Working Paper
Series

FINRISK
National Centre of Competence in Research
Financial Valuation and Risk Management

National Centre of Competence in Research
Financial Valuation and Risk Management

Working Paper No. 426

# The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India

**Philippe Aghion** **Robin Burgess**

**Stephen Redding** **Fabrizio Zilibotti**

First version: September 2006
Current version: September 2007

This research has been carried out within the NCCR FINRISK project on
"Macro Risk, Systemic Risks and International Finance"

# The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India*

Philippe Aghion† Robin Burgess‡ Stephen Redding§
Fabrizio Zilibotti¶

September 2007

**Abstract**

We study whether the effects on registered manufacturing output of dismantling the *license raj* – a system of central controls regulating entry and production activity in this sector – vary across Indian states with different labor market regulations and different financial development. To guide the empirical analyisis, we first construct a model of industry equilibrium with financial market imperfections. Then, we test the predictions of our theory. The effects of the industrial policy reform are found to be unequal across Indian states. In particular, following delicensing, industries located in states with pro-employer labor market institutions as well as industries located in financially more developed states grew more quickly than those in pro-worker environments.

*We are grateful to Timothy Besley, Bronwen Burgess, Judith Chevalier, David Donaldson, Rachel Griffith, Elhanan Helpman, Ethan Kaplan, Larry Katz, Sigrid Röhrs, Petia Topalova, Eric Verhoogen, two anonymous referees and seminar participants at Berkeley, Canadian Institute for Advanced Research, East Anglia, European Bank for Reconstruction and Development, IIES Stockholm, LSE, NBER Summer Institute, Princeton, the MacArthur Inequality Workshop, the Society for Economic Dynamics Florence Meeting, Stanford, Tokyo BREAD-CEPR Conference on Institutional Development, Market Integration and Growth, UCL, Yale and the University of Zurich for useful comments and suggestions. Arunish Chawla, Ashwini Natraj, Juan Pablo Rud and Kwok Tong Soo provided excellent research assistance. We thank the National Centre of Competence in Research "Financial Valuation and Risk Management" (NCCR FINRISK), the Research Priority Program on Finance and Financial Markets of the University of Zurich, CEPR, Leverhulme Trust, Bank of Sweden Tercentenary Foundation, STICERD-LSE, Princeton University Department of Economics and UC Berkeley Department of Economics for financial support.

†Department of Economics, Harvard University and CEPR
‡Department of Economics, LSE, CEPR and NBER
§Department of Economics, LSE and CEPR
¶University of Zurich and CEPR

## 1 Introduction

In the post-war period, planned industrialization became a widespread development strategy for tackling economic backwardness. However, in the 1980's, amidst growing dissatisfaction about its results, many developing countries progressively liberalized their economies by dismantling government controls over industry and opening up to trade. Despite the pervasiveness of these reforms, there is little sound empirical evidence on whether and how they interact with local institutions. The same nationwide reform could lead to quite different outcomes depending on the local institutional environment in which it takes place.

To shine light on this issue, this paper examines the interaction between product market deregulation and a variety of local institutions, particularly the organization of labor markets and financial development. We focus on a little studied internal liberalization episode, the dismantling during the 1980's and 1990's of the *license raj* – a system of central controls introduced in 1951 regulating entry and production activity in the registered manufacturing sector. Delicensing reforms were nationwide in scope - a given industry was affected irrespective of the Indian state in which it was located. However, production in a given industrial sector is spread across a number of states. This implies that the institutional environment in which a state-industry is embedded can affect how industrial performance responds to the same delicensing reform. In particular, labor market regulations differ across Indian states. We capture such differences by coding state amendments to the 1947 Industrial Disputes Act as pro-employer, pro-worker and neutral, and looking at indicators of financial market development.

Our main finding is that, following delicensing, industries located in states with pro-employer labor market institutions grew more quickly than those in pro-worker environments. This result stands up to a wide variety of robustness checks. Since pro-worker regulations are, on average, associated with weaker industrial performance, our study shows that dropping barriers to investment and entry via delicensing magnified the disadvantage of states with pro-worker labor market institutions. Likewise, industries located in states with better developed financial markets reacted more positively to the reforms.

Our work relates to several strands of literature. First, several recent papers argue that the impact of pro-competitive reforms on economic performance will vary significantly depending on the technological and institutional environment in which they take place (Acemoglu, Aghion and Zilibotti, 2006; Aghion et al, 2005).[1] Second, there is a new literature which studies the effect of labor or entry regulation on economic performance (Holmes, 1998; Bertrand and Kramarz, 2002; Djankov et al, 2002; Besley and Burgess, 2004; Caballero et al, 2005). Finally, a recent literature analyzes the interaction between product market and labor market regulations (Blanchard and Giavazzi, 2003, Cunat and Melitz, 2005).

[1] In a similar spirit the recent trade literature has studied how heterogeneous firms and industries react differently to trade liberalization (Tybout, de Melo and Corbo, 1991; Pavcnik, 2002; Melitz, 2003; Trefler, 2004; Bernard, Redding and Schott, 2007; Verhoogen, 2007).

## 2 A Simple Model of Industry Equilibrium with Financial Market Imperfections

To guide the empirical analysis of the following sections, we construct a stylized model of industry equilibrium where the reduction of barriers to entry and of regulation to productive activity generates entry, exit and resource reallocation between regions ("states") characterized by different labor market and financial market institutions. Its building blocks are the following. First, firms are heterogenous in productivity and geographical locations. Productivity differences may stem from entrepreneurial skills, availability of local infrastructure, or knowledge embodied in the local labor force. Second, firms face common labor market institutions within each state but institutions vary across states. We capture such differences in a reduced-form fashion by cross-state variation in average unit labor costs: in states with pro-worker (pro-employer) labor markets institutions firms have to pay a higher (lower) wage to otherwise identical workers.[2] Third, firms are subject to entry costs (licence fees) or to regulations constraining their productive capacity. Fourth, there are financial market imperfections implying that firms are subject to credit constraints, limit the number and size of firms in equilibrium. Delicensing is modeled as slashing license fees and removing regulations on firm size.

More formally, we assume that firms are located in two different states, A and B, assumed to be of equal economic size. Neither firms nor workers are mobile across states, while there is a unique nationwide product market.[3] Firms use homogenous labor as their only input, but they differ in their unit labor costs: "good" firms have low unit cost. Labor productivities are drawn from a uniform density function with support, $\theta \in [0, 1]$.

### 2.1 Removing Entry Barriers

In the first part of the analysis, we assume that each active firm produces one unit of output, while in the second part we allow for endogenous production levels. Firms face a barrier represented by a licence fee $b$ to be paid up front before starting production. Because of credit market imperfections, firms cannot borrow to pay for the licence fees, nor can they use their future profits as collateral. Thus, entrepreneurs (firms) must cover entry costs out of their wealth. Wealth, denoted by $\omega$ is uniformly distributed across firms in the interval $[0, \bar{b}]$, and is assumed to be independent of productivity. In particular, $\phi(\omega) = \phi_0 \equiv \bar{b}^{-1}$, for all $\omega \in [0, \bar{b}]$. Given these assumptions, a proportion $b/\bar{b}$ of firms at any productivity level is credit constrained and cannot enter irrespective of their potential profitability.

Consider firms which are unconstrained ($\omega > \bar{b}$). The profit of firm $i$ located in state

[2]Higher labor costs is a catch-all for a variety of regulations to the use of labor that can include flexibility, minimum wages dismissal law, working time conditions etc.. Modelling explicitly labor market institutions is beyond the scope of the stylized model presented in this section.

[3]Measured factor mobility across Indian states are low (see, for example, Topalova, 2005). As discussed in the trade literature, factor mobility is important in determining the incidence of policy reforms (see for example Neary 1978 and Banerjee and Newman 2003).

$s \in \{A, B\}$ is given by

$$\pi_{is} = p - \frac{w_s}{\theta_{is}} - b \tag{1}$$

where $w_s$ denotes unit labor costs. A firm enters if $\pi_{is} > 0$, i.e., if $\theta_{is} \geq \theta_0 \equiv w_s/(p-b)$. We assume that $\theta_0 < 1$, implying that in both states some but not all firms want to enter. Production in state $s \in \{A, B\}$ is

$$S_s(p, b, w_s) = \left(1 - \frac{w_s}{p-b}\right)\left(1 - \frac{b}{\bar{b}}\right). \tag{2}$$

Total supply equals then $S_A(p, b, w_A) + S_B(p, b, w_B)$. The industry equilibrium requires then:

$$D(p) = \left(1 - \frac{b}{\bar{b}}\right)\left(2 - \frac{w_A + w_B}{p-b}\right)$$

where $D(p)$ is the aggregate industry demand. We assume throughout that $D'(p) \leq 0$.

We now analyze the effect of delicensing, i.e., moving from $b > 0$ to $b = 0$. We assume labor market institutions to be more pro-worker in state A than in state B, implying that $w_A > w_B$. We denote by $\Delta S_s$ the post-reform output change in state $s \in \{A, B\}$, and by $p'$ the post-reform equilibrium price. The following Proposition summarizes results in the case with barriers to entry and fixed production at the firm level.

**Proposition 1** *Assume $w_A > w_B$ and $b < \bar{b}$ (barriers to entry are binding for some firms in both states before the reform). Then, delicensing induces production reallocation from state A to state B, namely, $\Delta S_B > \Delta S_A$. Moreover, if the demand is sufficiently inelastic, then $\Delta S_B > 0$ and $\Delta S_A < 0$.*

**Proof of Proposition 1** (a) First, from (2) we immediately get:

$$\Delta S_B - \Delta S_A = (w_A - w_B)\left[\frac{1}{p-b}(1 + \frac{b}{\bar{b}}) - \frac{1}{p'}\right]. \tag{3}$$

Next, let $p' = p'_L$ denote the post-equilibrium price in case of a totally inelastic demand, $D(p) \equiv \overline{D}$, calculated by setting $\Delta S_B + \Delta S_A = 0$. This yields:

$$p'_L = \left[\frac{1}{p-b}\left(1 + \frac{b}{\bar{b}}\right) - \frac{b}{\bar{b}}\left(\frac{2}{w_A + w_B}\right)\right]^{-1}.$$

Now, substituting for $p' = p'_L$ into (3) gives:

$$\Delta S_B - \Delta S_A|_{D(p)=\overline{D}} = 2\frac{w_A - w_B}{w_A + w_B}\frac{b}{\bar{b}} > 0.$$

Clearly, if $\Delta S_B - \Delta S_A]_{D(p)=\overline{D}} > 0$, then, *a fortiori,* $\Delta S_B - \Delta S_A > 0$ in general since $D'(p) < 0$ implies that $p' \geq p'_L$.
(b) In the limit case where demand is totally inelastic, with $D(p) \equiv \overline{D}$, we have

$$\Delta S_B + \Delta S_A = 0.$$

This, together with

$$\Delta S_B - \Delta S_A > 0$$

immediately implies that $\Delta S_B > 0$ and $\Delta S_A < 0$. This establishes the proposition. QED

The liberalization reform causes high-productivity firms which were previously credit-constrained to enter in both states, but more so in $B$ where labor costs are lower. The entry of these firms works as an aggregate supply shock causing a movement along the downward-sloped demand curve. Thus, the equilibrium price falls, and this, in turn, triggers the exit of less productive incumbents. Although there is exit in both states, the entry flow of high-productivity firms is larger in $B$. This results in the number of firms and output rising in $B$ relative to $A$, and possibly falling in $A$ if the demand is sufficiently inelastic.

### 2.2 Allowing Firms to Expand Capacity

An important piece of the Indian delicensing reform is the elimination of costs and barriers to the expansion of productive capacity in existing firms. A version of the model with variable production at the firm level can be used to generate predictions on the effects of this aspect of the liberalization package. In particular, we now assume that firms face the following production function:

$$y = x^{\alpha},$$

where $x$ denotes the effective units of labor hired, and $\alpha < 1$. Decreasing returns to x reflect the presence of fixed factors of production. For simplicity, we abstract here from barriers to entry ($b = 0$). As before, "good" firms have lower unit labor costs, namely, they need fewer workers to attain a given number of effective units of labor. If unconstrained, firms would set their optimal production level such that the marginal product of labor equals the unit labor cost, i.e., $\alpha x^{\alpha-1} = w/(p\theta)$, or, identically,

$$y = \left(\frac{\alpha p \theta}{w}\right)^{\frac{\alpha}{1-\alpha}}.$$

However, prior to delicensing, prohibitive barriers prevent firms from expanding production above the level $\bar{y}$. Since, absent constraints, more productive firms would produce more output, this ceiling is binding for high-productivity firms but not for low-productivity ones. As before, we assume that $w_A > w_B$. Prior to delicensing, production in State $s \in \{A, B\}$ equals:

$$S_s(p, \bar{y}, w) = \int_0^{\tilde{\theta}_s} \left(\frac{\alpha p \theta}{w_s}\right)^{\frac{\alpha}{1-\alpha}} d\theta + \left(1 - \tilde{\theta}_s\right) \bar{y} = \left(1 - \alpha \tilde{\theta}_s\right) \bar{y}, \tag{4}$$

where[4]

$$\tilde{\theta}_s = \min\left[\frac{w_s}{\alpha p}\bar{y}^{\frac{1-\alpha}{\alpha}}, 1\right] \tag{5}$$

is the threshold productivity level such that the production ceiling is binding for all firms with $\theta > \tilde{\theta}_s$. We assume that prior to reform the ceiling $\bar{y}$ is binding for a positive measure of firms in both states, namely, $\tilde{\theta}_B < \tilde{\theta}_A < 1$.

