No Country for Dying Firms: Evidence from India*

Shoumitro Chatterjee
Johns Hopkins & CEPR

Kala Krishna
Penn State University & NBER

Kalyani Padmakumar
Florida State University

Yingyan Zhao
George Washington University

May 22, 2024

Abstract

This paper examines the impact of exit barriers on firm growth and development in India. Despite being one of the largest and fastest-growing economies, India's manufacturing sector, particularly low-skill manufacturing, remains underdeveloped. We argue that Indian institutions create frictions that hinder factor adjustment and firm exit, trapping resources in unproductive firms and contributing to this underperformance. Our findings show that firms in India face significant adjustment costs and exit frictions, especially in states with higher misallocation and labor-intensive sectors. We develop and estimate a dynamic heterogeneous firm model incorporating entry, exit, and input adjustment costs. Our estimates suggest that reducing exit frictions to achieve firm exit rates at 70% of those in the US could increase aggregate value added and productivity by about 13% and 3%, respectively. The impact on employment, however, depends on the availability of capital and can potentially be negative if capital is fixed.

*Chatterjee: School of Advanced International Studies, Johns Hopkins University, 555 Pennsylvania Ave NW, 558Z, Washington D.C. 20001. shoumitroc@jhu.edu. Krishna: Department of Economics, The Pennsylvania State University, University Park, PA 16802. kmk4@psu.edu. Padmakumar: Department of Economics, Florida State University. Email: kpadmakumar@fsu.edu. Zhao: Department of Economics and the Elliot School of International Affairs, George Washington University. yingyan_zhao@gwu.edu. We thank Nitya Pandalai-Nayar, Nina Pavnick, Tristan Reed, Arvind Subramanian, Jim Tybout, seminar/conference participants at the NBER Summer Institute, Washington Area Trade Symposium, STEG Annual Conference, Ashoka University, Georgetown, HKU, IIM-Ahmedabad, IMF, SMU-INSEAD, Toronto Metropolitan, UVA, and the World Bank for helpful suggestions and comments. All errors are our own.

1 Introduction

Schumpeterian creative destruction, the process where innovative production units replace outdated ones, propels the economy toward the technological frontier. Structural impediments to this dynamic process can severely hinder productivity growth and economic development. Specifically, barriers to exit—such as bankruptcy costs and factor adjustment expenses—can stifle firm creation and dampen economic dynamism. In this paper, we leverage micro-data from Indian manufacturing plants to investigate the critical role of exit costs in shaping India's economic development

Understanding the aggregate impact of exit barriers is crucial for informed policy-making and development economics. These impediments manifest in various forms, from stringent labor regulations (notably in India and France) to compulsory contributions to unemployment insurance (as in the U.S.) and protracted, costly bankruptcy proceedings. Such regulations diminish expected profits, deterring potential market entrants. Additionally, resources become misallocated as inefficient firms linger, tying up assets that could be more productively employed elsewhere. Consequently, this leads to lower labor demand, suppressed wages, and ultimately, reduced overall employment–counteracting the intended protective goals of such regulations and diminishing output and productivity.

While our empirical context is India, these economic mechanisms have broad relevance. They are central to current debates about the diverging economic trajectories of the US and European economies, particularly since the Covid-19 pandemic. One reason for this disparity could lie in the differing pandemic responses. Europe's strategy focused on preserving jobs and firms, which inadvertently caused economic rigidity. In contrast, the US opted to provide direct stimulus to individuals, allowing the labor market to adjust without a focus on bailouts. This approach may have enabled greater economic flexibility and resilience.[1]

We study India's manufacturing sector for two reasons. First, India is now one of the world's largest and fastest-growing countries, but several puzzles related to India's macro-development and structural transformation do not have a coherent explanation. These include India's pre-mature deindustrialization (Rodrik, 2016), the existence of a long tail of unproductive firms (Hsieh and Klenow, 2014), and under-performance in key low-skill manufacturing sectors (Chatterjee and Subramanian, 2023).

Second, in India, various institutional and non-institutional barriers to exit vary across states. This, along with the availability of a rich longitudinal dataset on firms that record unique information on plants after they stop production while waiting to exit, gives us the perfect laboratory to identify and estimate these costs.

Third, prima facie evidence exists that exit costs in India are high. India has one of the lowest firm exit rates in the world (see 1a below), and a large fraction of firms in India remain dormant (i.e., they are registered and may even employ workers but do not run operations/produce output)

[1]As of January 2024, the US leads the G7 economies in economic growth, driven by robust innovation, productivity, and job creation. On the US vs Europe debate, see The Economist, The Financial Times, and this Economic Letter from the Federal Reserve Bank of San Francisco

for a long time before they finally exit. 20% of all registered firms in India are dormant, and 35% of all registered firms between 1981-1990 were inactive by 2016, i.e., they were in the process of liquidation but had not exited (Sengupta and Singh, 2019).[2] It is well known that such exit delays, especially for distressed firms, cause a huge burden on banks. Firms in India mostly borrow from public sector banks, which often have to bear the firm's costs during dormancy. Such practices have contributed to India's non-performing assets (NPA) problem.[3]

Even if a firm is not involved in any litigation or disputes and has all the necessary documentation in order, the process of voluntary closure still takes approximately 4.3 years. Of this, about 2.8 years are dedicated solely to securing clearances and refunds from various government departments, such as the Income Tax, Provident Fund, and Goods and Services Tax authorities. In comparison, voluntary liquidation processes are significantly shorter in other countries: about 12 months in Singapore, 12-24 months in Germany, and 15 months in the United Kingdom (Economic Survey of India 2020-21).

Our analysis has two parts. First, we provide evidence, both associations and causal, that exit barriers impose significant costs on firms in India, resulting in the misallocation of resources, entry deterrence, and in a long tail of very old firms with low productivity. Second, we build and estimate a firm dynamics model to quantify the effect of these frictions on India's aggregate productivity and growth. Exit barriers could be institutional. For example, those coming from labor regulations or imperfect land and capital markets. They could also be unobserved, like variations in the implementation of similar policies or idiosyncrasies in judicial outcomes across states. Our approach captures both. In particular, first, we allow for flexible functional forms to estimate labor and capital adjustment costs. Second, we incorporate unobserved fixed costs of production as well as a scrap value of firms to capture exit costs explicitly. Higher fixed costs make it more likely for a firm to stop producing but remain in the market. A higher scrap value means lower exit costs and makes a firm more likely to choose to exit.

