes by labor regulation strictness

	Labor		*Capital and intermediate inputs*			*Output and profits*		
	Number of workers	Man-days (thousands)	Capital	Materials	Fuel	Value added	Profits	Output
Rainfall shock	1,124.76	296.61	-35.32*	-37.36	3.42	-21.73**	-11.36*	32.419
	(872.26)	(310.62)	(20.82)	(33.35)	(4.12)	(9.26)	(6.48)	(47.658)
Rainfall shock interacted with								
Pro-worker state	271.98	137.87	-0.40	-27.85	-4.37	16.93**	4.44	-5.725
	(545.89)	(190.77)	(12.00)	(20.80)	(2.69)	(8.18)	(6.54)	(26.641)
Pro-employer state	-1,580.27***	-433.36**	36.25***	21.72	1.11	6.28	4.59	14.411
	(531.33)	(175.67)	(12.16)	(20.52)	(2.21)	(6.16)	(4.86)	(25.723)
Difference between interaction coefficients	1852	571.2	-36.65	-49.57	-5.478	10.65	-0.147	-20.14
	(503.10)***	(175.00)***	(15.71)**	(22.20)**	(3.25)*	(9.90)	(7.94)	(24.26)
Fixed effects	District and year		District and year			District and year		
Number of obs.	956	956	956	957	956	956	957	957

Notes: *** p<0.01; ** p<0.05; * p<0.1; robust standard errors are reported in parentheses below the coefficient estimates and allow for clustering within state-year; "Yield" is output per area cropped (see Data section for details); "Rainfall shock" = 1 if annual rainfall is less than 20th percentile of district's historical average; = 0 if between 20th and 80th percentiles; and = -1 if above 80th percentile; "Capital" is the value of fixed capital stock at close of business year; "Materials" and "Fuel" are annual values of intermediate inputs used; "Value added" is the pecuniary value of total output minus intermediate inputs; all dependent variables are trimmed at the 99th percentile of their distributions to remove outliers; all pecuniary values have been converted to thousands of 2009 US dollars; dummy for pro-worker state (main effect) is absorbed by district FE; coefficient on dummy for pro-employer state is identified as Karnataka has variation in labor strictness over time (coefficient not reported).

Table 7b: SMALL FACTORIES

Effect of rainfall shock on industrial sector outcomes by labor regulation strictness

	Labor		*Capital and intermediate inputs*			*Output and profits*		
	Number of workers	Man-days (thousands)	Capital	Materials	Fuel	Value added	Profits	Output
Rainfall shock	-1,208.76***	-401.95***	-5.87***	-28.03***	-2.72***	-7.89***	-2.92**	-81.894***
	(305.20)	(113.61)	(2.11)	(8.61)	(0.63)	(2.28)	(1.39)	(20.537)
Rainfall shock interacted with								
Pro-worker state	373.68	94.95	-3.60	0.51	0.26	-0.39	-0.84	-19.828
	(354.01)	(129.34)	(3.17)	(12.37)	(0.77)	(2.73)	(1.39)	(24.013)
Pro-employer state	-50.18	-15.25	0.55	6.84	0.19	0.86	0.22	12.376
	(303.61)	(91.93)	(1.12)	(6.64)	(0.33)	(1.44)	(0.85)	(11.232)
Difference between interaction coefficients	423.9	110.2	-4.153	-6.327	0.0747	-1.250	-1.065	-32.20
	(496.30)	(163.00)	(3.35)	(13.45)	(0.85)	(2.92)	(1.39)	(25.52)
Fixed effects	District and year		District and year			District and year		
Number of obs.	988	989	989	988	989	989	989	989

Notes: *** p<0.01; ** p<0.05; * p<0.1; robust standard errors are reported in parentheses below the coefficient estimates and allow for clustering within state-year; "Yield" is output per area cropped (see Data section for details); "Rainfall shock" = 1 if annual rainfall is less than 20th percentile of district's historical average; = 0 if between 20th and 80th percentiles; and = -1 if above 80th percentile; "Capital" is the value of fixed capital stock at close of business year; "Materials" and "Fuel" are annual values of intermediate inputs used; "Value added" is the pecuniary value of total output minus intermediate inputs; all dependent variables are trimmed at the 99th percentile of their distributions to remove outliers; all pecuniary values have been converted to thousands of 2009 US dollars; dummy for pro-worker state (main effect) is absorbed by district FE; coefficient on dummy for pro-employer state is identified as Karnataka has variation in labor strictness over time (coefficient not reported).