Delicensing eliminates the ceiling $\bar{y}$, causing an expansion of output in more productive firms. After-reform production is captured in the model by letting $\bar{y} \to \infty$ and, consequently, $\tilde{\theta}_s = 1$ in (4)-(5). Standard algebra (using the definition of $\tilde{\theta}_s$) shows that

$$S_s(p', \infty, w) = \int_0^1 \left(\frac{\alpha p'\theta}{w_s}\right)^{\frac{\alpha}{1-\alpha}} d\theta = (1-\alpha)\left(\frac{p'}{p}\right)^{\frac{\alpha}{1-\alpha}} \tilde{\theta}_s^{-\frac{\alpha}{1-\alpha}} \bar{y}.$$

As above, let $\Delta S_s$ denote the output change, namely, $\Delta S_s \equiv S_s(p', \infty, w) - S_s(p', \bar{y}, w)$

The following Proposition can be established.

**Proposition 2** *Assume $w_A > w_B$ and $\tilde{\theta}_A < 1$ (production ceilings are binding for some firms in both states before the reform). Then, the elimination of barriers to production induces production reallocation from state A to state B, namely, $\Delta S_B > \Delta S_A$. Moreover, if the demand is sufficiently inelastic, then $\Delta S_B > 0$ and $\Delta S_A < 0$.*

**Proof of Proposition 2** First, note that for $s \in \{A, B\}$,

$$\Delta S_s = (1-\alpha)\left(\frac{\alpha p'}{w_s}\right)^{\frac{\alpha}{1-\alpha}} - \left(\bar{y} - \frac{w_s}{p}\bar{y}^{\frac{1}{\alpha}}\right).$$

Let $\zeta \equiv w_B/w_A$, so that $\zeta \in (0,1)$. Then:

$$\begin{aligned} \Delta S_B - \Delta S_A &= (1-\alpha)\left(\frac{\alpha p'}{w_A}\right)^{\frac{\alpha}{1-\alpha}}\left(\zeta^{-\frac{\alpha}{1-\alpha}} - 1\right) \\ &\quad -(1-\zeta)\bar{y}^{\frac{1}{\alpha}}\frac{w_A}{p}. \end{aligned} \tag{6}$$

In the inelastic demand case where $\Delta S_B + \Delta S_A = 0$, we have

$$(1-\alpha)\left(\frac{\alpha p'_L}{w_A}\right)^{\frac{\alpha}{1-\alpha}} = \frac{2\overline{y} - (\zeta+1)\bar{y}^{\frac{1}{\alpha}}\frac{w_A}{p}}{\zeta^{-\frac{\alpha}{1-\alpha}} + 1}. \tag{7}$$

[4]The second equality is obtained by noting that, using repeteadly the definition of $\tilde{\theta}_c$:

$$\begin{aligned} &\int_0^{\tilde{\theta}_c}\left(\frac{\alpha p\theta}{w_c}\right)^{\frac{\alpha}{1-\alpha}} d\theta + \left(1-\tilde{\theta}_c\right)\bar{y} = \left(\frac{\alpha p}{w_c}\right)^{\frac{\alpha}{1-\alpha}}(1-\alpha)\,\tilde{\theta}_c^{\frac{1}{1-\alpha}} + \left(1-\tilde{\theta}_c\right)\bar{y} \\ = \;& (1-\alpha)\frac{w_c}{\alpha p}\bar{y}^{\frac{1}{\alpha}} + \left(1-\tilde{\theta}_c\right)\bar{y} = \left(1-\alpha\tilde{\theta}_c\right)\bar{y} \end{aligned}$$

Next, replacing $p'$ in (6) by the expression of $p'_L$ implied by (7), and simplifying terms, we obtain:

$$\Delta S_B - \Delta S_A|_{D(p)=\overline{D}} = \frac{2\bar{y}}{\zeta^{-\frac{\alpha}{1-\alpha}}+1}\left(\zeta^{\frac{\alpha}{-1+\alpha}} - 1 - \bar{y}^{\frac{1-\alpha}{\alpha}}\frac{w_A}{p}\left(\zeta^{-\frac{\alpha}{1-\alpha}} - \zeta\right)\right) \quad (8)$$

$$\geq \frac{2\bar{y}}{\zeta^{-\frac{\alpha}{1-\alpha}}+1}\left(\zeta^{\frac{\alpha}{-1+\alpha}} - 1 - \frac{\alpha p}{w_A}\frac{w_A}{p}\left(\zeta^{-\frac{\alpha}{1-\alpha}} - \zeta\right)\right) \quad (9)$$

$$= \frac{2\bar{y}}{\zeta^{-\frac{\alpha}{1-\alpha}}+1}\Phi(\zeta) > 0, \quad (10)$$

where $\Phi(\zeta) \equiv \left(\zeta^{\frac{\alpha}{-1+\alpha}} - 1 - \alpha\left(\zeta^{\frac{\alpha}{-1+\alpha}} - \zeta\right)\right)$. The inequality (9) follows from the definition of $\tilde{\theta}_A$ given in (5), from the assumption that $\tilde{\theta}_A < 1$, implying that $\bar{y}^{\frac{1-\alpha}{\alpha}} \leq \alpha p/w_A$, and from the fact that, since $\zeta^{-\frac{\alpha}{1-\alpha}} > \zeta$, the right hand-side of (8) is decreasing in $\bar{y}^{\frac{1-\alpha}{\alpha}}$. The inequality (10) follows from the fact that, in the range $\zeta \in (0,1)$, $\Phi'(\zeta) < 0$, and from the fact that $\Phi'(1) = 0$ (thus, $\Phi(\zeta) > 0$ in the relevant range). Finally, since $p' \geq p'_L$, by (6), $\Delta S_B - \Delta S_A|_{D(p)=\overline{D}}$ is a lower bound to $\Delta S_B - \Delta S_A$. $\Delta S_B - \Delta S_A|_{D(p)=\overline{D}} > 0$ implies therefore that $\Delta S_B > \Delta S_A$ for any demand elasticity, establishing the first part of the proposition. The second part follows from the same argument as in the proof of Proposition 1.QED

Slashing production ceilings causes an expansion in the production of high-productivity firms which were previously constrained, and a fall in the equilibrium price. Low-productivity firms which were previously unconstrained react by reducing their output. Note that if production were subject to fixed costs, some firms would actually exit. On average, production expands more in state $B$ (due to lower labor costs), and possibly falls in state $A$.

In reality, the Indian reforms entailed both the reduction of barriers to entry and the elimination of controls on the productive capacity of firms. Thus, our theory predicts that the delicensing triggers both the entry of new firms – accompanied by the exit of less productive incumbents – (Proposition 1) and the expansion of more productive firms – accompanied by the contraction of less productive ones – (Proposition 2). Both effects give rise to a reallocation of economic activity. Within each industry, output, employment and the number of factories expand more in regions where labor costs are lower. Activity will expand less, and possibly fall, in regions where labor costs are higher. It is these predictions that we shall confront in the next sections with Indian state-industry panel data.

The idea that market liberalization favors the more productive firms at the expense of the less productive ones is reminiscent of Melitz (2003). In his theory, firms with heterogenous productivities can either produce for the domestic market or export. Trade liberalization is modelled as either a reduction in the per-unit iceberg cost of export, or a reduction in the fixed cost of exporting. A reform reducing either of these costs causes more productive firms to expand production whereas it forces the less productive firms

to exit or shut down.[5] Unlike in our model, in Melitz's model there is only one factor market and firm-level productivity is the only source of heterogeneity. Thus, his theory has no prediction on the interplay between liberalization and the heterogeneity in labor markets. Moreover, his emphasis is on trade liberalization, not on delicensing.

## 3 Background and Data

The centerpiece of centrally-planned industrialization in India was the Industries (Development and Regulation) Act of 1951 which brought all key industries in the registered manufacturing sector under central government control via industrial licensing. Under the Act an industrial license was required to establish a new factory, significantly expand capacity, start a new product line or change location (see Hazari, 1966; Bhagwati and Desai, 1970; Malik, 1997). This allowed the government to allocate plan production targets to firms. Figure 1 uses statements on industrial policy, press notes and notifications issued by the federal government to code when different three-digit industries were exempted from industrial licensing.[6]

A first delicensing wave occurred following Rajiv Gandhi's unexpected rise to power after the assassination of his mother Indira in 1984. He was an unknown quantity – an airline pilot with no political experience – who turned out to be a reformer (Rodrik and Subramanian, 2004). It was under his government, in 1985, that about one third of all three-digit industries were delicensed. In May 1991 Rajiv Gandhi was himself assassinated in an election campaign which subsequently returned the Congress party to power. His successor Narasimha Rao, faced with a balance of payment crisis and external pressure from an IMF-imposed structural adjustment program, launched a major liberalization program. Industrial licensing was effectively abolished in 1991 except for a small number of industries where it was retained "for reasons related to security and strategic concerns, social reasons, problems related to safety and over-riding environmental issues, manufacture of products of hazardous nature and articles of elitist consumption" (Government of India, 1991). As was the case with Rajiv Gandhi, the depth of the reformist tendencies of the Rao government was largely unanticipated. The 1985 and 1991 delicensing waves are clearly visible in Figure 1. There is little action away from these leadership transitions. Table 1 documents that the share of output and employment in delicensed industries rises first in 1985 and then again post-1990.

¿From 1991 onwards tariff barriers were also slashed (Krishna and Mitra, 1998; Topalova, 2005). In order to separate the effects of delicensing from those of trade liberalization, we construct a measure of the actual tariff rate applied by customs officials at the Indian border by combining basic, auxiliary and countervailing rates of

[5] In his model, the reduction in trade costs induces entry by more productive firms which can afford the fixed exporting cost. This increases domestic labor demand and therefore the real domestic wage rate, which in turn forces more low productivity firms to exit, as their profit margins become too small for them to cover their fixed production costs.

[6] Table A1, which is available as a web-based Appendix, provides the detail on how the delicensing variable was coded for each three-digit registered manufacturing industry. See Table 1 for summary statistics of the main variables and the Data Appendix for further information on variable definitions and data sources.

duty for each three-digit industry between 1980 and 1997. These provide us with a direct measure of the evolving Indian trade policy regime and enable us to control for the effects of trade liberalization in our regressions. In Table 1 we see how our applied tariff measure is high and relatively flat across the 1980-1990 period and then falls dramatically post-1990 (starting in 1991).

We match our delicense and tariff measures with state-industry panel data on the registered manufacturing sector for the period 1980-1997 drawn from the Annual Survey of Industries.[7] This is the most disaggregated level at which one can obtain representative data on industrial performance across the pre- and post-delicensing periods. The sampling unit is a state and three-digit industry pair, so that the data are representative at the state-three-digit industry level. To minimize the role played by industry entry and exit in explaining our results we restrict our attention to a balanced panel of state-industries on which data exist for all eighteen years of our data set.[8] This gives us 18,324 observations on an average of 64 three-digit industries in each of the 16 main Indian states over an 18-year time period.[9] These sixteen states account for over 95 percent of the Indian population.

We want to examine whether the impact of delicensing is heterogeneous depending on the institutional conditions in a state. To capture the institutional environment we exploit the fact that India is a federal democracy and, under the Indian Constitution of 1950, industrial relations is a concurrent subject, namely, it is under the joint jurisdiction of central and state governments. The key piece of central legislation is the Industrial Disputes Act of 1947 which sets out the conciliation, arbitration and adjudication procedures to be followed in the case of an industrial dispute. This Act has been extensively amended by state governments during the post-Independence period. Thus, although all states have the same starting point, they have diverged from one another over time. Following Besley and Burgess (2004) we code each state amendment as neutral (0), pro-worker (+1) or pro-employer (-1). Having obtained the net direction of amendments in any given year, we cumulate the scores over time to give a quantitative picture of how the regulatory environment evolved over the 1947-1997 period.

The results for the 1980-1997 period are displayed in Figure 2. A number of states are already above or below the zero line in 1980 since we are coding from 1947. There is a striking heterogeneity in labor regulation across Indian states. There are six 'neutral' states (Assam, Bihar, Haryana, Jammu and Kashmir, Punjab and Uttar Pradesh) that do not experience any amendment in either direction (in Figure 2, these are the states with flat lines at zero). Among those that have passed amendments, our method classifies

[7]Under the Factories Act of 1948 enterprises are required to register if either they have more than ten employees and electric power or have more than twenty employees and no electric power. Smaller enterprises below these size thresholds are classified as part of unregistered manufacturing and are not covered by the Annual Survey of Industries. In our sample period, registered manufacturing makes up about 9 percent of total state output and unregistered manufacturing around 5 percent.

[8]As we are interested in comparing performance across states within industries we also restrict our attention to industries that exist in at least five states in each year of the sample.

[9]We check that all our results are robust to running regressions on an unbalanced panel where industries are in the data for at least ten years and are active in at least five states. This raises our sample size to 24,374 observations.

six states (Andhra Pradesh, Karnataka, Kerala, Madhya Pradesh, Rajasthan and Tamil Nadu) as moving in a "pro-employer" direction. In Figure 2 these states lie below the zero line. This leaves four states (Gujarat, Maharashtra, Orissa and West Bengal) which move in a "pro-worker" direction and lie above the zero line.

Finally, we stress that both labor regulations and the system of industrial licensing only apply to the registered manufacturing sector. It is also the case that the Annual Survey of Industries, which we use to track state-industry performance, only covers production activity in the registered sector. Our data are therefore well-suited to examine how product market deregulation, in the form of delicensing, interacts with heterogeneous state-level labor institutions in shaping the pattern of industrial development across Indian states. We turn to this task in the next section.