The broad mechanism that we are proposing here is not new. In the literature on sunk costs of entry (e.g. Hopenhayn, 1992a; Hopenhayn and Rogerson, 1993; Roberts and Tybout, 1997; Das et al., 2007), such costs, in effect, discourage exit in response to bad shocks. Our main focus here is a quantitative evaluation of this critical mechanism in an important setting. That being said, the literature has ignored the general equilibrium effects of exit costs on firm entry and the interactions between various policies that drive exit costs. Studies have largely focused on the country by country's specific regulations or frictions (like labor regulations, bankruptcy regulations, government subsidies, and land market frictions).

On specific frictions, perhaps the most extensive literature is on labor regulations, employment protection, and the consequences of firing costs across a number of countries. Papers span both reduced form (Besley and Burgess, 2004; Autor et al., 2007; Adhvaryu et al., 2013; Chaurey, 2015;

[2]Numbers in the ASI data are lower; around - percent are dormant with workers, and - percent are dormant without workers. This is to be expected as firms that are dormant without workers are dropped from the data after three years.

[3]See Kaul (2020) for an excellent account of India's banking crisis.

Amirapu and Gechter, 2020; Aghion et al., 2008) and structural methods (Guner et al., 2008; Cooper and Willis, 2009; Lapatinas, 2009; Poschke, 2009; Da-Rocha et al., 2019; Mukoyama and Osotimehin, 2019; Padmakumar, 2022; Bertrand et al., 2021).

In India, one of the main laws regulating the firing of workers is the Industrial Disputes Act of 1947. The literature has examined its impact by building indices based on reforms in this law, which occurred differently over time in various states, see (see Besley and Burgess, 2004, the foundational paper in this area). Using this index and rainfall as an instrument, Adhvaryu et al. (2013) shows that industrial employment is more sensitive to shocks where labor regulation is less restrictive. Chaurey (2015) shows that firms in Indian states with more restrictive labor laws hire more contract workers but not more permanent workers (who are protected by the law) in response to transitory local demand shocks. Aghion et al. (2008) shows that states with restrictive labor laws benefited less from India's trade liberalization.

There are three main shortcomings to this approach. First, such indices are far from perfect and have been heavily criticized (see Bhattacharjea, 2006). Second, the implementation of these laws is both imperfect and uncertain. A lot is left to the discretion of the courts and authorities, making outcomes uncertain.[4] Rulings in lower courts have been extreme and often overturned by higher courts.[5] Third, there are many non-legal reasons, like political constraints that create exit costs and which are not fully captured by the indices. Fourth, none of these papers focus on the macro implications of labor regulations. Building on Cooper and Willis (2009), our approach is able to estimate labor adjustment costs more broadly and quantify the macro implications of the same.

There is far less work on the role of exit barriers other than on labor regulations. Exceptions are the work on capital adjustment costs (e.g Cooper and Haltiwanger, 2006), government subsidies as exit barriers (Chu, 2000), and bankruptcy in finance as these costs act as exit barriers (e.g. Li and Ponticelli, 2022; White, 2016; Bernstein et al., 2019; Corbae and D'Erasmo, 2021)). Easing barriers to firm liquidation has been important for the historical growth of modern industrial nations. Di Martino (2005), for example, argues that the early introduction of bankruptcy codes in England and the United States was a factor in the more vibrant private sector in these countries. In contrast, the commercial codes in Italy and France based on the Napoleonic code were seen as discouraging firm failure and hence greatly affecting the ability of economies to adjust (Bignon and Sgard, 2007). More recently, Li and Ponticelli (2022) shows that in China, the introduction of specialized bankruptcy courts led to the reallocation of labor out of zombie firms, firm entry, and growth in productivity.

In India, till relatively recently as discussed in Section 2.3 below, there was no well-defined path to bankruptcy. The most recent reform was the formulation of the Insolvency and Bankruptcy Code (IBC) in 2016 which was then put on hold during COVID. However, even the IBC has had

[4]Issues include whether the IDA covers only manufacturing, mines, and plantations as stated in the act, or not. What constitutes a workman, i.e., a regular worker, and what is the definition of a contract worker?

[5]For example, in the case of Bharat Forge Co Ltd v Uttam Manohar Nakate, the worker, Nakate, was repeatedly found sleeping on the job and dismissed. However, the lower courts forced his reinstatement with some back pay. Only after 22 years, did the supreme court finally allow his dismissal.

very limited success due to judicial bottlenecks and court congestion. Akcigit et al. (2021) argues that part of the reason might be the difficulty in enforcing contracts in India arising from an overtaxed judicial system. As a result, firms remain family run which can constrain their expansion and efficiency. Finally, frictions in land markets also contribute to exit costs and misallocation as buying and selling land for industrial purposes in India is hard, see (Sood, 2020), which focuses on frictions in acquiring land for manufacturing. Note that rather than constraining ourselves to a particular source of exit costs, we capture a plethora of measurable and un-measurable exit costs in our estimates of scrap value: a low scrap value means high exit costs.

Focusing on specific regulations may suffice for studying firm exit in advanced countries because other factors might be limited, the analysis would be incomplete for developing countries and especially India. First, in developing countries, there can be multiple factors that interact with each other that add up to a large exit cost. Second, since the interpretation and implementation of laws are imperfect, a reduced-form approach is at best incomplete and at worst incorrect. Moreover, many of the factors that stall exit may be extra-legal or unmeasurable, and thus ignored in existing analyses. Finally, the general equilibrium effects on entry and thorough the interaction of various policies regulating exit may be large. Our approach makes advances on all these fronts.

