Distortionary Policies and the Size Distribution of Firms

Shanthi Nataraj

Preliminary Draft

December 2008

Abstract

India's firm size distribution (FSD) is very different from the FSD in the US or Europe, with many more small and large firms, and relatively few firms with 50-500 employees. The existing literature suggests that the FSD in India may reflect distortionary policies that lead to the misallocation of resources among firms, thus significantly decreasing output. In this paper, I examine the effects of relaxing six distortionary policies on the FSD. Preliminary results suggest that the relaxation of India's high import barriers moved its FSD closer to that of the US, pushing 2% more firms above the 50-employee mark. Relaxing India's stringent regulations on the firing of workers would move approximately 3% more firms above the 50-employee mark.

1 Introduction

The firm size distribution (FSD) in India is very different from the FSD in the US and Europe. Panels (a) and (b) of Figure 1 show the number of manufacturing firms, and total manufacturing employment, by firm size (measured as the number of employees) in India and the US. Nearly 60% of manufacturing firms in India have fewer than 5 employees, compared to only 35% in the US. Conversely, the US has many more firms with 20-500 employees.

Figure 2 shows that the majority of Indian manufacturing firms with fewer than 20 employees are found in India's unorganized (informal) sector. Manufacturing firms with more than 10 employees, that use a power source, or with more than 20 employees, that do not use a power source, are required to register with the government. These firms constitute the organized (formal) sector. Firms that do not meet these size requirements are not required to register, and make up the unorganized (informal) sector. Figure 3 shows that if we remove informal firms and compare formal Indian firms with more than 10 employees to US firms with more than 10 employees, a similar pattern emerges. India's employment is concentrated in very small and very large firms, relative to

the US; this phenomenon has been called the "missing middle" (Little, Mazumdar and Page 1987). This phenomenon has, if anything, become more striking over time; Figure 4 shows that the the number of small firms increased between 1985 and 1994.

Why does it matter that the FSD in India is different from the US? A number of authors have argued that the bimodal nature of the FSD in India and other developing countries is caused by distortionary policies that constrain the growth of firms and lead to the misallocation of resources among firms. The resulting industrial structure is thought to consist of many tiny firms that operate at an inefficiently small scale and a few large, oligopolistic firms that exercise significant market power[1]. There is some empirical evidence that supports this hypothesis. For example, Sleuwaegen and Goedhuys (2002) and Biesebroeck (2005) find that small firms grow more slowly in developing countries than in developed countries. Sleuwaegen and Goedhuys (2002) also find that a higher share of mid-sized firms in African countries report facing financial, regulatory, or other barriers to growth, compared to small and large firms. Angelini and Generale (2008) show that the distribution of firms that report being financially-constrained is left-shifted compared to the distribution of other firms.

Recently, two papers have attempted to measure the extent of resource misallocation across firms. Alfaro, Charlton and Kanczuk (2008) use the US FSD as an efficient benchmark and calculate the extent of distortions necessary to account for the FSDs in a number of different countries. They estimate that if the FSD in India looked like the FSD in the US (i.e., had more mid-sized firms and fewer large firms), output would increase by 31%. Hsieh and Klenow (2007) use a different efficiency benchmark; they argue that if there are no distortions, then the marginal revenue products of labor and capital should be equal across firms. They use this assumption to estimate the "efficient" FSDs for firms in China, India, and the US, and compare them to the actual FSDs in those three countries. In contrast to Alfaro et al. (2008), they find that India could be 40-50% more efficient if it had more small and large firms, and fewer mid-sized firms. Interestingly, these papers agree that India's FSD is distorted, but come to contrasting conclusions with respect to how it should change in order to become more efficient. There are various possible reasons for the discrepancy, including the fact that the authors use different datasets and different measures of firm size (Alfaro et al. (2008) use employment while Hsieh and Klenow (2007) use output). The consensus in the recent literature appears to be that India's FSD is distorted, and that removing the distortions could increase output significantly. However, as highlighted by the contrasting findings

[1]Rauch (1991) formalizes the idea that policies can create a bimodal industrial structure with a model of firms with different productivity levels. He shows that if wages are higher for firms above a certain size, then the least productive firms will choose to stay small in order to avoid the higher wage costs, while the most productive firms will pay the higher wages in order to achieve optimal size. There will be a size range, just above the cutoff at which the wage cost increases, where no firms will choose to locate, because the higher wage costs outweigh the size advantage. Empirically, Little et al. (1987) and Mazumdar and Sarkar (2008) discuss FSD in India, and Tybout (2000) provides a nice summary of the work on FSD in developing countries.

of Alfaro et al. (2008) and Hsieh and Klenow (2007), it is unclear what the undistorted FSD would look like.

In this paper, I avoid having to make assumptions about what the FSD should look like; rather, I examine the effects of relaxing six specific policy distortions on the FSD in India. The distortions I study include three policies that specifically increase costs for firms that are larger than certain size thresholds. First, I examine the impact of India's labor regulations. Firms with 50 or more employees are required to pay severance benefits, and firms with 100 or more employees are required to obtain government permission prior to firing employees or shutting down (Industrial Disputes Act, 1947). Second, India requires that 40% of bank credit be extended to certain "priority sectors" including small-scale industry (SSI), which includes firms with capital under certain limits. Banks have discretion as to how they allocate the 40% among the various priority sectors (Sen and Vaidya 1997). Third, until the 1990's, India required that most manufacturing firms with more than 50 employees and a certain amount of capital obtain a license in order to operate; the license dictated their output mix and quantity, inputs, location, and other factors (Sharma 2006). The licensing restrictions were lifted for a few industries during the 1980's, and for most industries in 1991.

I also consider the impacts of three policies that do not specifically restrict firm size, but theoretically could affect the FSD. The first two are related to trade and financial openness. Prior to 1991, manufacturing firms faced an average import tariff of 132%; due to a sweeping trade reform that began in 1991, the average tariff fell to 85% by 1994. Foreign direct investment (FDI), which required case-by-case approval prior to 1991, was also allowed into many industries without approval after 1991. The recent literature on trade with heterogeneous firms, beginning with Melitz (2003), suggests that trade affects the FSD. Nocke and Yeaple (2008) extend the Melitz (2003) framework by allowing firms to manage multiple products. They also show that a unilateral trade liberalization causes larger firms to increase in size, while smaller firms decrease in size, thus making the FSD steeper; a multilateral liberalization can either cause the FSD to become flatter or steeper, depending on modeling assumptions about the relationship between productivity and marginal cost[2]. Finally, theoretical work by Eifert (2007) suggests that electricity shortages, which are common in India, may contribute to the "missing middle" phenomenon. In the absence of a reliable electricity source, most firms choose small-scale, traditional methods of production that do not require a power source; a few firms choose modern methods of production and grow large enough to provide their own electrical power.