## 4 Empirical Analysis

### 4.1 Method

We begin with a baseline specification:

$$y_{ist} = \alpha_{is} + \beta_t + \gamma d_{it} + \mu r_{st} + \theta(r_{st})(d_{it}) + \varepsilon_{ist}, \tag{1}$$

where $y_{ist}$ is a (logged) three-digit state-industry outcome variable, $d_{it}$ is a dummy variable which switches on (i.e., takes the value of unity) in the year a three-digit industry is delicensed (see Figure 1) and then stays on thereafter, $r_{st}$ is the labor regulation measure measured in state $s$ at time $t$ (see Figure 2), $\alpha_{is}$ are state-industry fixed effects which control for any unobserved time-invariant determinants of state-industry performance (e.g. natural endowments, location), $\beta_t$ are year dummies which control for common macroeconomic shocks and $\varepsilon_{ist}$ is a stochastic error. The main industry outcome variable we examine is output, though we also look at the number of factories, employment and fixed capital.

Our interest centers on the delicense-labor regulation interaction coefficient ($\theta$) which captures the role of state-specific labor regulation in mediating the impact of the delicensing reform. A concern with the baseline specification (1) is that the interaction term might be picking up time-varying industry or state effects that are due to factors other than the delicensing reform or labor regulations in the Indian states. To address this concern, we augment the baseline specification with state-year and industry-year interactions. Our preferred augmented specification takes the form:

$$y_{ist} = \alpha_{is} + \beta_{st} + \eta_{it} + \theta(r_{st})(d_{it}) + \varepsilon_{ist} \tag{2}$$

where $\beta_{st}$ are state-year interactions and $\eta_{it}$ are industry-year interactions. Including these controls precludes estimating the level effects of labor regulation and delicense, respectively. The coefficient of interest ($\theta$) is identified by the mix of industry-year variation in delicensing interacted with state-year variation in labor regulation.[10]

[10] As is evident from Figure 2, there is limited time variation in labor regulation over the period 1980-1997. Thus, much of our identification is coming from the interaction between delicensing and initial (pre-delicensing) differences in state labor regulation.

We cluster the standard errors by state and year of delicensing. This is not only to address serial correlation concerns (and to allow for heteroskedasticity) but also to take account of the fact that delicensing is highly clustered in time. Delicensing happened overwhelmingly in 1985 and 1991, implying that different industries within a state in these years cannot be treated as independent observations.

### 4.2 Results

To examine the average effect of delicensing across all Indian states, we begin by considering, in Table 2, a specification without the interaction term. The coefficient on delicense indicates how an industrial outcome changes in industries that delicensed relative to those where licensing was retained. If the licensing system was acting as a barrier to entry we would expect its removal to be associated with an increase in entry in delicensed versus still-licensed industries. We check this in columns (1) to (3) where the number of factories is the dependent variable.[11] In column (1), which includes state-industry fixed effects and year dummies, we find that delicensing leads to a statistically significant increase in the number of factories within an industry of around 6 percent. The delicensing reform therefore does appear to have had bite in terms of encouraging entry. In column (2) we include state-year interactions to control for time-varying effects of state characteristics. The coefficient remains positive and significant, and of a similar magnitude. In column (3) we include labor regulation as an additional regressor in a specification with state-industry and year fixed effects. The coefficient on labor regulation is negative and significant, indicating that states that have moved in a pro-worker direction experience less net entry relative to pro-employer states. The coefficient on delicense remains positive and significant, and of a similar magnitude. Delicensing and pro-worker labor regulation are thus pulling in opposite directions in determining the number of factories operating in state-industries.

Columns (4) to (6) examine the average effect of delicensing on output. In column (4), which includes state-industry fixed effects and year dummies, we find a positive, but not statistically significant effect of delicensing. The pattern is similar when we include state-year interactions in column (5) and labor regulation in column (6). The small average effect on output, however, may be masking substantial heterogeneity of delicensing effects depending on the institutional conditions in Indian states. Output may have risen in some states and fallen in other states in response to the same nationwide delicensing reform. To examine this possibility we added interactions between state fixed effects and delicense to the three output regressions reported in Table 2. In the column (4) specification, for example, the coefficient on this interaction is positive in nine states and negative in seven states – delicensing led to a rise in output in some states and a fall in output in other states (relative to industries where licensing was retained).[12] We also

[11] Unfortunately, we do not observe separate entry and exit flows, but changes in the number of factories operating in a state-industry provide us with a measure of net entry.

[12] Eleven of the individual delicense-state interactions are statistically significantly different from zero at the 5 percent level. We can reject the null hypothesis that the coefficient on delicense is the same across states at the 1 percent level. In the interest of brevity we do not report the individual coefficients on the delicense-state interactions.

find a similar pattern of effects for employment and fixed capital – the average effect of delicensing is small and insignificant but hides considerable heterogeneity across states.

The big question is then which elements of a state's make-up affect how industries within its jurisdiction respond to delicensing. Of particular interest, would be policies and institutions over which state governments exercise some control. In column (6) of Table 2 we find that regulation in a pro-worker direction is associated with lowered output relative to regulating in a pro-employer direction. This lines up with a growing body of evidence which suggests that labor regulation affects industrial performance across Indian states.[13] The question examined in this paper is whether state-specific labor institutions influence how nationwide delicensing impacts industrial performance across states.

Column (1) of Table 3 estimates our baseline specification (1) including state-industry and year fixed effects for real output. The coefficient on the delicense-labor regulation interaction is negative and statistically significant. This tells us that when delicensing occurred, industries in states with pro-employer regulation experienced larger increases in output relative to those located in pro-worker states. Column (2) presents results from our preferred augmented specification (2), which includes state-industry, state-year and industry-year interactions, so that identification is coming from the mix of industry-year variation in delicensing and state-year variation in labor regulation. The interaction coefficient remains negative and significant, indicating that liberalization leads to larger economic improvements where labor regulations are more pro-employer. This is the key result in the paper. Given the demanding nature of the specification we regard this result as compelling evidence that labor regulations passed over time at the state level affected how industries responded to a nationwide delicensing experiment.[14]

We checked that our findings are not driven by individual states by sequentially excluding each state from the sample and re-estimating the column (2) specification. In each case the estimated coefficient on the interaction term between delicense and labor regulation remains significant at the 5 percent level and is not statistically significantly different from the estimate for the full sample. This suggests that our results capture a general relationship between industrial performance, delicensing and labor market institutions rather than the influence of individual states. In column (3) we consider a less-demanding clustering strategy, which clusters the standard errors at the state-industry level (see Bertrand, Mullainathan and Duflo 2004). This reduces the standard errors slightly, rendering the coefficient significant at the 1 percent level.[15]

[13]Besley and Burgess (2004) show that states which amended in a pro-worker direction in the pre-1992 period experienced greater industrial unrest and lowered output, employment, investment and productivity in registered manufacturing. In contrast, output in unregistered manufacturing increased. Labor regulation therefore seems to be picking up something specific to the institutional environment facing firms in registered manufacturing. Unfortunately data on unregistered manufacturing is not available at the state-industry level across our period.

[14]A model developed in the working paper version of the paper helps us to understand this key result. Delicensing encourages firm entry and expansion but more so in pro-employer states. The falls in price that ensue lead to exit and contraction of less productive firms particularly in pro-worker states. The net effect is a reallocation of economic activity towards pro-employer states (see Aghion, Burgess, Redding and Zilibotti, 2006).

[15]We have checked all our results using both clustering strategies and find an almost identical pattern

One potential concern is that state labor regulations are responding to changes in industrial development following delicensing. Therefore, column (4) considers a specification where we interact delicense with state labor regulations in 1980 before delicensing occurred. State-level amendments to the Industrial Disputes Act are coded and cumulated from 1947, so column (4) is asking whether pre-delicensing cross-state variation in labor regulation affected how industries responded to delicensing in subsequent years. The interaction coefficient continues to be negative and significant, indicating that industries located in states classified as pro-employer in 1980 tended to grow more quickly, relative to their counterparts in pro-worker states, after they were delicensed.

To provide further evidence against a feedback from industrial development to labor regulation, we exploit the instrumental variables estimation strategy of Besley and Burgess (2004). Following a Supreme Court ruling, which found Indira Gandhi's Congress party guilty of election fraud, she imposed martial law and suspended elections between 1975 and 1977. When state elections resumed she and her party were heavily punished – ten of the sixteen states in our data switched from Congress to non-Congress majorities. The new governments brought new ideas and we observe a flurry of labor regulation activity following this political shock. We use interactions between a post-1977 dummy variable and pre-1977 mean unionization in a state and between the post-1977 dummy and patterns of land tenure in British India (from Banerjee and Iyer, 2005) as our two instruments for state labor regulation. Unionization and historical land tenure both affected how politics had evolved in each state and hence the direction of labor regulation when political competition intensified post-1977.

Our IV strategy is to predict labor regulation using a first-stage regression, which includes our two instruments, state fixed effects and year dummies, for the period 1958-1997.[16] We then interact the predicted value of labor regulation with delicense and include it in our second-stage regression. The result is in column (5) for our augmented specification (2).[17] The estimated coefficient on the delicense-labor regulation interaction is of a similar magnitude to before and statistically significant at the 5 percent level, supporting our interpretation of the interaction term as capturing the role of state-specific labor regulation in determining the heterogeneous impact of delicensing.

In Column (6) we include a set of interactions between each state dummy and delicense. These interactions control for all fixed state characteristics which affect how industries respond to delicensing, including cross-state differences in labor regulation at the beginning of our sample period. Identification of the interaction coefficient now solely comes from changes in labor regulation during the sample period. Even with this limited variation (see Figure 2) the coefficient remains negative and significant indicating that, after being delicensed, industries located in states which moved in a pro-employer direction experienced greater output growth relative to those located in states which

of effects. We adopt the more demanding strategy in the paper as this takes account of the fact that delicensing occurs predominately in 1985 and 1991.

[16]The $F$ statistic on the excluded instruments in the first-stage regression is 7.27 (this is a state-year regression, with standard errors clustered on state), indicating that the instruments have some power in explaining the direction of labor regulation.

[17]Standard errors in column (5) have been corrected to take account of the fact that predicted labor regulation is generated in a first-stage regression.

moved in a pro-worker direction.

Results for two alternative measures of industrial performance – total employment and fixed capital – are presented in columns (7) and (8) using our augmented specification (2). We find that pro-worker states experience less employment growth and investment relative to pro-employer states following delicensing.

Our results demonstrate that liberalization had unequal effects across Indian states, and accentuated the importance of labor regulation in determining the trajectory of industrial activity in India. To gauge the economic significance of our findings we construct a counterfactual of what would have happened to the distribution of output across Indian states had delicensing had no heterogenous effects in states with different labor regulations. To do this we first construct fitted values for log output from our preferred specification in column (2) of Table 3. We next construct a counterfactual series for log output without heterogeneous effects of delicensing (by falsely assuming that $\theta(r_{st})(d_{it}) = 0$ in column (2) of Table 3).[18] Taking exponents and summing across industries within each state allows us to compare the evolution of state output with and without heterogeneous effects of delicensing.

Figure 3 displays the ratio of the fitted to the counterfactual series multiplied by a hundred. Percentage deviations from a value of one hundred are therefore attributable to the heterogeneous effects of delicensing in states with different labor regulations. As Figure 3 demonstrates the differential effects of the reform on industrial performance are sizeable. The largest relative increases in output following delicensing are found in Andhra Pradesh and Tamil Nadu, the states with the most pro-employer labor regulations. Output in Andhra Pradesh and Tamil Nadu, is around 11 percent higher in 1997 relative to the counterfactual. In contrast, output in West Bengal and Maharashtra, the states with the most pro-worker regulations, is 19 percent and 10 percent lower. Similar results are found for employment and fixed capital.[19]

The results paint a consistent picture. State labor regulations affected in a sizeable fashion the relative development of registered manufacturing across Indian states following the delicensing episodes of the 1980's and 1990's.

### 4.3 Financial Development, Trade and Robustness Checks

A potential concern with our results is that the delicense and labor regulation variables may be picking up the effects of omitted variables which vary by industry-year and state-year and are correlated with state-industry output.

Liberalization in 1991 in India came as a package. It is therefore important to check that our delicense-labor regulation results are robust to controlling for the potentially heterogeneous effects of other elements of the liberalization package. Trade liberalization was a central element of the 1991 reforms and import tariffs, which are set centrally but

[18] Since industry-year and state-year effects absorb, respectively, the level effects of delicensing and labor regulation, the difference between the fitted and counterfactual series can only identify the heterogeneous effects of delicensing.

[19] Our estimates imply that, relative to the counterfactual, employment in 1997 is 10 percent higher in Andhra Pradesh and Tamil Nadu, and 18 percent lower in West Bengal. Similarly fixed capital is 11 percent higher in Andhra Pradesh and Tamil Nadu and 20 percent lower in West Bengal.

vary across industries and time, are an area of particular concern (see Krishna and Mitra, 1998; Topalova, 2005). We would therefore like to control for this other form of product market deregulation.

In column (1) of Table 4 we find a negative but statistically insignificant average effect of tariffs on output.[20] This lines up with the weak direct effects of delicensing on output that we observe in Table 3. As before the coefficient on labor regulation is negative and significant. In column (2) of Table 4 we interact tariffs with labor regulation in the baseline specification (1). The estimated interaction coefficient is positive and significant. This would suggest that, within each industry, tariff reductions led to output expansion in pro-employer states relative to pro-worker states. This result, however, is not robust in the augmented specification (2) which includes state-year and industry-year interactions (column (3)).