Appendix Table 1

Effect of rainfall shock on informal sector outcomes

	Dependent variable is number of workers in given industry			
	Household enterprises		Small business enterprises	
Rainfall shock	5197**	-10,856.313***	391.7	-498.691
	(2215)	(3891.980)	(289.4)	(653.023)
Rainfall shock interacted with				
Pro-worker state		2,069.427		1,428.246*
		(10325.685)		(706.011)
Pro-employer state		-8,894.982*		259.940
		(5106.113)		(683.226)
Difference between interaction coefficients		10964		1168
		(10101.00)		(660.70)*
Fixed effects	District and year		District and year	
Number of observations	693	673	693	673

Notes: *** p<0.01; ** p<0.05; * p<0.1; robust standard errors are reported in parentheses below the coefficient estimates and allow for clustering within state-year; "Rainfall shock" = 1 if annual rainfall is less than 20th percentile of district's historical average; = 0 if between 20th and 80th percentiles; and = -1 if above 80th percentile; all dependent variables are trimmed at the 99th percentile of their distributions to remove outliers; dummy for pro-worker state (main effect) is absorbed by district FE; coefficient on dummy for pro-employer state is identified as Karnataka has variation in labor strictness over time (coefficient not reported).

Appendix Table 2: ALTERNATE RAINFALL SHOCK MEASURE

Effect of rainfall shock on industrial sector outcomes by labor regulation strictness

	Labor		*Capital and intermediate inputs*			*Output and profits*		
	Number of workers	Man-days (thousands)	Capital	Materials	Fuel	Value added	Profits	Output
Rainfall shock	-79.46	-112.51	2.42	-39.40	1.84	-5.53	-3.95	-43.274
	(561.11)	(209.86)	(6.40)	(25.42)	(2.79)	(7.02)	(4.48)	(29.749)
Rainfall shock interacted with								
Pro-worker state	326.62	119.30	5.87	-11.05	-1.65	11.67*	2.32	7.871
	(300.50)	(125.99)	(5.28)	(22.02)	(1.55)	(5.92)	(4.00)	(24.781)
Pro-employer state	-910.50**	-264.62*	-2.26	8.28	2.34	5.26	1.23	22.569
	(370.84)	(142.46)	(3.54)	(13.56)	(2.38)	(3.94)	(3.75)	(20.648)
Difference between interaction coefficients	1237	383.9	-18.91	-19.33	-3.993	6.410	1.083	-14.70
	(389.0)***	(157.7)**	(12.52)	(25.32)	(3.123)	(6.737)	(5.711)	(26.71)
Fixed effects	District and year		District and year			District and year		
Number of obs.	963	963	962	962	962	963	962	953

Notes: *** p<0.01; ** p<0.05; * p<0.1; robust standard errors are reported in parentheses below the coefficient estimates and allow for clustering within state-year; "Yield" is output per area cropped (see Data section for details); "Rainfall shock" is the negative of the deviation of annual rainfall from district's historical average normalized by the historical standard deviation within district; "Capital stock" is the value of fixed capital stock at opening of business year; "Materials" and "Fuel" are annual values of intermediate inputs used; "Value added" is the pecuniary value of total output minus intermediate inputs; all dependent variables are trimmed at the 99th percentile of their distributions to remove outliers; dependent variables in columns 4-8 have been converted to thousands of 2009 US dollars; dummy for pro-worker state (main effect) is absorbed by district FE; coefficient on dummy for pro-employer state is identified as Karnataka has variation in labor strictness over time (coefficient not reported).