In order to identify the impacts of these policies on the FSD, I exploit the fact that the industrial

[2]There is sparse empirical work examining the effect of trade on firm size. Head and Ries (1999) and Dutz (1991) show that firm size falls as a result of import competition in Canada and Morocco, respectively, providing some support for the modeling predictions. However, Roberts and Tybout (1991) perform a similar exercise for trade liberalizations in Chile and Colombia and fail to find robust evidence that trade liberalization changes the FSD within a country.

policies (trade barriers, FDI allowances, and licensing) varied across industries and over time, while the labor regulations, credit allocation, and electricity shortages varied across states and over time. I use conditional quantile regression (QR) techniques to estimate the impact of each policy on various percentiles of the FSD.

My preliminary results suggest that the two policies that affected the FSD in an economically significant way were trade liberalization and labor regulations. I find that a 50 point fall in output tariffs (the average fall from 1985-1994) is associated with an additional 2 percent of firms growing over the 50-employee mark, and an additional 1 percent of firms growing over the 100-employee mark. Similarly, a one-standard-deviation movement towards more employer-friendly labor regulations would be associated with an additional 3 percent of firms growing over the 50-employee mark, and an additional 1 percent of firms growing over the 100-employee mark. These changes bring the Indian FSD significantly closer to the US FSD, which has approximately 6 percent more firms above the 50-employee mark than India[3].

The remainder of this paper is organized as follows. Section 2 briefly summarizes the six major policy distortions I examine. Section 3 discusses the QR methodology I will employ to estimate the effects of policies on the FSD. Section 4 presents preliminary results, and Section 5 discusses future work.

2 Brief Overview of Policy Distortions

Prior to 1991, India's economy was characterized by restrictive trade and industrial policies. In 1991, following a combination of economic and political shocks, India requested assistance from the IMF, which required that India undertake several major reforms. The first was a trade liberalization; between 1991 and 1994, the average tariff faced by manufacturing firms fell from over 130% to 85%. Figure 5 shows the changes in tariffs between 1985 and 1994; data are based on Aghion et al. (2008). India also significantly loosened its restrictions on FDI inflow; prior to 1991, all FDI had to be approved on a case-by-case basis. Between 1991 and 1994, FDI of up to 51% was gradually allowed in approximately 30% of industries without approval. The other major change in industrial policy during the 1980's and 1990's was the fall of the "license raj". Prior to the 1980's, firms with more than a certain number of employees and a certain amount of capital had to obtain a license that restricted output quantity, product mix, and other factors[4]. Delicensing - the process of removing the licensing requirements from most industries - began during the 1980's, and was accelerated when the 1991 reforms occurred. Between 1985 and 1994, approximately 40% of

[3]Since most Indian firms with fewer than 10 employees are located in the informal sector, I compare formal firms with 10 or more employees to US firms with 10 or more employees in making this comparison.

[4]The employment limit was 50 employees with power, or 100 employees without. From 1985-1990, the capital limit was Rs. 50 million; it was increased to Rs. 150 million in 1990 (Sharma 2006).

industries were delicensed. Recent work has shown that the trade, FDI, and delicensing reforms increased productivity among formal manufacturing firms (Topalova 2006, Sivadasan 2006, Aghion, Burgess, Redding and Zilibotti 2008, respectively).

Although India has liberalized its trade regime and some of its industrial policies, several remaining policies have been criticized for constraining firms. Besley and Burgess (2004) show that India's labor regulations, which make it difficult for firms over a certain size to fire workers or to shut down, decrease output among formal sector firms. They identify the effects of the labor regulations by exploiting the variation across states and over time; although the federal government imposes certain basic labor regulations, states can pass amendments to either make the laws more or less stringent. The authors code each state amendment to the federal labor regulations as "pro-employer" or "pro-worker"; I use their classification of labor regulations to identify the impact of those regulations on the FSD. Panel (a) of Figure 6 shows the changes in labor regulations from 1985-1994.

India's credit policy has also been criticized for constraining firms. Federal banking regulations require that all domestic commercial banks (public and private) allocate 40% of credit to "priority sectors", which include agriculture, small transport operators, and small-scale industries (SSIs). A firm can register as an SSI if its capital is below a certain limit[5]. Individual banks have some discretion as to how they allocate the 40% among the various priority sectors; there is no specific target for SSIs. I calculate the fraction of credit allocated to SSIs in various states every year[6] to identify the impact of credit allocation to SSIs on the FSD. Panel (b) of Figure 6 shows the changes in credit allocated to SSIs over time.

Finally, India's lack of infrastructure, and in particular its unreliable electricity service, has been identified as a barrier to growth. Although some reforms have been made in recent years, electricity shortages remain common (Engineer 1999). Eifert (2007) develops a theoretical model in which unreliable public energy provision creates a bimodal firm structure, with entering firms remaining small and using traditional production techniques that do not require power, while large incumbent firms use modern techniques and provide their own power. The Centre for Monitoring the Indian Economy (CMIE) calculates the expected annual electricity demand in every state, as well as the electricity supply based on in-state production and transfers. I use the electricity surplus/shortage (demand minus supply) as a measure of electricity availability; Eifert's (2007) theory suggests that states with greater electricity deficits should skew the distribution towards more small firms. Panel (c) of Figure 6 shows the electricity surplus/deficity in various states from 1985-1994.

Table 1 provides summary statistics for the policy measures discussed above.

[5]The capital limit was Rs. 3.5 million until 1989; Rs. 6 million from 1989-1991; and Rs. 10 million from 1991-1994.

[6]Data from various publications of the Reserve Bank of India.

3 Empirical Strategy

I begin by estimating firm size at various percentiles of the size distribution. I measure firm size in terms of the number of employees. The literature on firm size has used various measures, including output, assets, and employment; here, I focus on employment in order to minimize measurement issues associated with output or assets. However, as I discuss in Section 5, there are interesting and possibly different insights to be gained from using different measures of size.