In columns (4)-(5) of Table 4 we include the interaction of labor regulation with both tariff and delicense alongside one another, using the baseline and augmented specification, respectively. In both specifications the delicense-labor regulation interaction remains negative and significant, indicating robustness to controlling for the interaction of trade liberalization with labor regulation. The tariff-labor regulation interaction is not significant in either column (4) or (5).

We have carried out a parallel exercise to control for foreign direct investment reforms which is reported in Table A2 in a web-based Appendix. To capture liberalization in this arena we record, from 1991 onwards, how many six-digit products within a three-digit industry were opened to automatic approval of FDI (up to 51 percent equity). Our measure takes a value of zero before 1991 when FDI was strictly controlled. In Table A2 we see that, when we include our FDI reform measure interacted with labor regulation alongside the delicense-labor regulation and tariff-labor regulation interactions, we find that the delicense-labor regulation interaction remains significant (and of similar magnitude to our earlier results in Table 3) for both the baseline and augmented specifications. In contrast, the FDI reform-labor regulation and tariff-labor regulation interactions are both insignificant (see columns (4) and (5) of Table A2).

Another concern is that labor regulation may be a proxy for other state-level policies and characteristics influencing the impact of delicensing on industrial performance within each state. Table 5 attempts to deal with such concerns. For simplicity, we restrict our attention to the augmented specification (2). In column (1) we include the interaction of delicense with state development expenditure and with a measure of state financial development. Development expenditure includes state spending on health, education and infrastructure and helps crudely to measure differences in state government investment in these activities across time. For financial development we use the instrumented state-level bank branch expansion measure from Burgess and Pande (2005). This captures the expansion of bank branch networks into locations with no banks across Indian states driven by the introduction (in 1977) and removal (in 1990) of a branch licensing rule.[21] It thus allows us to sidestep some of the problems associated with the

[20]The slight difference in the number of observations between Table 4 and Table 3 is due to the fact that there are a small number of three-digit industries for which tariff data is unavailable.

[21]Between 1977 and 1990 the Indian Central Bank imposed a licensing rule which required that for

fact that financial development is endogenous to industrial development whilst controlling for this potentially important determinant of industrial performance (see Acemoglu and Zilibotti, 1997; Aghion, Howitt and Mayer-Foulkes, 2005; Manova, 2006).

The coefficient on the delicense-development expenditure interaction is positive and significant suggesting that within each industry, states with larger development expenditures tend to gain more from the delicensing reform relative to those that spend less. The delicense-financial development coefficient is also positive and significant suggesting that states which had made greater inroads in expanding access to finance benefited from delicensing relative to those where bank branch expansion had been less marked. The coefficient on the delicense-labor regulation interaction, however, remains negative and significant, and similar in magnitude to before, when we include these controls. The labor regulation measure does not appear to be just picking up the propensity of state governments to promote health and education, develop infrastructure or expand access to finance.

Labor market regulations may also be correlated with the technological level of industries in a given state. To address this concern we construct a dummy for whether a state-industry is in the top, middle or bottom tercile of the cross-state distribution of labor productivity for a given year. We then interact the top and bottom-tercile dummies with our delicense measure omitting the middle-tercile interaction which serves as a reference. In column (2) we see that being in the top tercile is associated with a larger increase in output after delicensing relative to being in the middle tercile.[22] Being in the bottom tercile is associated with smaller increases. Both effects are large in magnitude and highly statistically significant. Technological level clearly has a bearing on which state-industries in a three-digit sector benefit from delicensing. Controlling for technology, however, has little effect on the delicense-labor regulation interaction term which remains negative and significant. The direction of labor regulation in a state does not appear to be just proxying for how technologically advanced industries in a state are.

Many aspects of the policy environment are difficult to measure. In column (6) of Table 3 we have shown that our results are robust to including delicense-state interactions which control for the role that unobserved time-invariant state characteristics may have played in mediating the impact of delicensing. Unobserved time-varying state policies, however, remain a concern. As a further robustness check, we therefore add in controls for the political complexion of states on the grounds that policies towards the registered manufacturing sector are likely to be correlated with political outcomes. We expect past political outcomes to matter as they determine the attitude towards business that prevails in the bureaucracy and polity. This attitude will affect a range

each branch opened in a banked location four had to be opened in unbanked locations. Burgess and Pande (2005) use the number of bank branches per capita in 1961 interacted with (i) a post-1976 time trend and (ii) a post-1989 time trend as instruments for state-level bank branch expansion. Standard errors in columns (1) to (3) of Table 5 have been adjusted to take account of the fact that predicted financial development is generated in a first-stage regression.

[22]This finding is consistent with the theory of Acemoglu, Aghion and Zilibotti (2006) who argue that the removal of entry barriers favors the performance of firms and industries that are closer to the technological frontier, while it may harm less advanced ones. See also Aghion and Griffith (2005) for corresponding UK evidence.

of policy actions that we cannot observe in our data. We therefore assemble a picture of each state's "political history" as measured by the number of years since 1957 that particular political groupings have held a majority of the seats in the state legislature. The relevant groupings for this exercise are: the Congress party, the Janata parties, hard left parties, hindu parties and regional parties. The results are in column (3), which also contains the full set of controls for development expenditure, bank branch expansion and technology from columns (1) and (2). The coefficient on the interaction between delicense and labor regulation remains negative and significant when we control for the interaction between delicense and state political histories. The same result holds if we use contemporaneous share of seats held in state assemblies in these five groupings interacted with delicense.[23]

The timing of delicensing varies across industries. A natural question to ask is whether the actual year in which industries are delicensed matters. To investigate this we run a Monte Carlo simulation in which we draw a random year in which an industry is delicensed from the empirical distribution of delicensing years. We do this for each three-digit industry, thus creating a random or "placebo" delicense measure. We repeat this process to generate one hundred placebo delicense measures. For each of the placebo measures the probability of an industry being delicensed in a given year matches that in the actual data (see Figure 1) but we randomize over the identities of industries.

In a first falsification exercise we then estimate our augmented (2) regression specification using the placebo delicense measures in the place of our actual delicense measure. In ninety-three of the one hundred regressions, we find that the placebo delicense-labor regulation interaction has a lower absolute $t$ statistic than the actual delicense-labor regulation interaction (from column (2) of Table 3). In a second falsification exercise we include both the actual and placebo delicense measures interacted with labor regulation in our augmented (2) regression specification. The actual delicensing-labor regulation interaction is significant at the 5 percent level in ninety-eight of the one hundred regressions, whereas the placebo delicense-labor regulation interaction is significant at the 5 percent level in only seven of the regressions. The results of both falsification exercises serve as compelling evidence that the actual timing of when industries are delicensed is central to our main empirical result.[24]

A final concern is that the sequencing of delicensing may be driven by the underlying performance of industries. The fact that delicensing was a centrally-managed technocratic reform which was, in part, triggered by largely unexpected shocks (Rajiv Gandhi's sudden rise to power and the IMF-imposed structural adjustment program under Narasimha Rao) helps to allay the concern that industries may have acted in an-

[23]As part of a wider sensitivity analysis, not reported in the paper, we included all of the following additional variables interacted with delicense in columns (1) to (3) of Table 5: (i) the constituent health, education and other expenditure elements of development expenditure (to more finely control for state-government spending behavior), (ii) the proportion of people below the poverty line in a state (to capture overall backwardness), (iii) state-specific differences between industrial and agricultural electricity tariffs (to capture cross-subsidization of agriculture) and (iv) cumulative state land reform acts from Besley and Burgess (2000) (to capture how pro-rural a state was). For all columns of Table 5 the delicense-labor regulation interaction remains negative and highly significant.

[24]For both falsification exercises, we find the same pattern of results for the baseline specification (1).

ticipation of economic reforms. However, the industries that were delicensed in different waves may have been selected according to some characteristics related to performance potential. In particular, reformers in 1985 may have not chosen industries randomly. The concern is less severe for the 1991 wave as this covered most of the remaining industries, and the criterion for the exclusion of a few industries was their strategic, environmental and social importance. Endogenous sequencing would be a problem for analyzing the impact of delicensing if the selection criterion were correlated with the expected future performance of state-industries at the time of the reform.[25] As a crude check on this we ran a cross-section regression of the year in which a three-digit industry was delicensed on output growth in that industry during the 1980-84 period (prior to the first wave of delicensing). This is intended to detect whether politicians selected industries in 1985 according to their degree of economic success. We find no evidence of a relationship between when an industry is delicensed and pre-reform output growth (the estimated coefficient of interest is -0.383, and the standard error is 1.436). Similar results are found using other measures of pre-reform industrial performance such as employment or labor productivity growth during 1980-84.[26] The absence of systematic differences in pre-reform economic performance between industries that are delicensed in each of the two waves is reassuring.

## 5 Conclusions

The question of how to encourage industrial development has been one of the holy grails of development work. Intellectual fashions in this area have changed radically in the last fifty years. India is an emblematic case, as it began its post-independence life as the poster child for planned industrialization, and shifted more recently to a market-oriented strategy.

This paper investigates whether the effects on registered manufacturing output of dismantling the license raj – a system of central controls governing entry and expansion in this sector – vary across Indian states with different labor market regulations. We use the delicensing experiment to shine light on the role of local labor market institutions in determining industrial performance. The punchline is that output rose more in pro-employer states than it did in pro-worker states in response to the same delicensing reform. Delicensing resulted in a reallocation of industrial production from states with pro-worker labor institutions to states with pro-employer labor institutions. A policy implication of our analysis is that liberalization tends to make the creation of a more favorable investment climate a more pressing concern. This may require complementary institutional reforms as well as redistributive policies that ease the costs of adjustment associated with liberalization.

The world has tended to divide between those who are for or against liberalization. Reality it turns out is more nuanced – our results emphasize how local institutions mat-

[25] The fact that our interest centers on the delicense-labor regulation interaction helps somewhat in this regard. To explain our main result from column (2) of Table 3, endogenous selection would have to be based upon an industry's expected strong performance in pro-employer states and/or expected weak performance in pro-worker states.

[26] The regression coefficients (standard errors) are, respectively, -0.74 (1.57) and 0.23 (1.25).

ter for whether an industry in a region benefits or is harmed, in a relative sense, by a nationwide delicensing reform. The take-home message is that the focus should be squarely on the local policy and institutional environment in thinking about how to encourage growth in particular regions during periods of economic reform. Understanding which elements of this environment are important is critical to designing public policy to encourage industrialization and growth in a changing world.

## 6 References


**Acemoglu, Daron, Philippe Aghion and Fabrizio Zilibotti.** 2006. "Distance to Frontier, Selection and Economic Growth." *Journal of the European Economic Association*, 4(1): 37-74.

**Acemoglu, Daron, and Fabrizio Zilibotti.** 1997. "Was Prometheus Unbound by Chance? Risk, Diversification and Growth." *Journal of Political Economy*, 105(4): 709-51.

**Aghion, Philippe, Nick Bloom, Richard Blundell, Rachel Griffith and Peter Howitt.** 2005. "Competition and Innovation: An Inverted-U Relationship." *Quarterly Journal of Economics*, 120(2): 701-28.

**Aghion, Philippe, Robin Burgess, Stephen Redding and Fabrizio Zilibotti.** 2006. "The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India." NBER WP 12031.

**Aghion, Philippe and Rachel Griffith,** 2005. *Competition and Growth,* MIT Press.

**Aghion, Philippe, Peter Howitt and David Mayer-Foulkes.** 2005. "The Effect of Financial Development on Convergence." *Quarterly Journal of Economics,* 120(1): 173-222.

**Banerjee, Abhijit and Lakshmi Iyer.** 2005. "History Institutions and Economic Performance: The Legacy of Colonial Land Tenure Systems in India." *American Economic Review*, 95(4): 1190-1213.

**Bernard, Andrew, Stephen Redding and Peter Schott**. 2007. "Comparative Advantage and Heterogeneous Firms." *Review of Economic Studies*, 74(1): 31-66.

**Bertrand, Marianne and Francis Kramarz.** 2002. "Does Entry Regulation Hinder Job Creation? Evidence from the French Retail Industry." *Quarterly Journal of Economics*, 117(4): 1369-413.

**Bertrand, Marianne, Sendhil Mullainathan and Esther Duflo.** 2004. "How Much Should we Trust Difference in Differences Estimates?" *Quarterly Journal of Economics*, 119(1): 249-75.

**Besley, Timothy and Robin Burgess.** 2000. "Land Reform, Poverty and Growth: Evidence from India." *Quarterly Journal of Economics*, 115(2): 389-430.

**Besley, Timothy and Robin Burgess.** 2004. "Can Labor Regulation Hinder Economic Performance? Evidence from India." *Quarterly Journal of Economics*, 19(1): 91-134.

**Bhagwati, Jagdish and Padma Desai.** 1970. *India Planning for Industrialization: Industrialization and Trade Policies Since 1951.* New Dehli: Oxford University Press.

**Blanchard, Olivier and Francesco Giavazzi.** 2003. "Macroeconomic Effects of Regulation and Deregulation in Goods and Labor Markets." *Quarterly Journal of Economics,* 118(3): 879-909.

**Burgess, Robin and Rohini Pande.** 2005. "Do Rural Banks Matter? Evidence from the Indian Social Banking Experiment." *American Economic Review*, 95(3): 780-95.