The paper proceeds as follows. In Section 2, we provide more details about the institutional context. In Section 3, we discuss data sources and challenges with measuring exit in Indian data. In Section 4, we provide some empirical patterns as well as more causal evidence regarding how firms seem to respond to exit barriers. In Section **??** we build our dynamic model that explicitly tries to capture, in a flexible way, both labor market frictions created by size-based regulations as well as exit costs. In Section 6 we provide intuition on what identifies the key parameters and provide some preliminary estimates. Section 8 concludes.

2 Institutional Context

Firms take a long time to exit in India. Even if a firm is not embroiled in any litigation or dispute and all relevant paperwork is in place, its voluntary closure takes approximately 4.3 years. 2.8 years are spent alone on obtaining clearances and security refunds from various government departments like Income Tax, Provident Fund, Goods and Services Tax, etc. In contrast, voluntary liquidation takes about 12 months in Singapore, 12-24 months in Germany, and 15 months in the United Kingdom (Economic Survey of India 2020-21). Since the efficiency of government departments vary by state, the time taken to obtain these clearances can also vary a lot by state.

In addition to the above, if a firm gets entangled in legal disputes, then it substantially increases the time to exit (see Section 2.1 for an example). As worker retrenchment and firm liquidation are regulated by various central and state laws, their history, intent, and interpretation by courts shape the frictions to exit. Moreover, both the laws and their interpretation by courts evolve over time, giving rise to uncertainty in judicial outcomes. Finally, India's regulatory framework is not the only obstacle to firm exit. Political interference, a clogged judicial system, strikes, lockouts,

etc., can also prevent firm closures.

This section aims to illustrate that various observable and unobservable factors contribute to erecting barriers against firm exit in India. Thus, it would be impossible to quantify, even roughly, the aggregate costs of barriers to firm exit using reduce-form techniques. We illustrate the challenges faced by a firm wanting to exit first through a specific case study. Then, we highlight the complexities in the implementation of the two most important regulatory frameworks that might affect firm exit – i.e. labor and bankruptcy laws. In Appendix A, we present a detailed discussion of the history of these regulations.

2.1 The Exit of Nokia's Largest Factory: A Case Study

Nokia announced its plan to set up a plant in India on December 2004. At that point it sold about a million phones a month in India, all imported from China. Its goal was to increase this to six to seven million a month by reducing transaction and adjustment costs. Soon various state governments started to woo the company by offering them various incentive packages. In the end, Tamil Nadu won. In addition to the tax holiday they offered, the location offered at the special economic zone in Sriperumbudur was only 33km away from the Chennai International Airport. Also, the party in power (AIADMK) in the state was in coalition with the ruling party (Congress) at the center and the national Minister of Communications and IT belonged to AIADMK. Thus, the project had the blessing of both the central and state political rulers. Production started in 2006.

Between 2006–2012 this factory became the poster child of capitalism. This was Nokia's largest operation anywhere in the world. At its peak, the factory employed close to 20,000 employees and produced 15 million phones a month which were exported to 80 countries. About 70% of these employees were women.

Troubles started in 2013. Labor held strikes and lockouts demanding better working conditions and expecting a raise. The death on the job of a female assembly operator further fuelled discontent. The success of the factory attracted political attention as they saw the employees as a vote bank. A DMK-backed (the party in opposition to AIADMK) labor union gained ground around 2010.

There was tough competition in the international market as well. As the tax holiday came to an end, the incentives provided by Vietnam made it an even more attractive production destination. Moreover, cellphone technology was rapidly changing toward smartphones. The nail in the coffin was perhaps two tax evasion cases against Nokia – one by state authorities and the other by central authorities. While the Madras High Court later set aside the demands by state authorities, Nokia's assets linked to this factory were frozen by the Supreme Court of India in October 2013 due to the latter tax case.

Meanwhile, given the churn in cellphone technology and the global market, Nokia sold its devices and services business to Microsoft for USD 7.2 billion in April 2014 but the Indian factory was excluded from the deal owing to the legal challenges it was embroiled in. Initially, Microsoft wanted to use the factory as a contract manufacturer for low-cost cell phones but soon decided

against it and production came to a grinding halt.

At the factory, several contract workers not protected by labor laws were laid off. However, the permanent workers couldn't be. With the asset freeze in place, Nokia could not sell the factory either so was required to pay the workers as long as the tax dispute continued. Some permanent workers took voluntary retirement and severance payments offered by the company. Nokia did this because it would need approvals from the government and an agreement with the labor unions in order to close the factory once the tax dispute got resolved. Lawyers say that "7 or 8 out of 10 such cases are rejected" as "welfare statutes look out for the interest of employees". They advise that getting these permissions is easier if the employee headcount is low before the firm seeks government approval.

Nokia settled the tax dispute in 2018 by paying a penalty of 202 million euros, but even 4 years after production stopped it was uncertain whether it would be able to sell its factory owing to some other litigation that arose in the interim years. Finally, in 2020, after a gap of 6 years, the Chinese firm Salcomp bought and started manufacturing cell phone chargers with 1000 workers in the factory that was once the globally most productive cellphone factory.

This example illustrates three things. First, there is a great deal of political, judicial, and institutional complexity and uncertainty related to firm exit. Second, it illustrates the gargantuan delays in the administrative processes. Third, that this happened in the state of Tamil Nadu – a pro-employer state according to the Besley-Burgess measure – suggests that it might have been even worse in pro-labor states and that the letter of the law alone cannot be used as a measure of exit costs. It is worth noting that Nokia is far from the only multinational to find itself in such straits. GM and Ford also had a taste of trying to exit under Indian conditions. [6]

2.2 Labor Laws, Hiring, and Firing Labor

Labor regulation in India is governed by numerous laws, which vary significantly across states. For instance, Maharashtra has 48 labor laws, while West Bengal has 31. The Industrial Dispute Act (IDA) of 1947 is the most notable and frequently studied in Economics. Three points are worth noting:

1. Implementation vs. Legislation: The actual implementation of laws often diverges from their written form. A stringent IDA provision requires firms with over 100 workers to get government permission before dismissing employees. Obtaining this permission is complex and discretionary, leading to uncertain outcomes.