Suppose that firm i has productivity ϕ and faces competitive goods and factor markets, but that there are several policy distortions. In the spirit of Hsieh and Klenow (2007), I model each distortion as a shift in the output price or a factor price. The firm's profit-maximization problem is:

$$\max \Pi_i = p[1+\tau]\phi y_i(l_i, k_i, m_i, e_i) - p^m[1+\tau^m]m_i - w[1+\tau^l]l_i - r[1+\tau^k]k_i - p^e[1+\tau^e]e_i \quad (1)$$

where
$p =$ price of output good before tariff
$\tau =$ad valorem tariff on output good
$y =$output
$l =$quantity of labor input
$k =$quantity of capital input
$m =$quantity of material inputs before tariffs
$e =$quantity of electricity input
$p^m =$price of input materials
$\tau^m =$ad valorem tariff on material inputs
$w =$wage
$\tau^l =$distortionary effect of policy on labor cost
$r =$cost of capital
$\tau^k =$distortionary effect of policy on capital cost
$p^e =$price of electricity
$\tau^e =$distortionary effect of policy on electricity cost

The standard first-order conditions yield a labor demand function for firm i that is a function of output and input prices, as well as the distortions:

$$l_i^* = f(p[1+\tau], p^m[1+\tau^m], w[1+\tau^l], r[1+\tau^k], p^e[1+\tau^e]; \phi) \quad (2)$$

By linearizing Equation 2, allowing policy distortions to enter separately from prices, and adding time, state, and industry fixed effects, the labor demand equation for firm i in state s and

industry j at time t becomes:

$$\begin{aligned} l_i &= p_{jt}[1+\tau_{jt}]\beta_1 + p^m_{jt}[1+\tau^m_{jt}]\beta_2 + Delic_{jt}\beta_3 + FDI_{jt}\beta_4 + ... \\ &\quad ... + LaborRegs_{st}\beta_5 + ElecSurplus_{st}\beta_6 + CreditShare_{st}\beta_7 + ... \\ &\quad ... + w_{st}\beta_8 + r_{st}\beta_9 + p^e_{st}\beta_{10} + \alpha_j + \alpha_s + \alpha_t + \phi_i + u_{ijst} \end{aligned} \tag{3}$$

I proceed by estimating not the individual labor demand for firm i, but the labor demand for the firm at a certain percentile of the size distribution. Define $z \equiv (p_{jt}[1+\tau_{jt}]', p^m_{jt}[1+\tau^m_{jt}]', Delic'_{jt}, FDI'_{jt}, LaborRegs'_{st}, ElecSurplus'_{st}, CreditShare'_{st}, w'_{st}, r'_{st}, p^e_{st}, \alpha'_j, \alpha'_s, \alpha'_t)'$, and let $Q_\theta(l|z)$ be the θth quantile of firm size, where $\theta \in (0,1)$. The conditional quantiles are then given by:

$$Q_\theta(l_{ijst}|z_{ijst}) = z'_{ijst}\beta(\theta) \tag{4}$$

As shown by Koenker and Bassett (1978), $\beta(\theta)$ is found by minimizing:

$$n^{-1}\sum_{i=1}^{n}\rho_\theta(l_{ijst} - z'_{ijst}\beta_\theta)$$

where

$$\begin{aligned} \rho_\theta(u) &= \theta u, u \geq 0 \\ &\quad (\theta - 1)u, u \leq 0 \end{aligned} \tag{5}$$

Output prices before tariffs, p_{jt}, are approximated by using annual US export prices for each broad industry group; similarly, average input prices before tariffs, p^m_{jt}, are approximated using US export prices, weighted by corresponding input shares for each industry, from India's 1993-94 Input-Output Transactions Table. To avoid endogeneity in firm-level wages, I use the average wage paid by all firms in firm i's state, not including firm i's district. Due to a lack of reliable information on asset prices, I do not calculate capital rental rates directly; however, as Harper, Berndt and Wood (1989) point out, there should be a positive correlation between interest rates and capital rental prices. Therefore, I use the average interest rate paid by all firms in firm i's state, not including firm i's district, as a proxy for the capital rental price faced by firm i. The price of electricity p^e is taken as the average electricity tariff[7] charged by state s at time t. Industry, state, and time dummies are given by α_j, α_s, and α_t, respectively.

Output tariffs, input tariffs, delicensing, and FDI reform vary by industry and time. Input tariffs

[7]Data on electricity prices are from Engineer (1999).

τ_{jt}^{m} are estimated based on input cost shares from the 1993-94 Input-Output Transactions Table. $Delic_{jt}$ is a dummy variable equal to 1 if the industry was delicensed, 0 otherwise. FDI_{jt} is a dummy variable equal to 1 if the industry allowed FDI without case-by-case authorization, 0 otherwise. Labor regulations, credit allocated to SSIs, and electricity surplus vary across states and over time. $LaborRegs_{st}$ is the measure of the stringency of labor regulations, where higher numbers imply more stringency. $CreditShare_{st}$ is the share of total credit allocated to SSIs. $ElecSurplus_{st}$ is the electricity surplus (deficit). Each of these policy variables, including data sources for each, was discussed in Section 2.

To estimate these conditional quantiles, I combine the measures of policy distortions with employment, wage and interest rate data from annual, firm-level surveys from 1985-1994. In this draft, I focus only on formal sector firms, which are covered by the Annual Survey of Industries (ASI)[8]. The ASI sampling frame is based on the universe of registered firms that make up the organized (formal) sector. All units with more than a certain number of employees are surveyed every year[9]. All other firms are sampled, using each state-by-industry group as a stratum. Table 1 presents summary statistics.

4 Preliminary Results

I conducted the quantile regression analysis described above at every 5th percentile of the firm size distribution. Table 2 presents quantile regression results for the 25th, 50th, and 75th quantiles. Figures 7, 8, and 9 present the results for each policy variable (output and input prices, delicensing, FDI reform, labor regulations, and credit share to SSIs) at all quantiles graphically. Since the coefficients on electricity surplus were indistinguishable from zero (both statistically and economically), I do not include a graph of the QR results.

As we would expect, output and input prices had opposite impacts on the percentiles of the FSD[10]. An increase in the output price index causes firm size to decrease at all percentiles, while an increase in the input price index causes firm size to increase at all percentiles. This finding is in line with one view of the new trade theory (c.f. Melitz and Ottaviano (2008)), which predicts that a trade liberalization forces the least productive firms to exit, thus increasing average firm size.

[8] In future work, I will also consider informal firms. However, firm-level data for informal firms are only collected every 5 years, and data on the full informal sector (including firms with 6+ employees) are only available in 1994 and 1999. Therefore, to examine the impacts of the reforms that took place largely in the early 1990's, I currently consider only the formal sector.

[9] Until the 1986-87 survey year, all firms with 50 or more workers operating with power, and units having 100 or more workers operating without power, were surveyed. From 1986-87 through 1994-95, all firms with 100 or more workers were surveyed. All firms, regardless of size, in 12 states considered "industrially-backwards" were also surveyed.