**Caballero, Ricardo J., Kevin N. Cowan, Eduardo M.R.A Engel and Alejandro Micco.** 2004. "Effective Labor Regulation and Microeconomic Flexibility." NBER WP 10744.

**Chaudhary, Shri.** 1987. *IDRA and Industrial Licensing with Rules, Forms, Notifications, Press Notes, Guidelines, Policies.* New Delhi: Bharat Law House.

**Cunat, Alejandro and Marc Melitz.** 2005. "Labor Market Flexibility and Comparative Advantage." Unpublished.

**Debroy, B and A. T. Santhanam.** 1993. "Matching Trade Codes with Industrial Codes." *Foreign Trade Bulletin*, 24(1): 5-27.

**Djankov, Simeon, Rafael La Porta, Florencio Lopez-de-Silanes and Andrei Shleifer.** 2002. "The Regulation of Entry." *Quarterly Journal of Economics*, 117(1): 1-37.

**Government of India.** 1991. *Statement of Industrial Policy*, New Delhi.

**Government of India**. *Customs Tariff of India*, New Delhi, various issues.

**Government of India**. *Economic Survey*, New Delhi, various issues.

**Government of India**. *Handbook of Industrial Policy and Statistics*, New Delhi, various issues.

**Hazari, Rabindra K.** 1966. *Industrial Planning and Licensing Policy.* Interim Report to the Planning Commission, Bombay.

**Holmes, Thomas J.** 1998. "The Effect of State Policies on the Location of Manufacturing: Evidence from State Borders." *Journal of Political Economy*, 106(4): 667-705.

**Krishna, Pravin and Devashish Mitra.** 1998. "Trade Liberalization, Market Discipline, and Productivity Growth: New Evidence from India." *Journal of Development Economics*, 56(2): 447-62.

**Malik, P. L.** 1997. *Industrial Law.* Lucknow: Eastern Book Company.

**Manova, Kalina.** 2006. "Credit Constraints, Heterogeneous Firms and International Trade." http://ssrn.com/abstract=952552.

**Melitz, Marc J.** 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica*, 71(6): 1695-725.

**Pavcnik, Nina.** 2002. "Trade Liberalization, Exit, and Productivity Improvement: Evidence from Chilean Plants." *Review of Economic Studies*, 69(1): 245-76.

**Rodrik, Dani and Arvind Subramanian.** 2004. "From 'Hindu Growth' to Productivity Surge: The Mystery of the Indian Growth Transition." NBER WP 10376.

**Topolova, Petia.** 2005. "Trade Liberalization: Evidence on Poverty and Inequality: Evidence from Indian Districts." NBER Working Paper 11614.

**Trefler, Daniel.** 2004. "The Long and Short of the Canada-U.S. Free Trade Agreement." *American Economic Review*, 94(4): 870-95.

**Tybout, James, Jaime de Melo and Vittorio Corbo.** 1991. "The Effects of Trade Reforms on Scale and Technical Efficiency: New Evidence from Chile." *Journal of International Economics*, 31(3-4): 231-50.

**Verhoogen, Eric.** 2007. "Trade, Quality Upgrading and Wage Inequality in the Mexican Manufacturing Sector." Unpublished.

## 7 Data Appendix

Our data set on output, number of factories, employment and fixed capital covers an average of 64 three-digit industries in the 16 main states over an 18-year time period and comes from the Annual Survey of Industries (ASI).[27] To this data set we add the following variables.

**Delicense:** Appendix II of The Industries Development and Regulation Act of 1951 reports a comprehensive list of the "Scheduled Industries" subject to industrial licensing (Malik 1997). All key manufacturing sectors are covered by the 1951 Act. We assigned three-digit codes to the scheduled industries listed in the Act and used Press Notices and Notifications issued by the Ministry of Commerce and Industry to track when three-digit industries were delicensed during the 1980s (see Chaudhary 1987, Government of India's Economic Surveys, and the Handbook of Industrial Policy and Statistics 1987). The Statement of Industrial Policy of 1991 disbanded industrial licensing except for a small number of specified industries. Subsequent revisions to the list of licensed industries from 1991 onwards were tracked from Press Notices and Notifications published in various issues of the Handbook of Industrial Policy and Statistics.

**Tariffs:** Data on actual rates of duty are from the Customs Tariff of India manuals published through the Central Board of Excise and Customs. Prior to 1988, the basic, auxiliary and countervailing duties are reported for approximately one thousand one hundred products of the Brussels Tariff Nomenclature (BTN). From 1988 onwards, even more finely-detailed data are available for approximately five thousand six-digit products of the Harmonized System (HS). We combine the three rates of duty according to the official formula[28] and then aggregate product rates to the three-digit industry average using the mapping of Debroy and Santhanam (1993).

**Labor regulation:** This measure is based on state-specific text amendments to the Industrial Disputes Act 1947 reported in Malik (1997). Our coding of amendments follows Besley and Burgess (2004): 0 denotes a change judged not to affect the bargaining power of either workers or employers, 1 is a pro-worker change, and $-1$ denotes a pro-employer change. Where there was more than one amendment in a year we code the net direction of change thus restricting our measure to take a value of $0, 1, -1$ in any given state and year. These measures are then cumulated over the 1947-1997 period.

**Control variables:** State development expenditure is from the Public Finance Statistics published by the Ministry of Finance. Our measure of state financial development is from Burgess and Pande (2005). The data on political histories come from state election data published by the Election Commission of India. Data on when different HS six-digit products are opened to automatic FDI approval for up to 51 percent of equity is from the Handbook of Industrial Policy and Statistics. State poverty headcounts are from the National Sample Survey. State cumulative land reforms are from Besley and Burgess (2000). Agricultural and industry electricity tariff data comes from Annual Report on the Working of State Electricity Boards and Electricity Departments.

[27] The Indian industrial classification changes in 1987. We establish a concordance from the 1970 classification to the 1987 classification to create a consistent state-industry panel across the 1980-1997 period.

[28] Applied tariff = basic + auxiliary + (100+ basic + auxiliary) $\times$ (countervailing)/100.

**Table 1: Descriptive Statistics**

| | 1980 | 1985 | 1990 | 1997 | 1980-1997 |
|---|---|---|---|---|---|
| **Delicensing** | | | | | |
| Number of industries delicensed | 0 | 41 | 44 | 102 | 82.29 |
| Percentage of real output delicensed | 0 | 47.68 | 56.94 | 92.57 | 74.53 |
| Percentage of employment delicensed | 0 | 43.05 | 47.81 | 88.15 | 68.31 |
| **Trade liberalization** | | | | | |
| Tariff Rate | 119.19 | 142.31 | 132.53 | 47.58 | 117.62 |
| | (44.74) | (47.69) | (38.94) | (21.34) | (49.22) |
| **Labor Regulation** | | | | | |
| Labor Regulation | -0.16 | -0.05 | 0.13 | 0.13 | 0.04 |
| | (1.04) | (1.42) | (1.65) | (1.65) | (1.52) |
| **Industrial performance** | | | | | |
| Mean log real output | 11.47 | 11.88 | 12.31 | 12.68 | 12.13 |
| | (1.96) | (1.93) | (1.96) | (2.20) | (2.02) |
| Mean log employment | 7.22 | 7.37 | 7.46 | 7.55 | 7.43 |
| | (1.70) | (1.57) | (1.58) | (1.69) | (1.61) |
| Mean log number of factories | 3.30 | 3.42 | 3.50 | 3.58 | 3.46 |
| | (1.34) | (1.29) | (1.30) | (1.36) | (1.32) |
| Mean log real fixed capital | 9.78 | 10.39 | 10.74 | 11.27 | 10.61 |
| | (2.12) | (2.03) | (2.12) | (2.46) | (2.20) |
| Observations | 1018 | 1018 | 1018 | 1018 | 18324 |

**Notes:** The data set is a balanced panel of three-digit state-industries that are present in the data in all 18 years and includes an average of 64 three-digit industries in the 16 states over the period 1980 to 1997. Numbers in parentheses are standard deviations across state-industries. Tariff Rate is the tariff rate applied to a three-digit registered manufacturing industry. State amendments to the Industrial Disputes Act are coded 1=pro-worker, 0=neutral, -1=pro-employer and then cumulated over 1947-97 to generate the labor regulation measure. Real output is real registered manufacturing output in thousands of rupees (1981 prices). Employment is number of registered manufacturing employees. Number of factories is number of registered manufacturing factories. Real fixed capital is real registered manufacturing fixed capital stock in thousands of rupees (1981 prices). See the Data Appendix for further information on variable definitions and the data sources.

**Table 2: Average Effects of Delicensing on Industrial Performance in India: 1980-1997**

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | Log No. Factories | Log No. Factories | Log No. Factories | Log Real Output | Log Real Output | Log Real Output |
| Delicense | 0.064*** | 0.060*** | 0.064*** | 0.032 | 0.021 | 0.031 |
| | (0.024) | (0.019) | (0.024) | (0.043) | (0.036) | (0.043) |
| Labor Regulation | | | -0.062** | | | -0.137*** |
| | | | (0.027) | | | (0.044) |
| Observations | 18324 | 18324 | 18324 | 18324 | 18324 | 18324 |
| R-squared | 0.92 | 0.92 | 0.92 | 0.89 | 0.89 | 0.89 |
| State-industry fixed effects | YES | YES | YES | YES | YES | YES |
| Year fixed effects | YES | | YES | YES | | YES |
| State-year fixed effects | | YES | | | YES | |

**Notes:** Robust standard errors adjusted for clustering on state×year delicensed are reported in parentheses. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level. Log No. Factories is log number of registered manufacturing factories. Log Real Output is log real registered manufacturing output. Delicense is a dummy variable which is one if all or part of a three-digit industry is delicensed in a particular year and zero otherwise. State amendments to the Industrial Disputes Act are coded 1=pro-worker, 0=neutral, -1=pro-employer and then cumulated over 1947-97 to generate the labor regulation measure. The data set is a balanced panel of three-digit state-industries that are present in the data in all 18 years and includes an average of 64 three-digit industries in the 16 states over the period 1980 to 1997. See the Data Appendix for further information on variable definitions and the data sources.

**Table 3: Delicensing, Labor Regulation and Industrial Performance in India: 1980-1997**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---|---|---|---|---|---|---|---|---|
| | Log Real Output | Log Real Output | Log Real Output | Log Real Output | Log Real Output | Log Real Output | Log Employment | Log Real Fixed Capital |
| Delicense | 0.038 | | | | | | | |
| | (0.044) | | | | | | | |
| Labor Regulation | -0.074* | | | | | | | |
| | (0.040) | | | | | | | |
| Delicense × Labor Regulation | -0.070*** | -0.054** | -0.054*** | | | -0.202*** | -0.050*** | -0.054*** |
| | (0.018) | (0.024) | (0.018) | | | (0.078) | (0.019) | (0.020) |
| Delicense × 1980 Labor Regulation | | | | -0.062* | | | | |
| | | | | (0.035) | | | | |
| Delicense × Instrumented Labor Regulation | | | | | -0.068** | | | |
| | | | | | (0.030) | | | |
| Observations | 18324 | 18324 | 18324 | 18324 | 18054 | 18324 | 18324 | 18324 |
| R-squared | 0.89 | 0.91 | 0.92 | 0.92 | 0.92 | 0.92 | 0.93 | 0.89 |
| State-industry fixed effects | YES | YES | YES | YES | YES | YES | YES | YES |
| Year fixed effects | YES | | | | | | | |
| State-year fixed effects | | YES | YES | YES | YES | YES | YES | YES |
| Industry-year fixed effects | | YES | YES | YES | YES | YES | YES | YES |
| State-delicense fixed effects | | | | | | YES | | |
| Standard errors | Cluster State×ydel | Cluster State×ydel | Cluster State×ind | Cluster State×ydel | Cluster State×ydel | Cluster State×ydel | Cluster State×ydel | Cluster State×ydel |

**Notes:** Robust standard errors adjusted for clustering by state×year delicensed are reported in parentheses in columns (1)-(2) and (4)-(8). In column (3) standard robust standard errors are reported for clustering by state×industry. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level. Log Real Output is log real registered manufacturing output. Log Employment is log employment in the registered manufacturing sector. Log Real Fixed Capital is the log real registered manufacturing fixed capital stock. Delicense is a dummy variable which is one if all or part of a three-digit industry is delicensed in a particular year and zero otherwise. State amendments to the Industrial Disputes Act are coded 1=pro-worker, 0=neutral, -1=pro-employer and then cumulated over 1947-97 to generate the labor regulation measure. 1980 labor regulation is the labor regulation measure of states as of 1980. Instrumented labor regulation is predicted from a state-year regression for 1958-97 in which the instruments are interactions between a post-1977 dummy variable and pre-1977 mean unionization in a state and between the post-1977 dummy and patterns of land tenure in British India (from Banerjee and Iyer, 2005). The F-statistic for the significance of the excluded instruments in the first-stage state-year regression is 7.27. The Hansen-Sargan overidentification test regresses the residuals from the second-stage state-industry-time regression on interactions between the instruments and delicense. The instruments pass the overidentification test with a p-value of 0.255. Standard errors in column (5) are corrected for instrumented labor regulation being generated in a first-stage regression. The data set is a balanced panel of three-digit state-industries that are present in the data in all 18 years and includes an average of 64 three-digit industries in the 16 states over the period 1980 to 1997. The difference in the number of observations between column (5) and the other columns of the table is due to the absence of unionization data for Jammu and Kashmir, which implies that instrumented labor regulation is missing for Jammu and Kashmir. See the Data Appendix for further information on variable definitions and the data sources.