2. Judicial Backlog: Indian courts face severe backlogs, with over $100,000$ labor cases pending as of October 2020, 40% of which have been pending for over a year. Consequently, the efficiency of labor law enforcement varies across states and is influenced by both legal differences and court efficiency (Rao, 2019, 2021).

[6] See Reddif.com Business "GM, Ford switch off India ops but unable to exit", January 25, 2023.

3. Uncertainty in Legal Decisions: Firms encounter significant uncertainty regarding potential legal disputes. The interpretation of labor laws has evolved over the past six decades, influenced by socio-political and economic changes. Sarkar (2019) documented that while specific statutes have remained relatively unchanged, judicial interpretations have shifted. Courts have sometimes issued contradictory rulings on similar cases within short time frames, oscillating in their rulings on which workers and industries (software engineers vs factory workers) should be covered by labor laws and when. Even the Supreme Court has overturned its own decisions numerous times. Extensive documentation by Kaul (2008) and further details in Appendix A highlight this inconsistency further.

2.3 Bankruptcy Laws

Enforcing creditor rights in India has historically faced significant judicial delays. This is partly due to complex and fragmented insolvency procedures under multiple laws, such as the Companies Act of 1956 and the Sick Industrial Companies (Special Provisions) Act of 1985. Since the early 1990s, various reforms have been attempted with limited success.

In 1993, Debt Recovery Tribunals (DRTs) were established to streamline the legal process. However, inadequate infrastructure and personnel soon led to these tribunals becoming clogged. In 2002, the Securitization and Reconstruction of Financial Assets and Enforcement of Security Interests Act (SARFAESI) allowed secured creditors to take possession of assets within 60 days of a loan default notice. Over time, court interpretations diluted the Act's effectiveness, by, for example, granting borrowers the right to appeal, which hindered loan recovery.

In 2016, the Insolvency and Bankruptcy Code (IBC) was introduced to further streamline the process by giving creditors control of assets upon initiating insolvency proceedings and imposing strict timelines for liquidation. However, the IBC has also seen limited success due to judicial bottlenecks and court congestion.[7] And as with labor laws, there has been a lack of clarity about bankruptcy laws and higher courts have frequently quashed orders of lower courts.[8]

3 Data

Our data comes from the Annual Survey of Industries (ASI), the principal source of industrial statistics in India. The ASI collects data on all registered manufacturing and repair units in all states of India except northeastern Arunachal Pradesh, Mizoram, Sikkim, and the island of Lakshadweep under the statutory provisions of the Collection of Statistics Act, 1953. ASI's sampling frame is based on the lists of registered factories maintained by each state's Chief Inspector of Factories

[7] For a vivid account read India is No Country for Dying Firms by Andy Mukherjee in The Washington Post (Aug 23, 2021) [Link] and Three years later, India's bankruptcy reform languishes in courts in the Reuters (Jan 27, 2019) [Link].

[8] Singh, S. "SC asks HCs not to interfere with debt recovery proceeding", The Economic Times, Aug 3, 2010. [Link]

and those maintained by the licensing authorities of bidi and cigar establishments. The frame essentially has establishments with 10 workers or more and using power or with 20 workers and more even without power. Therefore, the ASI does not capture the informal manufacturing sector.

The units in the sampling frame are divided into two stratas. The census sector, which is surveyed on a complete enumeration basis, comprises all units employing 200 workers or more, as well as all units in the states of Manipur, Meghalaya, Nagaland, Tripura, and the Andaman and Nicobar Islands.[9] The sample sector, from which a representative sample is surveyed each year, contains the rest of the frame.[10]

We use the longitudinal version of the ASI, which is available from 1998 till 2018. Like many other establishment-level datasets, the ASI includes details of fixed assets, working capital and loans, employment, input items, products and by-products produced, other expenses, and receipts.

Several features of this data make it uniquely useful for our purposes. First, the survey records its initial year of production. This feature allows us to accurately measure entry by tracking the mass of establishments of a certain vintage over time as done in (Hsieh and Klenow, 2014). Second, the data records the status of the responding establishments as either "active" or "dormant". "Dormancy" occurs when the firm exists with all its capital, but does not engage in production. This is an important feature because it is exactly what one would expect with high exit barriers: that is, the presence of establishments that want to exit but do not, and instead stay dormant, both with and without workers. Third, the data records all details, such as factor payments, loans, and assets, even when an establishment is dormant, though the quality of the data for dormant firms tends to be worse. We exploit these features of the data in our analysis to estimate exit costs.

4 Facts

We begin by presenting a novel set of facts that suggest that exit costs are both large and differ across states and that the way manufacturing firms respond to these frictions is in line with simple theory.

Fact 1: Exit rates are low in India

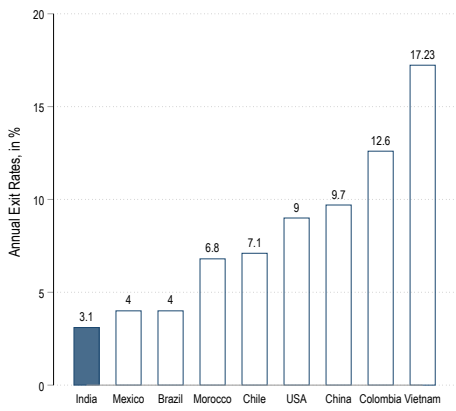
While there is no direct measure of exit available in either the PROWESS or ASI data, we use a novel approach due to Hsieh and Klenow (2014) to measure exit rates overall and at the state-industry level. From any survey round, we can calculate the number of establishments of a specific vintage (dating to the initial year of production). Since the sample is representative, the only reason why the survey in year $t + \Delta$ would give a lower number of firms of a certain vintage as compared to

[9] It is worth noting that Indian firms may choose not to provide the data requested by the government. If so, they are placed on a list of non-compilers. This creates holes in the data over time even for firms in the census sector.