[10] In the specifications presented here, the output price and output tariff enter jointly, as do the input price and input tariff. I obtain similar results when I allow the tariffs and prices to enter separately.

Somewhat surprisingly, delicensing decreases the firm size at nearly all quantiles of the distribution; we might have expected removing a licensing requirement to increase firm size, at least around the threshold where the licensing requirement begins (50 employees, or approximately the 75th percentile). However, it is possible that the capital limits for licensing are more binding than the employment limits. Allowing FDI inflows without case-by-case approval appears to decrease the size in the lowest quantiles, while increasing size in the higher quantiles. More onerous (more positive) labor regulations, as expected, decrease firm size at all quantiles. Finally, credit share to SSIs appears to increase the bottom 75% of percentiles (firm size up to about 75 employees) and decrease the top 25% of percentiles. This is consistent with the idea that credit subsidies for small firms help those firms to grow larger, but the potential for losing a credit source once a firm grows above a certain size slows the growth of mid-sized and large firms.

To estimate how large these results are, I calculate the impacts of relaxing each of these policies on the FSD. For the policy reforms that occurred between 1985 and 1994, I consider the impacts of the actual changes: that is, a 50% fall in output and input tariffs, a 40% increase in the number of firms delicensed, and a 30% increase in the number of firms facing FDI reforms. To assess the impact of loosening restrictive labor regulations on the FSD, I consider the impact of a one standard deviation decrease in the labor regulation variable (towards more employer-friendly policies). For credit allocation, I consider the impact of a 10% decrease in the share of total credit allocated to SSIs.

Table 3 summarizes the results, by presenting the percent of firms that would have more than 50 and 100 employees, respectively, under each set of reforms. Although all of the policies discussed above had statistically significant impacts on the FSD, only the fall in output tariffs and the hypothetical labor market deregulation exhibit economically significant impacts[11]. The fall in output tariffs pushed an additional 2% of firms over the 50-employees threshold, and an additional 1% of firms over the 100-employee threshold. Labor deregulation could have similar effects, pushing 3% more firms over the 50-employee threshold and 1% more firms over the 100-employee threshold. Figure 10 shows the effects of the trade and labor reforms on the cumulative distribution functions (c.d.f.) of firm size.

How large are these changes? Figure 11 shows the c.d.f. of firm size in India and the US, for firms with 10 or more employees[12]. The c.d.f. in the US is shifted to the right, reflecting the fact that the US has approximately 8% more firms with 50 or more employees, and 5% more firms with 100 or more employees. The trade reform reduced this gap by a quarter; labor reforms could reduce

[11]The finding that the fall in input prices did not affect the FSD appreciably is somewhat surprising, given recent evidence that imported intermediate inputs play a large role in trade liberalization (Amiti and Davis 2008, Goldberg, Khandelwal, Pavcnik and Topalova 2008, among others). However, the true effect of the input tariffs may be blunted by the fact that I use the input-output tables, rather than actual firm-level inputs, to calculate input prices.

[12]Since most firms with fewer than 10 employees in India are in the informal sector, I compare only formal firms with 10+ employees to US firms with 10+ employees.

the gap to half its original size.

5 Future Work

The preliminary results suggest that India's efficient firm size distribution, at least in terms of employment, should look more like the FSD in the US. However, as noted above, it is possible that some of the policies I consider have different, or more substantial, impacts on the FSD in terms of capital or output. Conducting a similar exercise using those measures of firm size can shed light on which aspects of firm input and output choices are most distorted by the policies I study. It may also help to resolve the issue of whether India's efficient FSD should have more or fewer mid-sized firms; it may be the case that the "missing middle" exists in terms of employment, but that an efficient allocation of resources leads to more large and small firms in terms of output.

In Section 4, I showed the predicted c.d.f. under different policy regimes. In future work, I will also use the technique pioneered by Machado and Mata (2005) to simulate the counterfactual probability distribution function (p.d.f.) under various policy regimes. This will allow me to compare the p.d.f. to the "efficient" p.d.f., calculated in a manner similar to Hsieh and Klenow (2007), and to estimate the potential increase in output that would result from reducing each policy distortion.

Finally, as discussed above, I restricted the the comparison between the Indian and US c.d.f. to firms with 10 or more employees, since most Indian firms with fewer than 10 employees are in the informal sector. However, any complete accounting of the FSD in India must take into account the lion's share of employment that is located in the informal sector. Although representative data are only available every 5 years, from 1994 onwards, for the informal sector, conducting a similar exercise for those years that are available is an essential extension to this work.

References

Aghion, Philippe, Robin Burgess, Stephen Redding, and Fabrizio Zilibotti, "The Unequal Effects of Liberalization: Evidence from Dismantling the License Raj in India," The American Economic Review, September 2008, 98 (4), 1397–1412.

Alfaro, Laura, Andrew Charlton, and Fabio Kanczuk, "Plant-Size Distribution and Cross-Country Income Differences," July 2008. Working Paper.

Amiti, Mary and Donald R. Davis, "Trade, Firms, and Wages: Theory and Evidence," June 2008. NBER Working Paper 14106.

Angelini, Paolo and Andrea Generale, "On the Evolution of Firm Size Distributions," The American Economic Review, 2008, 98 (1), 426–438.

Besley, Timothy and Robin Burgess, "Can Labor Regulation Hinder Economic Performance? Evidence from India," Quarterly Journal of Economics, February 2004.

Biesebroeck, Johannes Van, "Firm Size Matters: Growth and Productivity Growth in African Manufacturing," Economic Development and Cultural Change, March 2005, 53 (3), 545–584.

Dutz, Mark A., "Theory with Application to the Moroccan Experience," February 1991. World Bank Policy, Research, and External Affairs Working Paper 602.

Eifert, Benjamin P., "Infrastructure and Market Structure in Least-Developed Countries," April 2007. Working Paper.

Engineer, R. N., Power India Handbook, Published in association with IBPL Urja Research Foundation by Multi-Tech Pub. Co., 1999.

Goldberg, Pinelopi K., Amit Khandelwal, Nina Pavcnik, and Petia Topalova, "Imported Intermediate Inputs and Domestic Product Growth: Evidence from India," October 2008. NBER Working Paper 14416.

Harper, Michael J., Ernst R. Berndt, and David O. Wood, Technology and Capital Formation, MIT Press, 1989.

Head, Keith and John Ries, "Rationalization effects of tariff reductions," Journal of International Economics, 1999, 47, 295–320.

Hsieh, Chang-Tai and Peter J. Klenow, "Misallocation and Manufacturing TFP in China and India," May 2007. Working Paper.