**Table 4: Trade Liberalization, Labor Regulation and Industrial Performance in India, 1980-97**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Log Real Output | Log Real Output | Log Real Output | Log Real Output | Log Real Output |
| Delicense | | | | 0.049 | |
| | | | | (0.044) | |
| Labor Regulation | -0.132*** | -0.360*** | | -0.191* | |
| | (0.043) | (0.084) | | (0.098) | |
| Delicense × Labor Regulation | | | | -0.061*** | -0.059*** |
| | | | | (0.020) | (0.024) |
| Log Tariff Rate | -0.003 | -0.006 | | -0.008 | |
| | (0.048) | (0.051) | | (0.050) | |
| Log Tariff Rate × Labor Regulation | | 0.051*** | 0.009 | 0.026 | 0.008 |
| | | (0.015) | (0.019) | (0.016) | (0.020) |
| Observations | 17783 | 17783 | 17783 | 17783 | 17783 |
| R-squared | 0.89 | 0.89 | 0.92 | 0.89 | 0.92 |
| State-industry fixed effects | YES | YES | YES | YES | YES |
| Year fixed effects | YES | YES | | YES | |
| State-year fixed effects | | | YES | | YES |
| Industry-year fixed effects | | | YES | | YES |
| Standard errors | Cluster State×ydel | Cluster State×ydel | Cluster State×ydel | Cluster State×ydel | Cluster State×ydel |

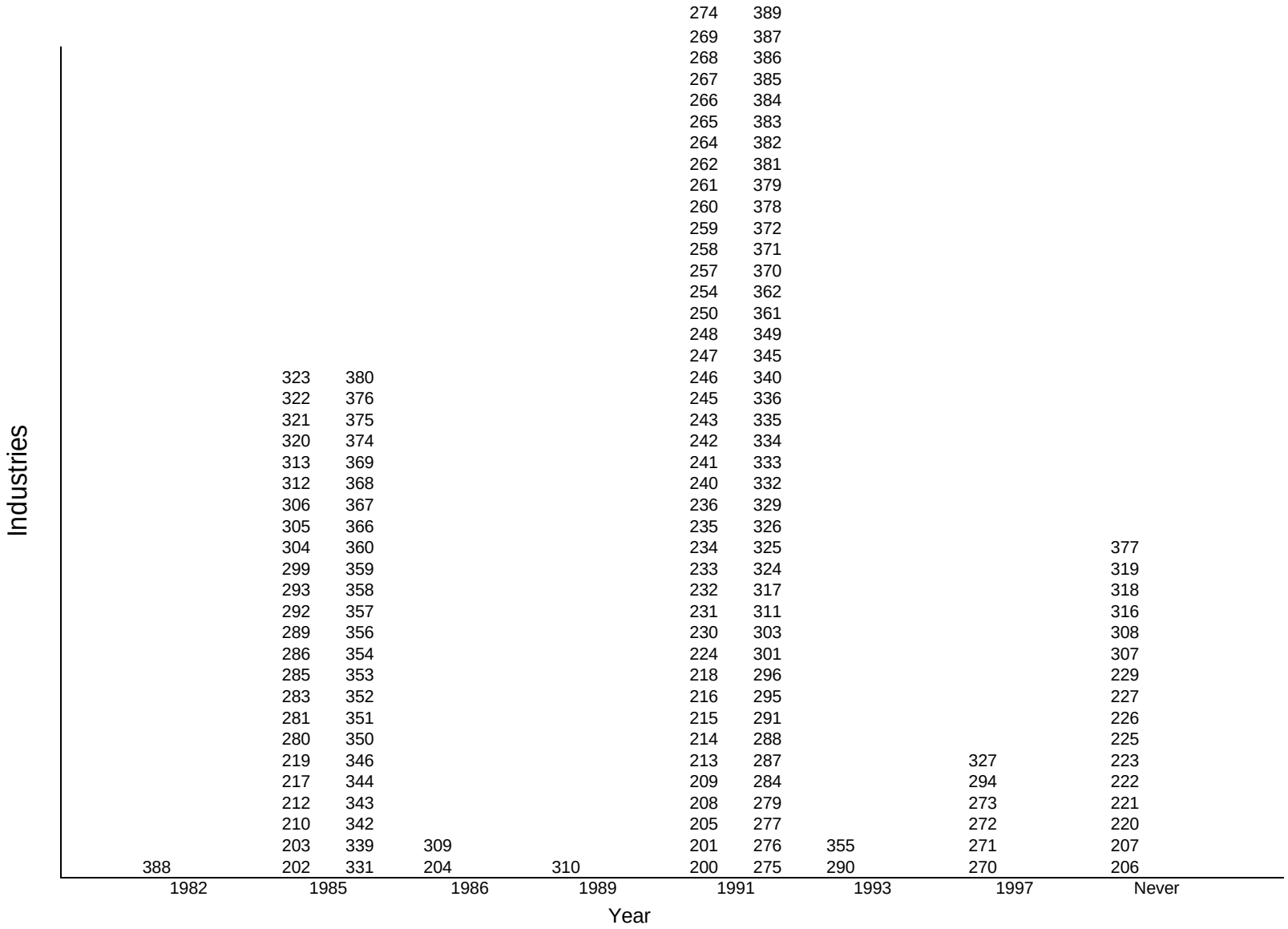
**Notes:** Robust standard errors adjusted for clustering on state×year delicensed are reported in parentheses. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level. Log Real Output is log real registered manufacturing output. Delicense is a dummy variable which is one if all or part of a three-digit industry is delicensed in a particular year and zero otherwise. Log Tariff Rate is the log tariff rate applied to a three-digit industry. State amendments to the Industrial Disputes Act are coded 1=pro-worker, 0=neutral and -1=pro-employer and then cumulated over 1947-97 to generate the labor regulation measure. The data set is a balanced panel of three-digit state-industries that are present in the data in all 18 years and includes an average of 64 three-digit industries in the 16 states over the period 1980 to 1997. The difference in the number of observations between Table 4 and Table 3 is due to the fact that there are a small number of three digit industries for which tariff data is unavailable. See the Data Appendix for further information on variable definitions and the data sources.

**Table 5: Robustness to Interactions with State and State-Industry Characteristics**

| | (1) | (2) | (3) |
|---|---|---|---|
| | Log Real Output | Log Real Output | Log Real Output |
| Delicense × Labor Regulation | -0.051** | -0.064** | -0.064*** |
| | (0.024) | (0.028) | (0.022) |
| Delicense × Log Development Exp | 0.188* | -0.113 | -0.118 |
| | (0.105) | (0.101) | (0.126) |
| Delicense × Financial Development | 0.030** | 0.029* | 0.047** |
| | (0.014) | (0.017) | (0.023) |
| Delicense × Top Tercile | | 0.472*** | 0.474*** |
| | | (0.032) | (0.032) |
| Delicense × Bottom Tercile | | -0.521*** | -0.523*** |
| | | (0.033) | (0.033) |
| Delicense × Congress Majority | | | -0.006 |
| | | | (0.005) |
| Delicense × Hard-left Majority | | | 0.005 |
| | | | (0.020) |
| Delicense × Regional Majority | | | 0.006 |
| | | | (0.019) |
| Delicense × Janata Majority | | | 0.003 |
| | | | (0.006) |
| Delicense × Hindu Majority | | | 0.072 |
| | | | (0.081) |
| Observations | 18324 | 18324 | 18324 |
| R-squared | 0.92 | 0.93 | 0.93 |
| State-industry fixed effects | YES | YES | YES |
| State-year fixed effects | YES | YES | YES |
| Industry-year fixed effects | YES | YES | YES |
| Standard errors | Cluster State×ydel | Cluster State×ydel | Cluster State×ydel |

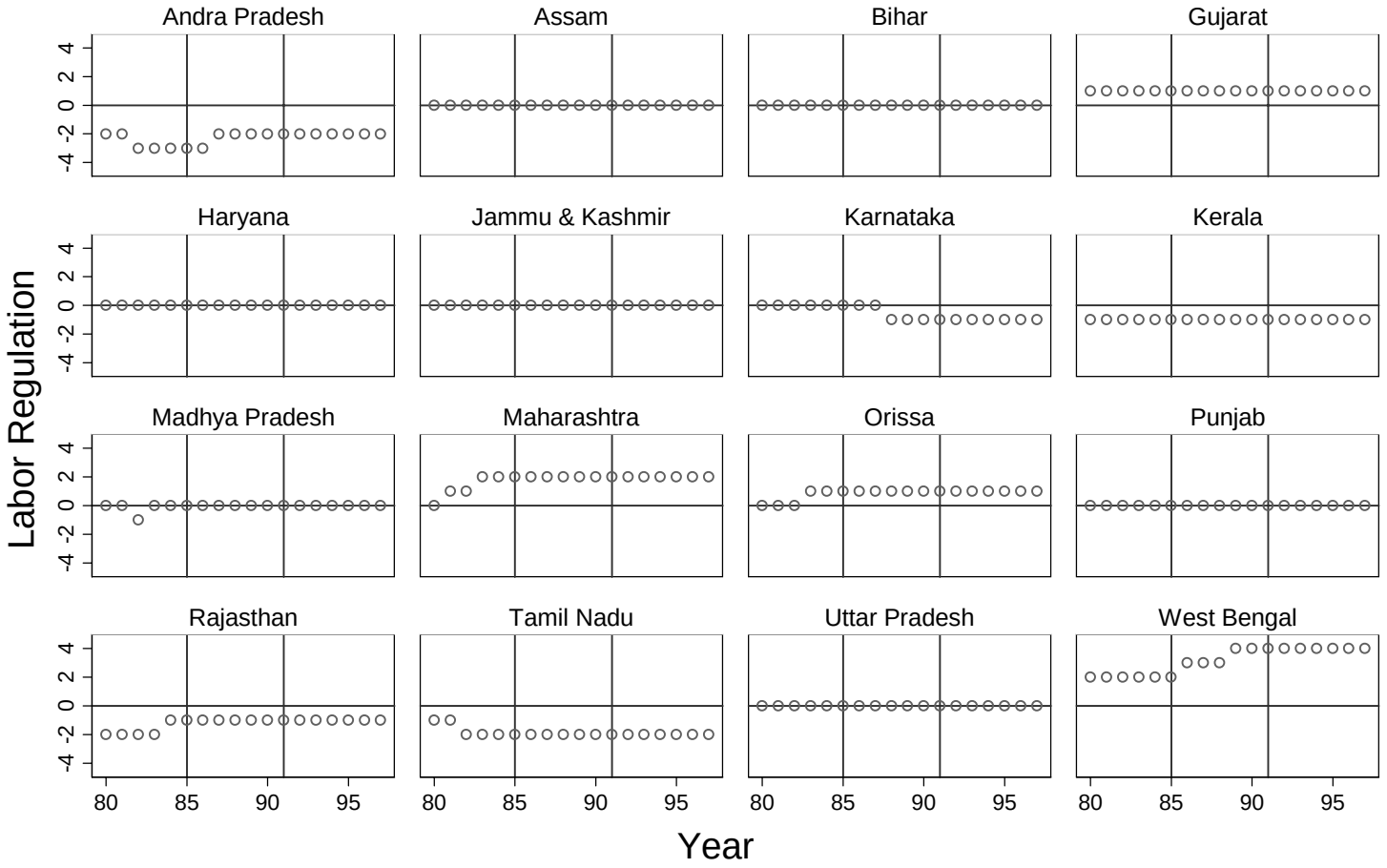
**Notes:** Robust standard errors adjusted for clustering on state×year delicensed are reported in parentheses. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level. Log Real Output is log real registered manufacturing output. Delicense is a dummy variable which is one if all or part of a three-digit industry is delicensed in a particular year and zero otherwise. State amendments to the Industrial Disputes Act are coded 1=pro-worker, 0=neutral and -1=pro-employer and then cumulated over 1947-97 to generate the labor regulation measure. Log development expenditure is real per capita state spending on social and economic services. Financial Development is from Burgess and Pande (2005) who use the number of bank branches per capita in 1961 interacted with (i) a post-1976 time trend and (ii) a post-1989 time trend as instruments for state-level bank branch expansion for the 1961-2000 period. We use predicted financial development from this state-year regression interacted with delicense above. The F-statistic for the significance of the excluded instruments in the first-stage state-year regression is 16.87. Standard errors in columns (1) to (3) of Table 5 have been adjusted to take account of the fact that predicted financial development is generated in a first-stage regression. Top tercile is a dummy which is one if a state-industry lies in the top third of the cross-state within-industry productivity distribution each year and zero otherwise. Bottom tercile is a dummy which is one if a state-industry lies in the bottom third of the cross-state within-industry productivity distribution and zero otherwise. Congress, hard left, Janata and regional majority are counts of the number of years for which these political groupings held a majority of the seats in the state legislatures since 1957. The data set is a balanced panel of three-digit state-industries that are present in the data in all 18 years and includes an average of 64 three-digit industries in the 16 states over the period 1980 to 1997. See the Data Appendix for further information on variable definitions and the data sources.