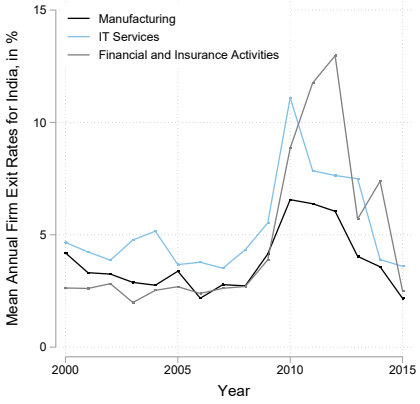
[10] More details are available on the website of Ministry of Statistics and Programme Implementation, Government of India.

when we use the sample from the survey in year t is because some firms have exited. This approach allows us to estimate exit rates within each state-industry cell.

Figure 1a shows that not only is firm exit (using ASI data) in the manufacturing sector in India lower than that in advanced economies like the United States, but it is also lower relative to the smaller economies of Bangladesh and Vietnam. Figure 1b (using PROWESS data) shows that firm exit has been low over the last decade across all sectors, and exit in manufacturing has been consistently lower than in IT services which comprises one of the more dynamic sectors of the Indian economy. The great recession, which hit India a little later than the US, raised exit rates considerably, but by 2015, they were back to their pre-recession levels.



(a) Exit Rates in the Manufacturing Sector



(b) Exit Rates across sectors (CMIE Data)

Figure 1: Firm Exit Rates

Notes: Panel (a): Exit rates of different countries have been calculated/taken from the following sources: India - calculated from Annual Survey of Industries dataset from survey years 2000-01 and 2015-16; Brazil and Mexico - taken from Bartelsman et al. (2009) averaged from 1990-1999; Chile, Colombia, and Morocco - taken from Roberts and Tybout (1996) for the year 1985; US - taken from figure 1 in "Business Exit During the COVID-19 Pandemic: Non-Traditional Measures in Historical Context" by Crane et al. (2022) for 2006; China - calculated from Annual Surveys of Industrial Production for 2006; Vietnam - calculated from Vietnam enterprise census for 2007.

Fact 2: Entry shares and exit shares are highly correlated

We begin by documenting that there is significant variation in manufacturing activity across Indian states. To illustrate this, we compute plant entry shares in major states of India.[11] We define the entry share of a state in a given year as the number of plants that enter the state that year divided by the total number of entrants in India for that year, normalized by the state's population share. Thus, if a state's entry share is greater (lower) than 1, then it attracts more (fewer) entrants relative to its size. The left panel of figure 2b plots entry shares of states averaged from 1999 to 2018, with the darker (lighter) shades of blue representing states with average entry shares greater

[11]We exclude North-Eastern states, Jammu and Kashmir, and Goa from our analysis because the sample data is very sparse.

(lower) than 1. It is immediately apparent that some states are disproportionately more attractive to industries relative to their size. In particular, entry into the states of Gujarat, Maharashtra, Andhra Pradesh, Karnataka, and Tamil Nadu is higher than that into the more populous Northern states of Uttar Pradesh, Madhya Pradesh, Rajasthan, Bihar and West Bengal. Moreover, as shown in Figure B.2, the spatial variation in entry shares has been persistent over time. This implies the existence of underlying structural factors driving plant entry that have remained unchanged.

As noted earlier, institutional features shape barriers to exit for plants in India, and institutions vary considerably across states. Thus, spatial variation in exit barriers faced by plants could be a reason why some states are more attractive to potential entrants than others. Intuitively, if a state has high exit barriers, then potential entrants would be discouraged to enter because of lower ex-ante expected profits.

The right panel of figure 2b shows the relationship between entry and exit shares of states. We calculate state-wise exit shares in two steps. First, within each state, we define exit share for each age cohort as the mass of plants that exited from the cohort in that state divided by the total mass of plants that exited from the cohort in India. The exit share of a state is, then, the weighted average of state-cohort-wise exit shares, with the fraction of plants belonging to each cohort in the state as weights. To facilitate comparison with entry shares, we normalize the exit share of a state with the state's population share. As with entry shares, a size-adjusted exit share of 1 is considered to be neutral. Figure 2b displays clear sorting – states with higher exit shares, represented in red, have higher entry shares, and vice-versa.

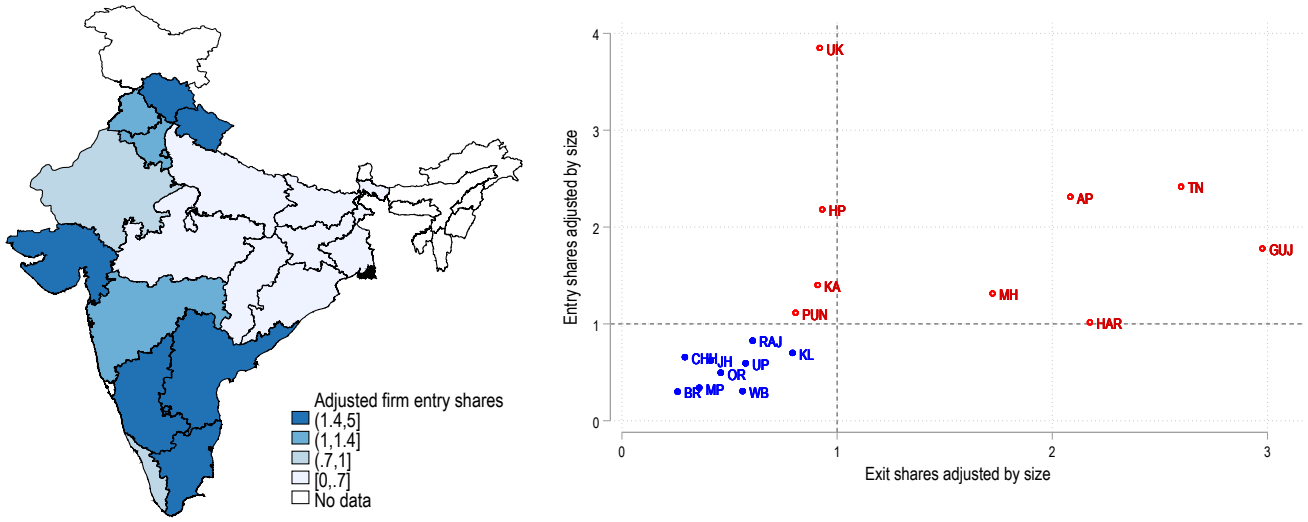
High- vs Low-performance states

For the analysis that follows we group states into high- and low-performance. This is based on a measure of misallocation for the states. Following the literature (Lucas, 1978; Hopenhayn, 1992b; Bento and Restuccia, 2021), we compute the elasticity of firm size with respect to productivity (see figure B.1). We residualized both size and productivity off industry×year fixed effects, and weighted each industry by its value-added share in the state. States with a higher than median elasticity have lower misallocation on average, and we label them as "high-performance". States with a lower than median elasticity are analogously labeled "low-performance".[12] This measure of misallocation also correlates well with entry. All states classified as high-performance have entry rates above 1 and visa-versa.