Koenker, Roger and Gilbert Bassett, "Regression Quantiles," Econometrica, 1978, 46, 33–50.

Little, Ian M.D., Dipak Mazumdar, and John M. Page, Small Manufacturing Enterprises: A Comparative Study of India and Other Economies, Oxford University Press, 1987.

Machado, Jose A. F. and Jose Mata, "Counterfactual Decomposition of Changes in Wage Distributions Using Quantile Regression," Journal of Applied Econometrics, 2005, 20, 445–465.

Mazumdar, Dipak and Sandip Sarkar, Globalization, Labor Markets and Inequality in India, New York: Routledge, 2008.

Melitz, Marc J., "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," Econometrica, November 2003, 71 (6), 1695–1725.

__ and Giancarlo I. P. Ottaviano, "Market Size, Trade, and Productivity," Review of Economic Studies, 2008, 75, 295–316.

Nocke, Volker and Stephen R. Yeaple, "Globalizaion and the Size Distribution of Multiproduct Firms," August 2008. PIER Working Paper 06-015.

Rauch, James E., "Modelling the Informal Sector Formally," Journal of Development Economics, 1991, 35, 33–47.

Roberts, Mark J. and James R. Tybout, "Size Rationalization and Trade Exposure in Developing

Countries," February 1991. World Bank Policy, Research, and External Affairs Working Paper 594.

Sen, Kunal and Rajendra R. Vaidya, The Process of Financial Liberalization in India, New Delhi: Oxford University Press, 1997.

Sharma, Gunjan, "Competing or Collaborating Siblings? Industrial and Trade Policies in India," May 2006. Working Paper.

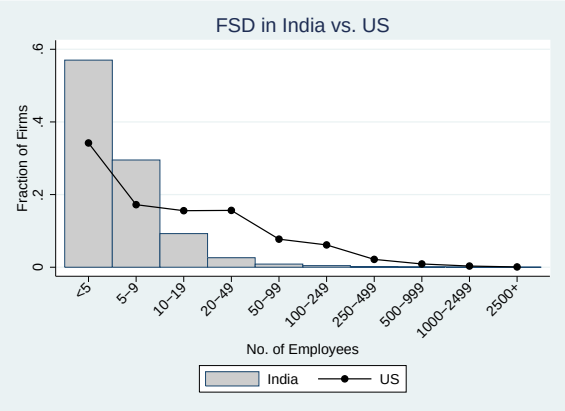
Sivadasan, Jagadeesh, "Productivity Consequences of Product Market Liberalization: Micro-evidence from Indian Manufacturing Sector Reforms," October 2006. Working Paper.

Sleuwaegen, Leo and Micheline Goedhuys, "Growth of firms in developing countries, evidence from Cote d'Ivoire," Journal of Development Economics, 2002, 68, 117–135.

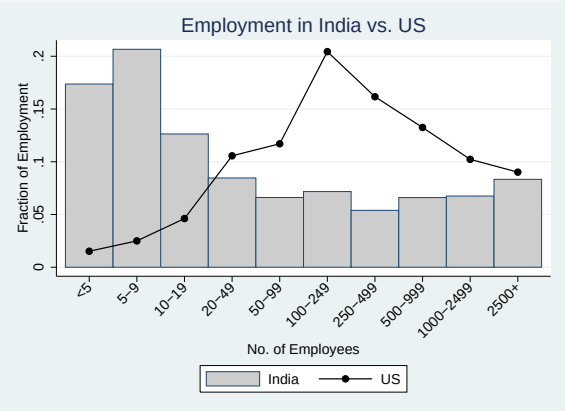
Topalova, Petia, "Trade Liberalization and Firm Productivity: The Case of India," February 2006. Working Paper.

Tybout, James, "Manufacturing Firms in Developing Countries: How Well Do They Do, and Why?," Journal of Economic Literature, 2000, 38 (1), 11–44.

Figure 1: Firm Size Distribution, India versus US



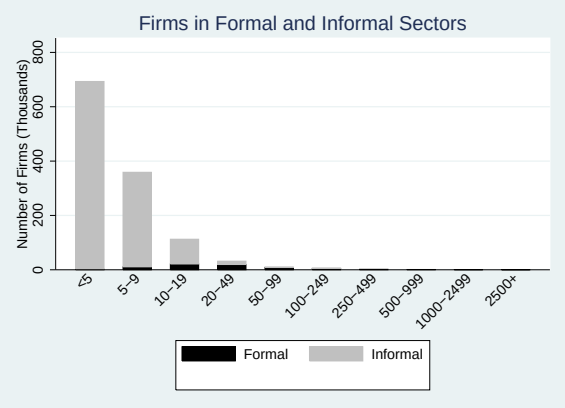
(a) Firm Distribution



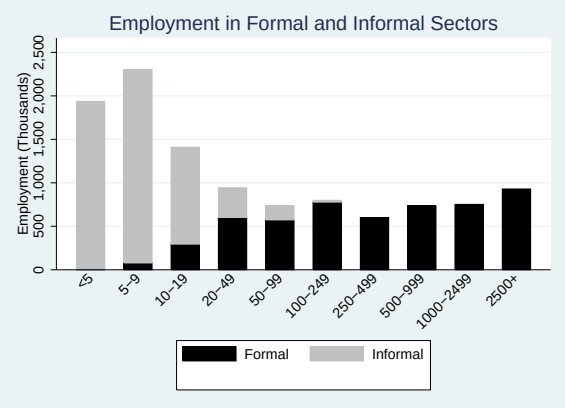
(b) Employment Distribution

Panels (a) and (b) show the share of manufacturing firms and employment, by firm size, in India and the US. Firm size is measured as the number of employees. Source: Author's calculations based on US Census of Manufactures, 1997; Annual Survey of Industries, 1994; National Sample Survey, 1994.