## Figure 1 : The Timing of Delicensing in India 1980-97



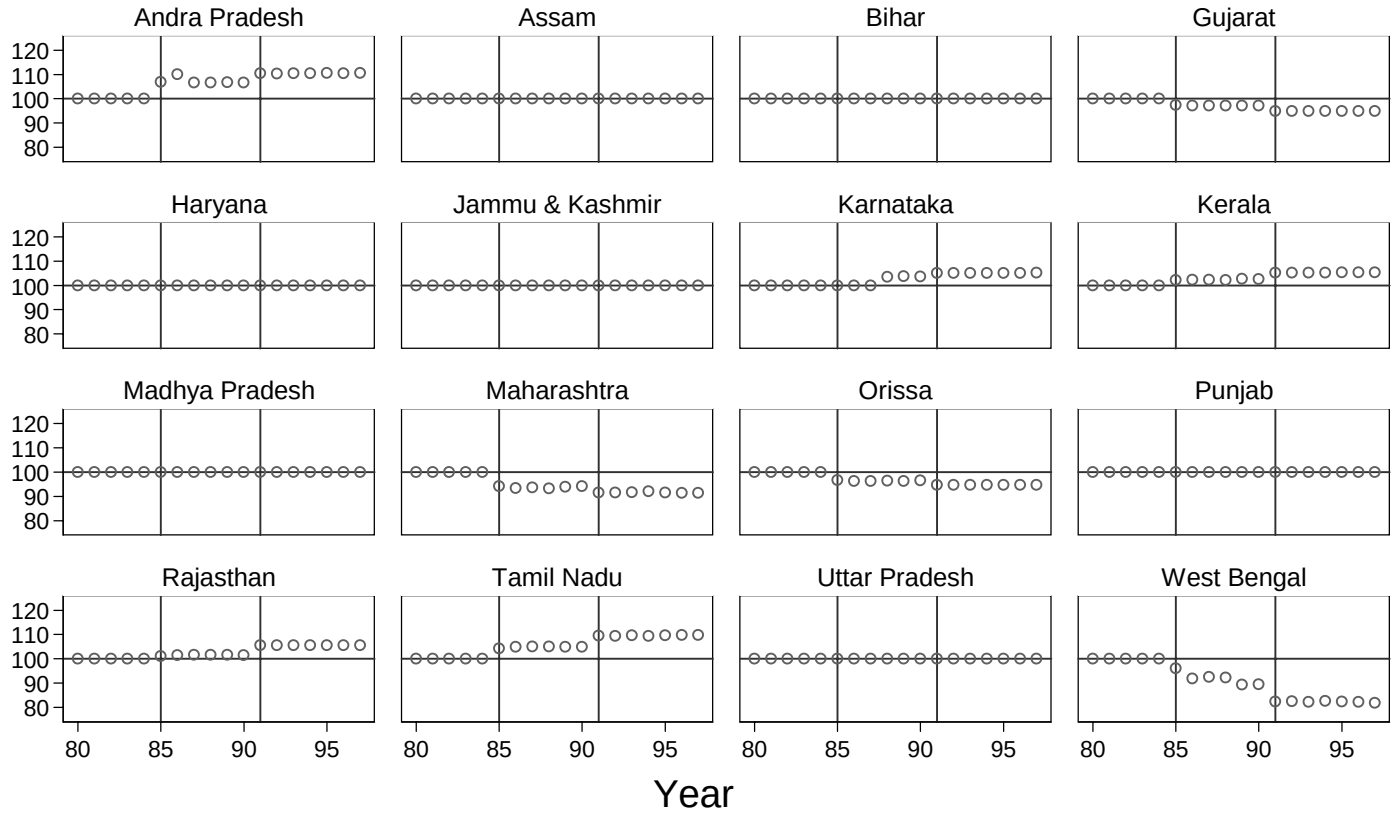

Notes: The figure displays the years in which different three-digit registered manufacturing industries in India were delicensed over the 1980-97 period. The industries shown in the Never column had not been delicensed as of 1997. Numbers refer to three-digit registered manufacturing codes from the Indian National Industrial Classification (NIC) 1987. See Table A1 and the Data Appendix for further information on variable definitions and the data sources.

# Figure 2: Labor Regulation in India 1980-97




Notes: State amendments to the Industrial Disputes Act are coded: 1=pro-worker, 0=neutral, -1=pro-employer and cumulated from 1947-97. Vertical lines denote the two waves of delicensing in 1985 and 1991. See the data appendix for further details on the variables and data sources.

# Figure 3: The Unequal Effects of Delicensing in India 1980-97




Notes: For each Indian state we display the ratio of fitted state output (from column (2) of Table 3) to counterfactual state output obtained by setting the delicense-labor regulation interaction to zero in this specification. The fitted-counterfactual ratio has been multiplied by one hundred to be expressed as a percentage. Deviations from a value of one hundred are attributable to the heterogeneous effects of delicensing across states due to their different labor market regulations. Since industry-year and state-year effects absorb, respectively, the level effects of delicensing and labor regulation, the difference between the fitted and counterfactual series can only identify the heterogeneous effects of delicensing. Vertical lines denote the two waves of delicensing in 1985 and 1991.

**Table A1: Coding for Delicense Variable**

| Nic 3 | Year delicensed | IDRA Industry | Reason Delicensed |
|---|---|---|---|
| 200 | 1991 | Food-processing industries (other) | Delicensed in the Statement on Industrial Policy of 1991 |
| 201 | 1991 | Food-processing industries (milk products) | Delicensed in the Statement on Industrial Policy of 1991 |
| 202 | 1985 | Food-processing industries (canned fruits) | "Canned fruits" mentioned in Press Note issued in March 1985 |
| 203 | 1985 | Food-processing industries (other) | "Marine products" mentioned in Press Note issued in March 1985 |
| 204 | 1986 | Food-processing industries (flour) | "Roller flour milling industry" mentioned in Press Note issued in July 1986 |
| 205 | 1991 | Food-processing industries (other) | Delicensed in the Statement on Industrial Policy of 1991 |
| 206 | 0 | Sugar | "Sugar" mentioned in Compulsory Licensing list 1991 |
| 207 | 0 | Sugar | "Sugar" mentioned in Compulsory Licensing list 1991 |
| 208 | 1991 | Salt (under processed food) | Delicensed in the Statement on Industrial Policy of 1991 |
| 209 | 1991 | Food-processing industries (other) | Delicensed in the Statement on Industrial Policy of 1991 |
| 210 | 1985 | Vegetable oils and vanaspati | "Vegetable oils" mentioned in Press Note issued in March 1985 |
| 212 | 1985 | Vegetable oils and vanaspati | "Vegetable oils" mentioned in Press Note issued in March 1985 |
| 213 | 1991 | Food-processing industries (other) | Delicensed in the Statement on Industrial Policy of 1991 |
| 214 | 1991 | Food-processing industries (other) | Delicensed in the Statement on Industrial Policy of 1991 |
| 215 | 1991 | Food-processing industries (other) | Delicensed in the Statement on Industrial Policy of 1991 |
| 216 | 1991 | Food-processing industries (other) | Delicensed in the Statement on Industrial Policy of 1991 |
| 217 | 1985 | Food-processing industries (other) | "Cattle feed" mentioned in Press Note issued in March 1985 |
| 218 | 1991 | Food-processing industries (other) | Delicensed in the Statement on Industrial Policy of 1991 |
| 219 | 1985 | Food-processing industries (malted food, other) | "Protein foods" mentioned in Press Note issued in March 1985 |
| 220 | 0 | Fermentation industries | "Distillation and Brewing of alcoholic drinks" mentioned in Compulsory Licensing list 1991 |
| 221 | 0 | Fermentation industries | "Distillation and Brewing of alcoholic drinks" mentioned in Compulsory Licensing list 1991 |
| 222 | 0 | Fermentation industries | "Distillation and Brewing of alcoholic drinks" mentioned in Compulsory Licensing list 1991 |
| 223 | 0 | Fermentation industries | "Distillation and Brewing of alcoholic drinks" mentioned in Compulsory Licensing list 1991 |
| 224 | 1991 | | Delicensed in the Statement on Industrial Policy of 1991 |
| 225 | 0 | Miscellaneous industries (tobacco) | "Tobacco and Substitutes" mentioned in Compulsory Licensing list 1991 |
| 226 | 0 | Miscellaneous industries (tobacco) | "Tobacco and Substitutes" mentioned in Compulsory Licensing list 1991 |
| 227 | 0 | Miscellaneous industries (tobacco) | "Tobacco and Substitutes" mentioned in Compulsory Licensing list 1991 |
| 229 | 0 | Miscellaneous industries (tobacco) | "Tobacco and Substitutes" mentioned in Compulsory Licensing list 1991 |
| 230 | 1991 | Textiles (cotton) | Delicensed in the Statement on Industrial Policy of 1991 |
| 231 | 1991 | Textiles (cotton) | Delicensed in the Statement on Industrial Policy of 1991 |
| 232 | 1991 | Textiles (cotton) | Delicensed in the Statement on Industrial Policy of 1991 |
| 233 | 1991 | Textiles (cotton) | Delicensed in the Statement on Industrial Policy of 1991 |
| 234 | 1991 | Textiles (cotton) | Delicensed in the Statement on Industrial Policy of 1991 |
| 235 | 1991 | Textiles (cotton) | Delicensed in the Statement on Industrial Policy of 1991 |
| 236 | 1991 | Textiles (cotton-dying/printing) | Delicensed in the Statement on Industrial Policy of 1991 |
| 240 | 1991 | Textiles (silk, synthetic, artificial) | Delicensed in the Statement on Industrial Policy of 1991 |
| 241 | 1991 | Textiles (wool) | Delicensed in the Statement on Industrial Policy of 1991 |
| 242 | 1991 | Textiles (wool) | Delicensed in the Statement on Industrial Policy of 1991 |
| 243 | 1991 | Textiles (wool-dying) | Delicensed in the Statement on Industrial Policy of 1991 |
| 245 | 1991 | Textiles (silk) | Delicensed in the Statement on Industrial Policy of 1991 |
| 246 | 1991 | Textiles (silk) | Delicensed in the Statement on Industrial Policy of 1991 |
| 247 | 1991 | Textiles (artificial) | Delicensed in the Statement on Industrial Policy of 1991 |
| 248 | 1991 | Textiles (artificial-dying/printing) | Delicensed in the Statement on Industrial Policy of 1991 |
| 250 | 1991 | Textiles (jute) | Delicensed in the Statement on Industrial Policy of 1991 |
| 254 | 1991 | Textiles (jute) | Delicensed in the Statement on Industrial Policy of 1991 |
| 257 | 1991 | Textiles (fibre) | Delicensed in the Statement on Industrial Policy of 1991 |
| 258 | 1991 | Textiles (fibre) | Delicensed in the Statement on Industrial Policy of 1991 |
| 259 | 1991 | Textiles (fibre) | Delicensed in the Statement on Industrial Policy of 1991 |
| 260 | 1991 | Textiles (various) | Delicensed in the Statement on Industrial Policy of 1991 |
| 261 | 1991 | Textiles (ropes) | Delicensed in the Statement on Industrial Policy of 1991 |
| 262 | 1991 | Textiles (various) | Delicensed in the Statement on Industrial Policy of 1991 |
| 264 | 1991 | Textiles (various) | Delicensed in the Statement on Industrial Policy of 1991 |
| 265 | 1991 | Textiles (various) | Delicensed in the Statement on Industrial Policy of 1991 |
| 266 | 1991 | Textiles (various) | Delicensed in the Statement on Industrial Policy of 1991 |
| 267 | 1991 | Textiles (various) | Delicensed in the Statement on Industrial Policy of 1991 |
| 268 | 1991 | Textiles (various) | Delicensed in the Statement on Industrial Policy of 1991 |
| 269 | 1991 | Textiles (various) | Delicensed in the Statement on Industrial Policy of 1991 |
| 270 | 1997 | Timber products (miscellaneous) | "Wood-based products" mentioned in Compulsory Licensing list 1991- Later delicensed in 1997 |
| 271 | 1997 | Timber products (plywood) | "Plywood" mentioned in Compulsory Licensing list 1991- Later delicensed in 1997 |
| 272 | 1997 | Timber products (miscellaneous) | "Wood-based products" mentioned in Compulsory Licensing list 1991- Later delicensed in 1997 |
| 273 | 1997 | Timber products (miscellaneous) | "Wood based products" mentioned in Compulsory Licensing list 1991- Later delicensed in 1997 |
| 274 | 1991 | Timber products (miscellaneous) | Delicensed in the Statement on Industrial Policy of 1991 |
| 275 | 1991 | Timber products (miscellaneous) | Delicensed in the Statement on Industrial Policy of 1991 |