Fact 3: Exit rates are higher in high-performance states than in low-performance states

Next, we compute annual exit rates by age cohort to rule out the possibility that low (high) exit shares might merely reflect the fact that low-performance (high-performance) states have fewer

[12]Ideally, we'd want to do the analysis at the state level. However, not all states have enough firms to facilitate structural estimation. Hence, we create two state groups.



(a) Size-adjusted entry shares

(b) Size-adjusted entry and exit shares

Figure 2: Size-Adjusted Entry and Exit Shares Across States

Notes: Size-adjusted entry share of state s at time t: entry share of state s at time t normalized by its population share. The size-adjusted exit share of the state s is analogously defined. Panel (a) shows size-adjusted firm entry shares in Indian states averaged from 1999 to 2018. High-performance states are those with size-adjusted entry share greater than 1 (the two darker shades of blue). Low-performance states are those with size-adjusted entry shares less than or equal to 1 (lighter shades of blue). Panel (b) shows the relationship between size-adjusted entry and exit shares for states. The relationship between un-adjusted entry and exit shares is in Figure B.3.

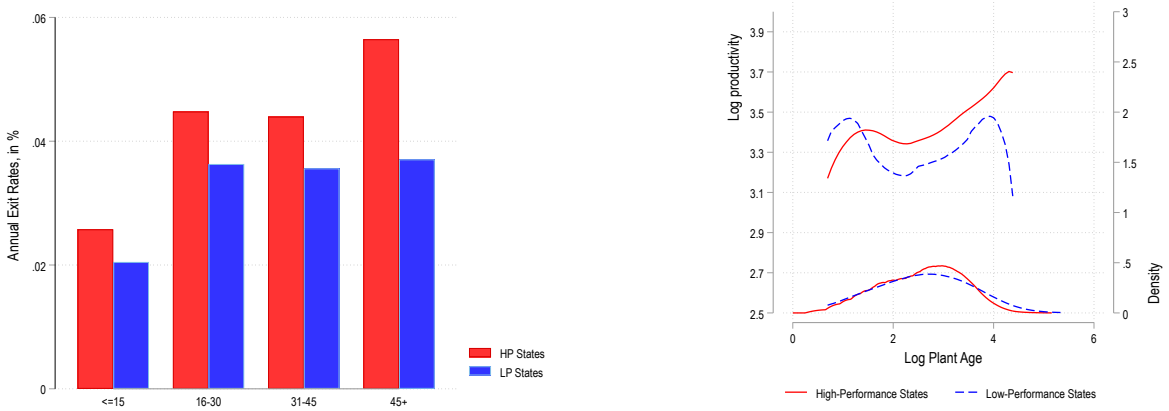
(more) plants. To be precise, we calculate the mass of plants that exited for each state group cohort and normalize it with the initial mass of plants. The left panel of Figure 3 shows that exit rates are lower in low-performance states across cohorts of plants of different ages. Among old plants, exit rates are much higher in high-performance states than in low-performance states.

Fact 4: Productivity is lower in low-performance states

The consequence of exit costs can be seen in the productivity distribution of plants. We follow Hsieh and Klenow (2009) and calculate plant productivity as a Solow residual from the production function. The right panel of Figure 3 examines the cross-sectional relationship between plant productivity and plant age (left axis), as well as the age distribution of plants (right axis). Because of greater dynamism, as expected, on average, plant productivity is higher in high-performance states by about 22 percent. More importantly, we show two non-trivial consequences of exit costs in Figure 3b.

First, since exit barriers act as entry barriers, there is stronger selection in low-performance states – productivity is higher among young plants as only the better plants can enter low-performance states. Second, as plants age, unproductive plants in low-performance states do not exit and hence productivity falls precipitously in low-performance states. This results in a right tail of really old plants with very low productivity in low-performance states. Such plants are absent in

high-performance states.



(a) Exit Rates in LP vs HP States

(b) Productivity versus Age

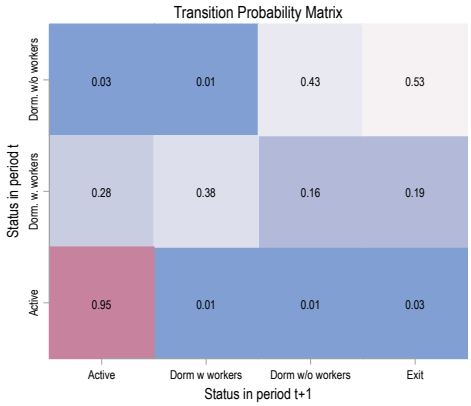
Figure 3: Low-Performance vs High-Performance States: Annual Plant Exit Rates and Manufacturing TFP

Fact 5: Dormancy is a Pathway to Exit for Plants

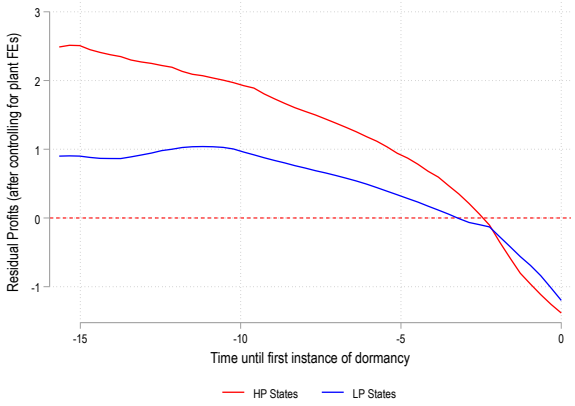
While we do not observe with certainty whether a plant in ASI data has exited, we do observe them in three states – actively producing, dormant with workers (those existing with fixed assets and maintaining staff but not actively producing)[13], and dormant without workers (those existing with fixed assets but not maintaining staff and not producing)[14]. As illustrated with the case study on Nokia's factory in Tamil Nadu, plants enter long periods of dormancy before exiting. During this period, they make various adjustments like obtaining government permissions and laying off workers, i.e. moving toward exit, while production is at a standstill.