Figure 2: Formal and Informal Sector Employment



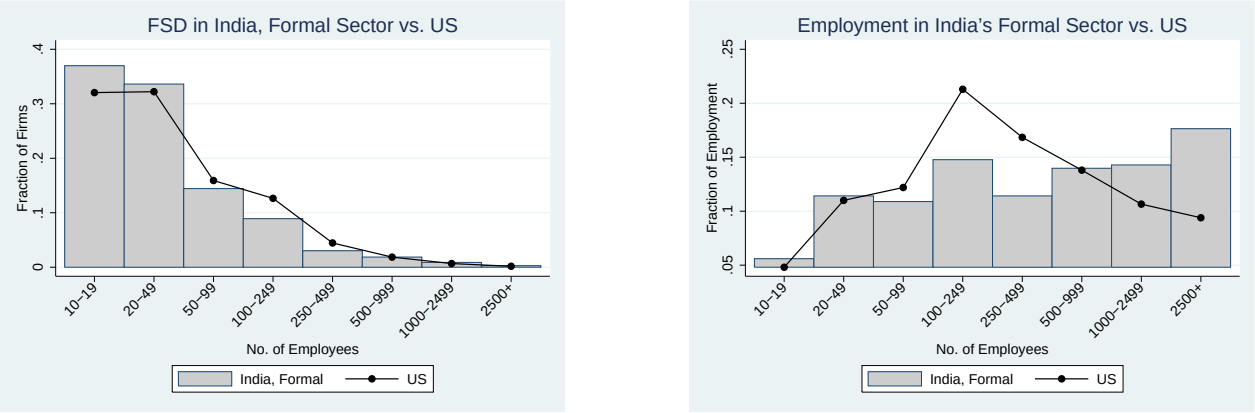
(a)



(b)

Panels (a) and (b) show the shares of firms and employment in the formal and informal sectors in India, by firm size in India. Firm size is measured as the number of employees. Source: Author's calculations based on Annual Survey of Industries, 1994; National Sample Survey, 1994.

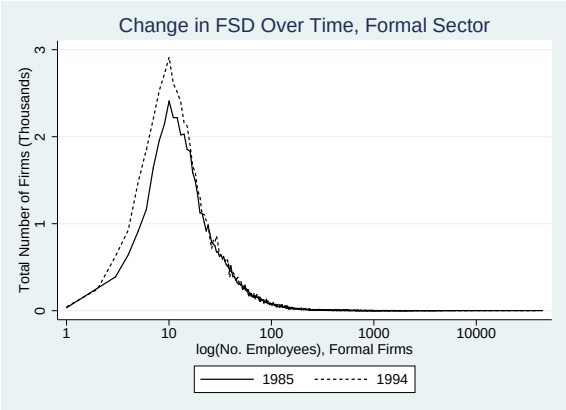
Figure 3: Firm Size Distribution, India Formal Sector versus US



(a) (b)

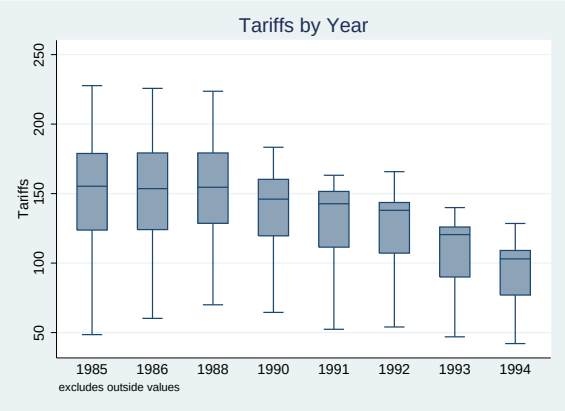
Panels (a) and (b) show the share of manufacturing firms and employment, by firm size, in India and the US, for firms with 10 or more employees. Only formal firms in India are included. Firm size is measured as the number of employees. Source: Author's calculations based on US Census of Manufactures, 1997; Annual Survey of Industries, 1994.

Figure 4: Change in Indian Firm Size Distribution Over Time



Change in the total number of Indian manufacturing firms by firm size, in the formal sector, from 1985-1994. Source: Author's calculations, based on Annual Survey of Industries, 1985 and 1994.

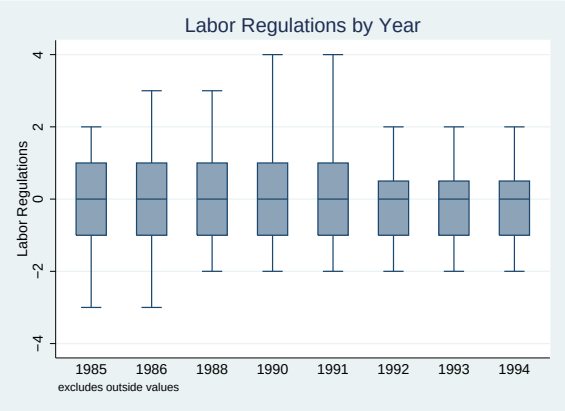
Figure 5: Tariff Reforms



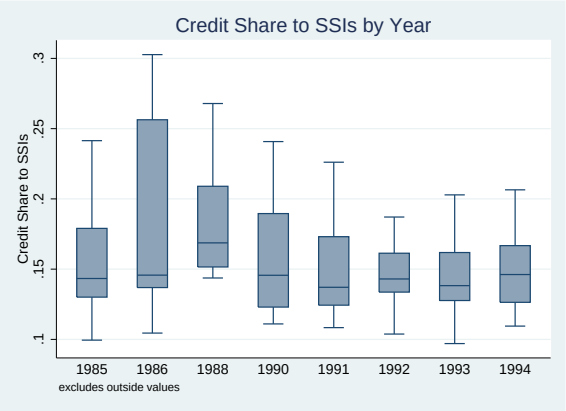
(a)

Median (line), 25th and 75th percentiles (box) and 10th and 90th percentiles (whiskers) of average tariffs. Source: Author's calculations based on Aghion et al. (2008).

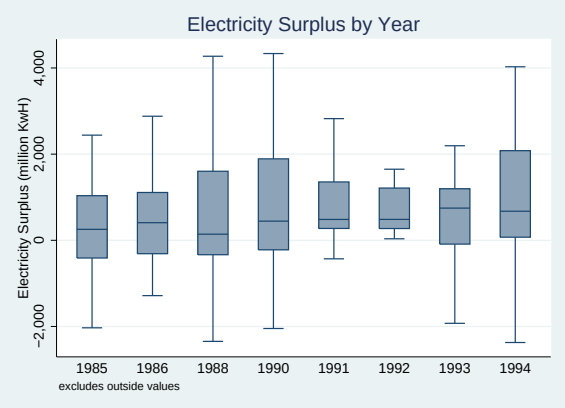
Figure 6: Labor, Credit, and Electricity Policies Over Time



(a)



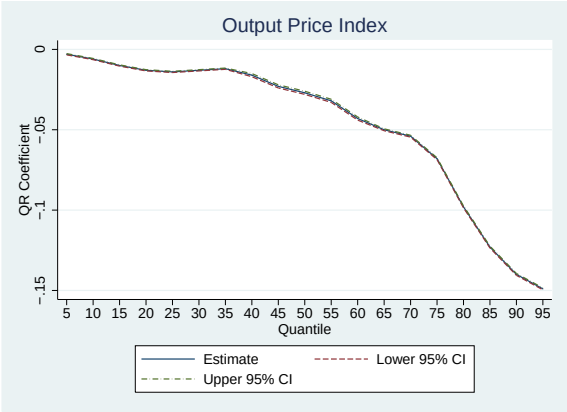
(b)