| | | | |
|---|---|---|---|
| 276 | 1991 | Timber products (miscellaneous) | Delicensed in the Statement on Industrial Policy of 1991 |
| 277 | 1991 | Timber products (miscellaneous) | Delicensed in the Statement on Industrial Policy of 1991 |
| 279 | 1991 | Timber products (miscellaneous) | Delicensed in the Statement on Industrial Policy of 1991 |
| 280 | 1985 | Paper and pulp | "Paper and pulp" mentioned in Press Note issued in March 1985 |
| 281 | 1985 | Paper and pulp | "Paper and pulp" mentioned in Press Note issued in March 1985 |
| 283 | 1985 | Paper and pulp | "Paper and pulp" mentioned in Press Note issued in March 1985 |
| 284 | 1991 | Printing and publishing of newspapers | Delicensed in the Statement on Industrial Policy of 1991 |
| 285 | 1985 | Printing | "Printing" mentioned in Press Note issued in March 1985 |
| 286 | 1985 | Printing | "Printing" mentioned in Press Note issued in March 1985 |
| 287 | 1991 | Engraving, etching, and block-making | Delicensed in the Statement on Industrial Policy of 1991 |
| 288 | 1991 | Book binding on account of others | Delicensed in the Statement on Industrial Policy of 1991 |
| 289 | 1985 | Printing | "Printing" mentioned in Press Note issued in March 1985 |
| 290 | 1993 | Leather, leather goods and pickers | "Raw hides " mentioned in Compulsory Licensing list 1991- Later delicensed in 1993 |
| 291 | 1991 | Manufacture of footwear | Delicensed in the Statement on Industrial Policy of 1991 |
| 292 | 1985 | Leather, leather goods and pickers | "Leather goods" mentioned in Press Note issued in March 1985 |
| 293 | 1985 | Leather, leather goods and pickers | "Leather goods" mentioned in Press Note issued in March 1985 |
| 294 | 1997 | Leather, leather goods and pickers | "Tanned or dressed furskins" mentioned in Compulsory Licensing list 1991-Later delicensed in 1997 |
| 295 | 1991 | Leather, leather goods and pickers | Delicensed in the Statement on Industrial Policy of 1991 |
| 296 | 1991 | Leather, leather goods and pickers | Delicensed in the Statement on Industrial Policy of 1991 |
| 299 | 1985 | Leather, leather goods and pickers | "Leather goods" mentioned in Press Note issued in March 1985 |
| 301 | 1991 | Fertilisers | Delicensed in the Statement on Industrial Policy of 1991 |
| 303 | 1991 | Chemicals (Paints, varnishes) | Delicensed in the Statement on Industrial Policy of 1991 |
| 304 | 1985 | Drugs and pharmaceuticals | "List of drugs" mentioned in Press Note issued in March 1985 |
| 305 | 1985 | Soaps, cosmetics and toilet preparations | "Soap and cosmetics" mentioned in Press Note issued in March 1985 |
| 306 | 1985 | Chemicals (industrial gases, man-made fibres) | "Industrial gases" mentioned in Press Note issued in March 1985 |
| 307 | 0 | Timber products (matches) | "Matches" mentioned in Compulsory Licensing list 1991 |
| 308 | 0 | Chemicals (explosives) | "Explosives" mentioned in Compulsory Licensing list 1991 |
| 309 | 1986 | Chemicals (fine) | "Fine chemicals" mentiones in Press Note issued in September 1986 |
| 310 | 1989 | Rubber goods (tyres and tubes) | "Tyres and tubes" mentioned in Press Note 1989 |
| 311 | 1991 | Rubber goods (footwear) | Delicensed in the Statement on Industrial Policy of 1991 |
| 312 | 1985 | Rubber goods (surgical) | "Surgical instruments" mentioned in Press Note issued in March 1985 |
| 313 | 1985 | Miscellaneous mechanical and engineering industries (plastic moulded goods) | "Plastic moulded goods" mentioned in Press Note issued in March 1985 |
| 316 | 0 | Fuels | "Petroleum and its distillation products" mentioned in Compulsory Licensing list 1991 |
| 317 | 1991 | Fuels | Delicensed in the Statement on Industrial Policy of 1991 |
| 318 | 0 | Fuels (coke and derivatives) | "Coal and lignite" mentioned in Compulsory Licensing list 1991 |
| 319 | 0 | Fuels (coal and lignite) | "Coal and lignite" mentioned in Compulsory Licensing list 1991 |
| 320 | 1985 | Ceramics (refractories) | "Refractories" mentioned in Press Note issued in March 1985 |
| 321 | 1985 | Glass | "Glassware" mentioned in Press Note issued in March 1985 |
| 322 | 1985 | Ceramics (pottery) | "Pottery" mentioned in Press Note issued in March 1985 |
| 323 | 1985 | Ceramics (sanitary ware, insulators) | "Sanitaryware, insulators" mentioned in Press Note issued in March 1985 |
| 324 | 1991 | Cement and gypsum products | Delicensed in the Statement on Industrial Policy of 1991 |
| 325 | 1991 | Cement and gypsum products | Delicensed in the Statement on Industrial Policy of 1991 |
| 326 | 1991 | Cement and gypsum products | Delicensed in the Statement on Industrial Policy of 1991 |
| 327 | 1997 | Cement (asbestos) | "Asbestos" mentioned in Compulsory Licensing list 1991-later delicensed in 1997 |
| 329 | 1991 | Miscellaneous non-metallic mineral products | Delicensed in the Statement on Industrial Policy of 1991 |
| 331 | 1985 | Metallurgical industries (ferrous-iron and steel) | "Sponge Iron" mentioned in Press Note issued in March 1985, "Pig Iron" mentioned in Press Note issued in December 1985 |
| 332 | 1991 | Metallurgical industries (ferro-alloys) | Delicensed in the Statement on Industrial Policy of 1991 |
| 333 | 1991 | Metallurgical industries (non ferrous) | Delicensed in the Statement on Industrial Policy of 1991 |
| 334 | 1991 | Metallurgical industries (non ferrous) | Delicensed in the Statement on Industrial Policy of 1991 |
| 335 | 1991 | Metallurgical industries (non ferrous) | Delicensed in the Statement on Industrial Policy of 1991 |
| 336 | 1991 | Metallurgical industries (non ferrous) | Delicensed in the Statement on Industrial Policy of 1991 |
| 339 | 1985 | Metallurgical industries (castings and forgings) | "Iron forgings" mentioned in Press Note issued in March 1985, "Castings and forgings" mentioned in Press Note issued in December 1985 |
| 340 | 1991 | Fabricated structural metal products | Delicensed in the Statement on Industrial Policy of 1991 |
| 342 | 1985 | Metallurgical industries (ferrous-iron and steel products) | "Steel furniture" mentioned in Press Note issued in March 1985 |
| 343 | 1985 | Miscellaneous mechanical and engineering industries (hand tools) | "Hand tools" mentioned in Press Note issued in March 1985 |
| 344 | 1985 | Metallurgical industries (castings and forgings) | "Castings and forgings" mentioned in Press Note issued in December 1985 |
| 345 | 1991 | Metallurgical industries (semi-manufactures and manufactures) | Delicensed in the Statement on Industrial Policy of 1991 |
| 346 | 1985 | Commercial,office and household equipment (cutlery, pressure cookers) | "Pressure cooker, cutlery" mentioned in Press Note issued in December 1985 |
| 349 | 1991 | Metallurgical industries (semi-manufactures and manufactures) | Delicensed in the Statement on Industrial Policy of 1991 |
| 350 | 1985 | Agricultural machinery | |
| 351 | 1985 | Industrial machinery-Earth moving machinery | "Industrial machinery" mentioned in Press Note issued in December 1985 |

| | | | |
|---|---|---|---|
| 352 | 1985 | Primer movers | "Steam turbines" mentioned in Press Note issued in December 1985 |
| 353 | 1985 | Industrial machinery | "Industrial machinery" mentioned in Press Note issued in December 1985 |
| 354 | 1985 | Industrial machinery | "Industrial machinery" mentioned in Press Note issued in December 1985 |
| 355 | 1993 | Commercial,office and household equipment (Air-conditioners and refrigerators) | "White goods" mentioned in Compulsory Licensing list 1991-later delicensed in 1993 |
| 356 | 1985 | Industrial machinery (general items) | "Water pumps" mentioned in Press Note issued in December 1985 |
| 357 | 1985 | Industrial machinery (general items) | "Industrial machinery" mentioned in Press Note issued in December 1985 |
| 358 | 1985 | Commercial,office and household equipment (typewriter, calculating machines) | "Office equipment" mentioned in Press Note issued in March 1985 |
| 359 | 1985 | Industrial machinery (general items) | "Industrial sewing machines-office equipment" mentioned in Press Note issued in March 1985 |
| 360 | 1985 | Electrical equipment | "Electrical equipment" mentioned in Press Note issued in March 1985 |
| 361 | 1991 | Electrical equipment (cables and wires) | Delicensed in the Statement on Industrial Policy of 1991 |
| 362 | 1991 | Electrical equipment (storage batteries, dry cells) | Delicensed in the Statement on Industrial Policy of 1991 |
| 366 | 1985 | Telecommunications (+ some household/office equipment) | "Magnetic tapes, broadcasting equipment" mentioned in Press Note issued in December 1985 |
| 367 | 1985 | Electrical equipment (household appliances) | "Computer peripherals" mentioned in Press Note issued in December 1985 |
| 368 | 1985 | Electrical equipment (household appliances) | "Electronic components" mentioned in Press Note issued in March 1985 |
| 369 | 1985 | Electrical equipment (lamps, x-ray equipment) | "Electronic components" mentioned in Press Note issued in March 1985 |
| 370 | 1991 | Transportation(ships) | Delicensed in the Statement on Industrial Policy of 1991 |
| 371 | 1991 | Transportation(railway locomotives) | Delicensed in the Statement on Industrial Policy of 1991 |
| 372 | 1991 | Transportation(railway rolling-stock) | Delicensed in the Statement on Industrial Policy of 1991 |
| 374 | 1985 | Transportation(automobiles) | "Automotive ancillaries" mentioned in Press Note issued in March 1985 |
| 375 | 1985 | Transportation(cycles) | "Cycles" mentioned in Press Note issued in March 1985 |
| 376 | 1985 | Transportation(bicycles) | "Cycles" mentioned in Press Note issued in March 1985 |
| 377 | 0 | Transportation(aircraft) | "Electronic aerospace equipment" mentioned in Compulsory Licensing list 1991 |
| 378 | 1991 | Transportation(others) | Delicensed in the Statement on Industrial Policy of 1991 |
| 379 | 1991 | Transportation(others) | Delicensed in the Statement on Industrial Policy of 1991 |
| 380 | 1985 | Medical and surgical appliances, Industrial, mathematical instruments | "Industrail and Scientific instruments" mentioned in Press Note issued in March 1985 |
| 381 | 1991 | Photographic, cinematographic and optical goods | Delicensed in the Statement on Industrial Policy of 1991 |
| 382 | 1991 | Manufacture of watches and clocks | Delicensed in the Statement on Industrial Policy of 1991 |
| 383 | 1991 | Manufacture of jewellery and related articles | Delicensed in the Statement on Industrial Policy of 1991 |
| 384 | 1991 | Minting of currency coins | Delicensed in the Statement on Industrial Policy of 1991 |
| 385 | 1991 | Manufacture of sports and athletic goods | Delicensed in the Statement on Industrial Policy of 1991 |
| 386 | 1991 | Manufacture of musical instruments | Delicensed in the Statement on Industrial Policy of 1991 |
| 387 | 1991 | Manufacture of stationery articles | Delicensed in the Statement on Industrial Policy of 1991 |
| 388 | 1982 | Electrical equpiment | "Equipment for exploitation of alternate sources of energy" mentioned in Press Note January 1982 |
| 389 | 1991 | Manufacture of miscellaneous products | Delicensed in the Statement on Industrial Policy of 1991 |

**Notes:** a year delicensed of "0" indicates that an industry had not been delicensed by 1997.

**Table A2: Trade Liberalization, FDI Reform, Labor Regulation and Industrial Performance in India, 1980-97**

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | Log Real Output | Log Real Output | Log Real Output | Log Real Output | Log Real Output |
| Delicense | | | | 0.064 | |
| | | | | (0.044) | |
| Labor Regulation | | -0.306*** | | -0.184* | |
| | | (0.100) | | (0.106) | |
| Delicense × Labor Regulation | | | | -0.060*** | -0.059** |
| | | | | (0.018) | (0.024) |
| Log Tariff Rate | -0.015 | -0.015 | | -0.020 | |
| | (0.049) | (0.050) | | (0.050) | |
| Log Tariff Rate × Labor Regulation | | 0.041** | 0.009 | 0.025 | 0.008 |
| | | (0.018) | (0.019) | (0.018) | (0.020) |
| FDI Reform | 0.226*** | 0.237*** | | 0.242*** | |
| | (0.084) | (0.079) | | (0.078) | |
| FDI Reform × Labor Regulation | | -0.038 | -0.007 | -0.010 | -0.010 |
| | | (0.030) | (0.038) | (0.028) | (0.036) |
| Observations | 17783 | 17783 | 17783 | 17783 | 17783 |
| R-squared | 0.89 | 0.89 | 0.92 | 0.89 | 0.92 |
| State-industry fixed effects | YES | YES | YES | YES | YES |
| Year fixed effects | YES | YES | | YES | |
| State-year fixed effects | | | YES | | YES |
| Industry-year fixed effects | | | YES | | YES |
| Standard errors | Cluster | Cluster | Cluster | Cluster | Cluster |
| | State×ydel | State×ydel | State×ydel | State×ydel | State×ydel |

**Notes:** Robust standard errors adjusted for clustering by state×year delicensed are reported in parentheses. *** denotes statistical significance at the 1% level; ** denotes statistical significance at the 5% level; * denotes statistical significance at the 10% level. Log Real Output is log real registered manufacturing output. Delicense is a dummy variable which is one if all or part of a three-digit industry is delicensed in a particular year and zero otherwise. Log Tariff Rate is the log tariff rate applied to a three digit industry. FDI reform is a variable which before 1991 is equal to zero and after 1991 is equal to the fraction of Harmonized System 6-digit products within a three-digit industry opened to automatic approval of Foreign Direct Investment (FDI) for up to 51 percent equity. State amendments to the Industrial Disputes Act are coded 1=pro-worker, 0=neutral, -1=pro-employer and then cumulated over 1947-97 to generate the labor regulation measure. The data set is a balanced panel of three-digit state-industries that are present in the data in all 18 years and includes an average of 64 three-digit industries in the 16 states over the period 1980 to 1997. The difference in the number of observations between Table A2 and Table 3 of the paper is due to the fact that there are a small number of three digit industries for which tariff data is unavailable. See the Data Appendix for further information on variable definitions and the data sources.