[13]As per the ASI survey manual, for these units "it is found during the survey that the unit existed in the given location and had engaged some employees during the reference period, but could not initiate production or did not produce anything during the reference period due to various reasons, and can take up production any moment once the problems are sorted out."

[14]The ASI survey manual categorizes these units as those "which existed in the given location, but did not engage any employee during the reference period, and also, did not initiate production or produce anything during the reference period."



(a) Transition Probability Matrix



(b) Profits as they approach dormancy

Figure 4: Dormancy as a Pathway to Exit for Plants

Notes: The left panel calculates the probability with which a plant that is in state i in period t (where i ∈ {Active, Dormant with workers, Dormant without workers}) transitions to state j in period t+1 (where j ∈ {Active, Dormant with workers, Dormant without workers, Exit}). The right panel shows plant profits, deflated by sales, as they approach the first instance of either kind of dormancy. To plot the right panel, we first residualize the y-variable and x-variable of plant fixed effects. Second, we re-scale the residuals by adding back the unconditional sample means of the respective variables. Third, we divide observations into 20 equally sized bins based on their x values and calculate the mean of y and x values within each bin. The solid lines above are a polynomial fit of the resulting mean values.

The left panel of Figure 4 shows the transition probabilities of plants between the different states. Of the plants that are active in any period, the probability that they continue to remain active is very high (=95%), and this points indirectly to the low chances of exit. A small fraction transitions to dormancy or exits. Some dormant plants with workers transition back to being active, implying that they might have stopped production due to a temporary shock and would restart production soon. But a large fraction of them either continue to stay dormant with workers, or transition to laying-off workers and finally exiting. However, after entering dormancy without workers, it is highly unlikely that the plant ever restarts production. We constructed the left panel of Figure 4 by focusing on plants in the census sector and pooling data from 1999 to 2007. We classify a plant to have exited here if it does not show up in the data after 2007[15]. Based on these transition probabilities, we postulate that dormancy is a path to exit for plants.

Plants enter dormancy as a result of losses. The right panel of Figure 4 plots the profits of active plants as they approach dormancy. Two aspects are worth noting. First, on average, plants in low-performance states make lower variable profits than plants in high-performance states. Second, plant profits fall as they approach dormancy, and variable profits turn negative before they become

[15]Since we have data until 2018, we check if they show up again in the data in the next 11 years. If a plant stops showing up in the data, it could be because it has exited or hasn't complied with data reporting, or it was just dropped from the sample. However, exit is highly likely for the census sector plants, conditional on having observed a plant once and then not observing it for at least the next 11 years.

dormant, slightly earlier in low-performance states. Note that fixed costs are not included in variable costs so firms would be making lower profits than indicated by their variable profits alone.

Fact 6: Firing costs for regular workers are higher in low-performance states

In this section, we examine whether labor adjustment is harder in low-performance states than in high-performance states by comparing how plants in different states adjust labor in response to similar shocks to plant performance. We follow Guiso et al. (2005), Fagereng et al. (2018), and Contractor (2022) to isolate unanticipated changes in gross value added (GVA) that cannot be explained by plant-specific characteristics and aggregate fluctuations. In particular, we regress the inverse sine transformation of GVA[16] on a plant (λ_i), an industry-year (λ_{jt}), and a state-year (λ_{st}) fixed effect. This regression's residuals, r_{ijst}, capture the unanticipated shocks to a plant's GVA

$$\text{IHS}(GVA_{ijst}) = \lambda_i + \lambda_{jt} + \lambda_{st} + r_{ijst}.$$

Next, we want to estimate how plants adjust their employment when faced with negative shocks. Hence, first, we define a dummy variable $\mathbb{1}\{Negshock_{it}\} = 1$ whenever $r_{ijst} < 0$, and 0 otherwise. Then we use the following difference-in-differences specification to compare employment adjustment in plants facing similar shocks but located in different states.

$$Y_{ijst} = \alpha_i + \alpha_{jt} + \alpha_{st} + \gamma' \mathbf{X_{ijst}} + \beta_1 \mathbb{1}\{Negshock_{it-1}\} + \beta_2 \mathbb{1}\{Negshock_{it-1}\} \times \mathbb{1}\{LP_s\} + \epsilon_{ijst} \quad (1)$$

The outcomes of interest here are logarithms of regular employment, contract employment, and managerial employment at the plant level. $\mathbb{1}\{LP_s\}$ is a dummy variable that takes a value equal to 1 if the plant is located in a low-performance state. In order to minimize omitted variable bias, we incorporate a rich set of covariates that are both time-invariant and time-varying in the regression specification. In particular, plant fixed effects (α_i) account for time-invariant unobserved heterogeneity at the plant level. α_{jt} and α_{st} control for factors that are common across plants but vary at the industry-year, and state-year level respectively. $\mathbf{X_{ijst}}$ is a vector that includes size-year fixed effects, which account for differential trends by firm size, and firm age.

With these controls, β_1 measures the average impact of negative shocks on employment in the subsequent year by plants in high-performance states. β_2 captures the differential response to negative shocks in low-performance states. Since the set of controls includes industry-year and size-year fixed effects, β_1 and β_2 are identified by comparing similar-sized plants within the same industry.

[16]We take the IHS (Inverse Hyperbolic Sine) defined as $ln(x + (x^2 + 1)^{.5})$ instead of $log(x)$ because in the data GVA is sometimes negative so that $log(x)$ may not be defined. Results are consistent if we re-scaled GVA to be positive.