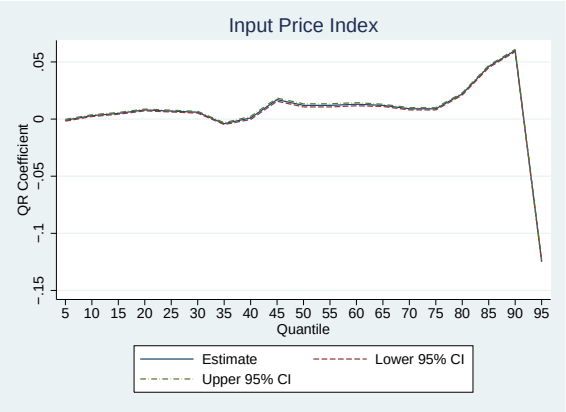
(c)

Labor regulations, credit allocated to SSIs, and electricity surpluses. Panel (a) shows the median (line), 25th and 75th percentiles (box) and 10th and 90th percentiles (whiskers) of labor regulations, where positive values indicate labor-friendly policies and negative values indicate employer-friendly policies. Panel (b) shows the median, 25th and 75th percentiles and 10th and 90th percentiles of the share of credit allocated to small-scale industries (relative to total credit) by scheduled commercial banks. Panel (c) shows the median, 25th and 75th percentiles and 10th and 90th percentiles of the share of electricity surplus (deficit) for each state, in million KwH. Source: Author's calculations based on sources described in Section 2.

Figure 7: QR results - Trade Reforms



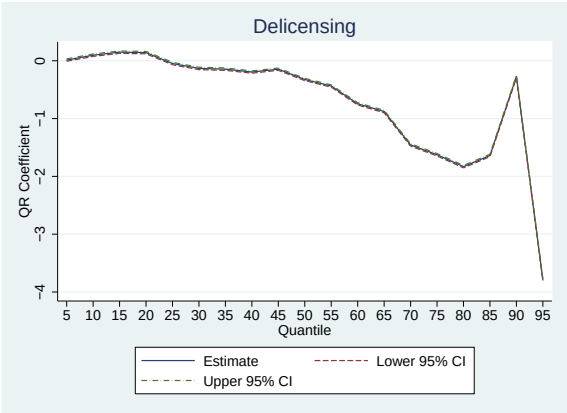
(a) Output Price Index



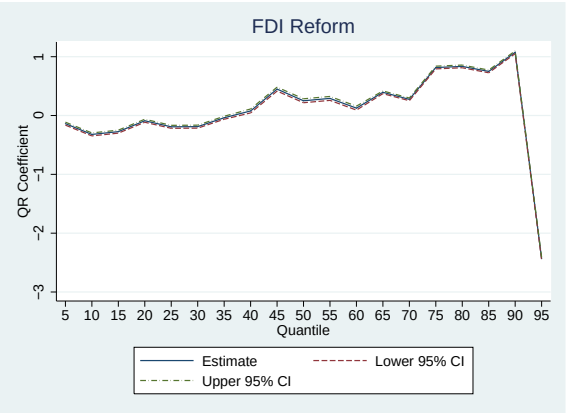
(b) Input Price Index

Panels (a) and (b) show quantile regression coefficients, and 95% confidence intervals, for the effects of output and input price indices on firm size (in number of employees). The output price index is calculated as $p_{jt}[1 + \tau_{jt}]$ where p_{jt} is proxied by US export price for industry j in year t, and is normalized to make the price in 2000 equal to 100. τ_{jt} is the ad valorem tariff faced by industry j in year t. The input price index is calculated similarly, except that the average prices of material inputs, weighted by cost shares from India's 1993-94 Input-Output Transactions Table, are used.

Figure 8: QR results - Industrial Policies



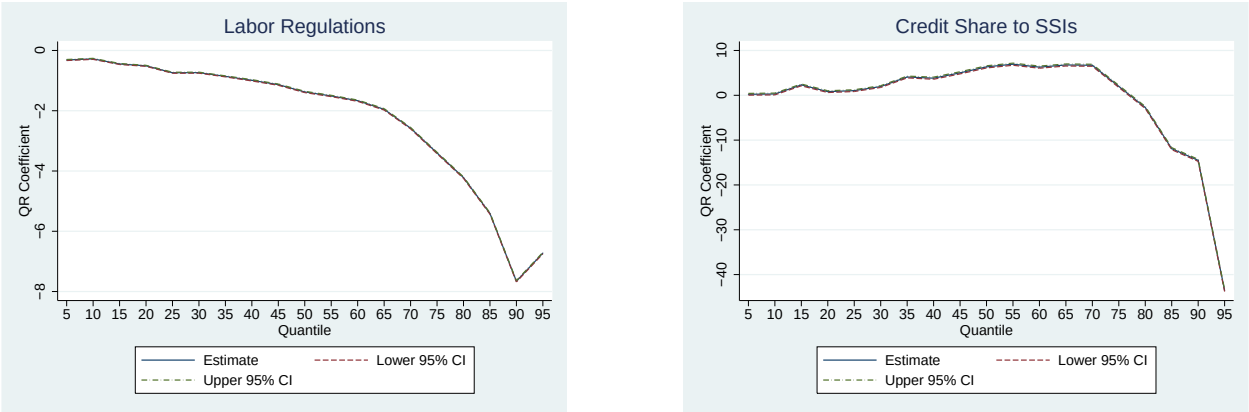
(a) Delicensing



(b) FDI Reform

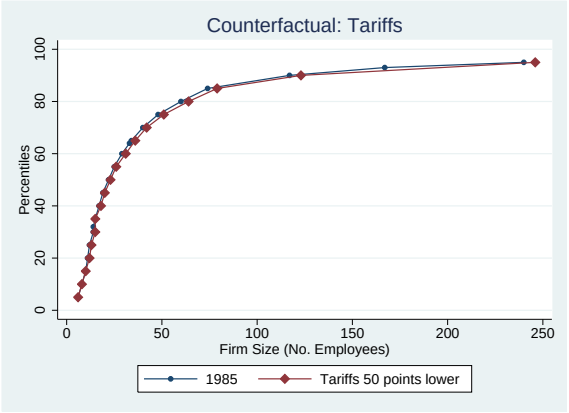
Panels (a) and (b) show the quantile regression coefficients, and 95% confidence intervals, for the effects of delicensing and FDI reform on firm size (in number of employees). Delicensing is a dummy variable, equal to 0 if firms above a certain size are required to obtain a license in order to operate, 1 otherwise. FDI reform is a dummy variable, equal to 0 if FDI requires case-by-case approval, 1 otherwise.

Figure 9: QR results - Labor and Credit Policies

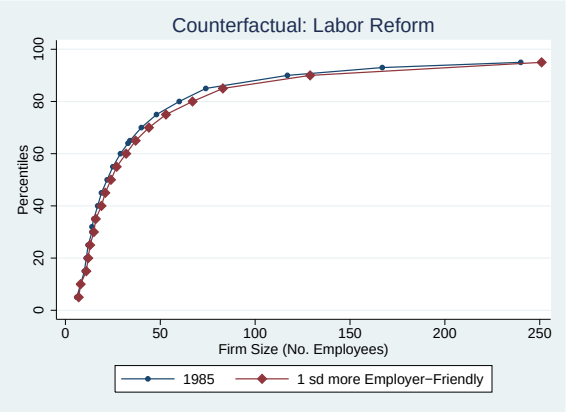


Panels (a) and (b) show the quantile regression coefficients, and 95% confidence intervals, for the effects of labor regulations and credit allocated to small-scale industries (SSIs) on firm size (in number of employees). Labor regulation measures are from Besley and Burgess (2004); more positive numbers reflect more "pro-employer" regulations. Credit share to SSIs is the fraction of credit allocated to SSIs.

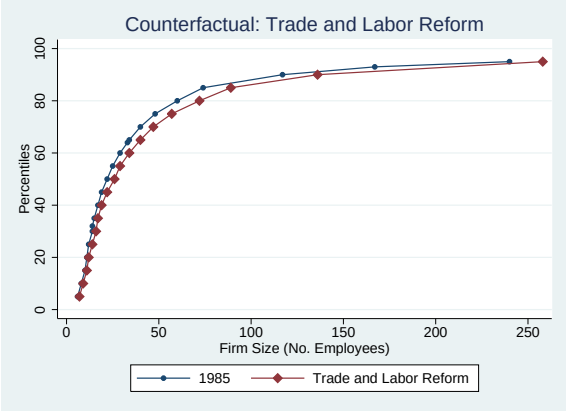
Figure 10: Counterfactual Predictions



(a) Trade Reform



(b) Labor Reform



(c) Trade and Labor Reform

Cumulative distribution functions (c.d.f.) of firm size in India in 1985, and predicted c.d.f.s under various policy regimes. Panel (a) shows the predicted c.d.f. for a fall in output tariffs of 50 percentage points. Panel (b) shows the predicted c.d.f. for a one standard deviation change in the labor regulations towards being more "pro-employer". Panel (c) shows the combined impacts of both trade and labor reforms.

Figure 11: India versus US c.d.f.

Cumulative distribution function (c.d.f.) of firm size in India and the US, for firms with 10+ employees. Source: Author's calculations based on US Census of Manufactures, 1997; Annual Survey of Industries, 1994.

Table 1: Summary Statistics

	Mean	sd	Min	Max
Per-firm Employment	79.62	452.58	1	65,193
Output Tariffs	118.66	40.10	2	347.33
Input Tariffs	77.81	21.82	12.67	131.61
Delicense	0.75	0.43	0	1
FDI Reform	0.16	0.31	0	1
Labor Regulations	-0.06	1.65	-3	4
Electricity Surplus (Million KwH)	1,584.76	7,165.11	-7,431	61,303
Share of Credit Allocated to SSIs	0.16	0.05	0.10	0.30
Average Wage (Rs/day)	35.52	25.90	16.52	215.44
Average Annual Real Interest Rate (%)	6.44	42.75	0.00	375.63
Average Electricity Price (Ps/KwH)	56.39	10.48	16.73	75.66
No. Obs.	258,707			
No. State-Industry Clusters	932			

Summary statistics for firm size (number of employees) and various policy measures. Output tariffs are ad valorem. Input tariffs are calculated based on cost shares from India's 1993-94 Input-Output Transactions Table. Delicensing is a dummy variable, equal to 0 if firms above a certain size are required to obtain a license in order to operate, 1 otherwise. FDI reform is a dummy variable, equal to 0 if FDI requires case-by-case approval, 1 otherwise. Labor regulation measures are from Besley and Burgess (2004); more positive numbers reflect more "pro-employer" regulations. Credit share to SSIs is the fraction of credit allocated to small-scale industry. Source: Author's calculations, based on Annual Survey of Industries, 1985-1994, and various sources as described in Section 2.

Table 2: Quantile Regression Results

	0.25	**0.5**	**0.75**
Output Price	-0.014***	-0.027***	-0.068***
	(0.0002)	(0.0005)	(0.0003)
Input Price	0.007***	0.012***	0.009***
	(0.0004)	(0.0007)	(0.0005)
Delicense	-0.048***	-0.324***	-1.625***
	(0.0106)	(0.01)	(0.0108)
FDI Reform	-0.192***	0.251***	0.816***
	(0.0129)	(0.017)	(0.0117)
Labor Regulations	-0.739***	-1.376***	-3.401***
	(0.0087)	(0.011)	(0.012)
Electricity Surplus	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Credit Share to SSIs	1.045***	6.343***	1.992***
	(0.1005)	(0.1218)	(0.1157)
Average Wage	0.0001	-0.008***	-0.012***
	(0.0001)	(0.0001)	(0.0001)
Average Real Interest Rate	0.001***	0.0001	-0.001***
	(0.00004)	(0.0001)	(0.0001)
Electricity Price	0.003***	-0.02***	-0.032***
	(0.0006)	(0.0007)	(0.0007)
No. Obs.	258707	258707	258707
No. State-Industry Clusters	932	932	932
Pseudo R^2	0.0899	0.0878	0.1617
Actual Firm Size	13	27	75

Dependent variable is firm size (number of employees). Column headings indicate percentiles. All specifications include industry, state, and year dummies. Standard errors are in parentheses, and were calculated using a design matrix bootstrap, clustered at the state-by-industry level. *, **, and *** represent significance at the 10%, 5% and 1% levels, respectively.

Table 3: Counterfactual Predictions

	Percent firms with	
	>50 employees	>100 employees
1985 (Actual)	24	12
Tariffs 50 points lower	26	13
Input tariffs 50 points lower	24	12
40% of firms delicensed	24	12
30% of firms with FDI allowed	24	12
Labor regulations 1 sd more employer-friendly	27	13
10% less credit allocated to SSIs	24	12

Counterfactual predictions of the percent of firms with over 50 and 100 employees if various policy distortions were reduced.