Table 1: Impact of negative shocks on employment in high and low-performance states

Dependent variable:	log Employment					
	(1)	(2)	(3)	(4)	(5)	(6)
	Regular Workers	Regular Workers	Contract Workers	Contract Workers	Managers	Managers
$\mathbb{1}\{Neg_shock_{it-1}\}$	-0.057***	-0.063***	-0.088***	-0.089***	-0.063***	-0.066***
	(0.004)	(0.004)	(0.009)	(0.010)	(0.003)	(0.004)
$\mathbb{1}\{Neg_shock_{it-1}\} \times \mathbb{1}\{LP_s\}$		0.018**		0.001		0.009
		(0.007)		(0.018)		(0.007)
N	180961	180961	102874	102874	180082	180082

All regressions contain plant, industry-year, state-year, and size-year fixed effects. Robust standard errors clustered at the plant level in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: Heterogeneous impact of negative shocks on employment in high and low-performance states

Dependent Variable:	Log Employment			
	(1)	(2)	(3)	(4)
	Regular Workers	Regular Workers	Contract Workers	Managers
$\mathbb{1}\{Neg_shock_{it-1}\}$	-0.055***	-0.057***	-0.082***	-0.058***
	(0.006)	(0.006)	(0.011)	(0.005)
$\mathbb{1}\{Neg_shock_{it-1}\} \times \mathbb{1}\{LP_s\}$	0.006	0.007	0.012	0.008
	(0.009)	(0.009)	(0.019)	(0.008)
$\mathbb{1}\{Above100_{it-1}\}$	0.489***			
	(0.013)			
$\mathbb{1}\{Neg_shock_{it-1}\} \times \mathbb{1}\{Above100_{it-1}\}$	-0.011	-0.011	-0.014	-0.016
	(0.008)	(0.008)	(0.020)	(0.008)
$\mathbb{1}\{LP_s\} \times \mathbb{1}\{Above100_{it-1}\}$	0.029	0.029	-0.044	0.036**
	(0.023)	(0.023)	(0.048)	(0.018)
$\mathbb{1}\{Neg_shock_{it-1}\} \times \mathbb{1}\{LP_s\} \times \mathbb{1}\{Above100_{it-1}\}$	0.029*	0.025	-0.034	-0.001
	(0.014)	(0.013)	(0.037)	(0.014)
N	180961	180961	102874	180082
Size-Year FE	No	Yes	Yes	Yes

All regressions contain plant, industry-year, and state-year fixed effects. Robust standard errors clustered at the plant level in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 1 reports estimates of β_1 and β_2 from specification (1). Column 1 of table 1 indicates that plants reduce their regular employment by 5.7% on average when faced with a negative shock in the previous year. However, plants in low-performance states are less sensitive to these shocks, as shown in column 2 below. In particular, a negative shock reduces average regular employment in the subsequent year by only 4.4% in low-performance states, compared to 6.3% in high-performance states. Columns 3 and 5 show that a negative shock reduces average contract and managerial employment in the subsequent year by 8.8% and 6.3%, respectively. There is no statistically significant difference between how high and low-performance states adjust their

contract and managerial employment in response to negative shocks[17].

The labor laws make firing particularly hard for firms employing more than a hundred workers. Therefore, next, we show that the labor adjustment frictions in low-performance states are precisely coming from the larger plants. To do so, we define a dummy variable $\mathbb{1}\{Above100_{it}\}$ that equals 1 for plants employing more than 100 workers in year t and is 0 otherwise. Then we estimate a triple differenced version of the model above (1), essentially interacting each co-variate with $\mathbb{1}\{Above100_{it-1}\}$. Column 1 of table 2 shows that primarily the large plants, those with more than 100 regular workers, drive the sluggish response to negative shocks in low-performance states.

Fact 7: Inflation helps in shedding regular workers, and more so in low-performance states.

As plants approach dormancy, they lay off workers – regular, contractual, and managers – as shown in panel (a) of figure B.5. Although adjustment of regular workers is hard because of labor regulations, plants still lay them off as they approach dormancy. How do they do it? We argue that one channel that they use to adjust labor is inflation. Plants on the path to dormancy, especially those in low-performance states and in high inflation periods, will want to incentivize attrition of regular workers by keeping nominal wages fixed, which makes outside options more attractive. Hence, we should see a larger fall in regular workers when a plant approaches dormancy in high inflation periods relative to low inflation periods, and more so in low-performance states than in high-performance states. Moreover, if inflation is being used by plants as a tool to adjust labor that is otherwise harder to fire, we should not see this pattern for contract workers or managers.

We look for employment effects by estimating the following specification.

$$Y_{ijst} = \beta_0 + \sum_b \beta_1^b \left(D-t\right)_{ijst}^b + \beta_2^b \left(D-t\right)_{ijst}^b \times \text{HI}_t + \mathbf{X}'_{ijst}\delta + \lambda_i + \lambda_{st} + \lambda_{jt} + \epsilon_{ijst},$$

The outcomes of interest are logarithms of regular employment, contract employment, and managerial employment for plant i in industry j, state s at time t. $\left(D-t\right)_{ijst}$ are the years until the first instance of either kind of dormancy for the plant. This is divided into four bins $b \in \{>6\text{years}, 5-6\text{years}, 2-4\text{years}, 1\text{year}\}$. >6 years is the omitted category. HI_t is an indicator that takes value 1 if the annual percentage change in CPI is greater than 5%. $\mathbf{X_{ijst}}$ is a vector of plant level, time-varying observable characteristics like plant age, age squared, and the book value of assets in the previous year. We also include plant fixed effects λ_i, state-year fixed effects denoted by λ_{st}, and industry-year fixed effects denoted by λ_{jt}.

The regression results on employment are reported in Figure 5. The left panel corresponds

[17]These patterns are robust even if we make the bins of GVA shocks finer. Please see table B.1 in the Appendix for details.

to the logarithm of regular workers, the middle panel corresponds to the logarithm of contract workers, and the right panel corresponds to the logarithm of managerial staff. The black and blue lines plot predicted estimates from the regression, and the vertical bars represent 95% confidence intervals. If the upper limit of the CI is below the blue line then β_2 must be significant, i.e. high inflation has a differential impact on the outcome variable of interest.

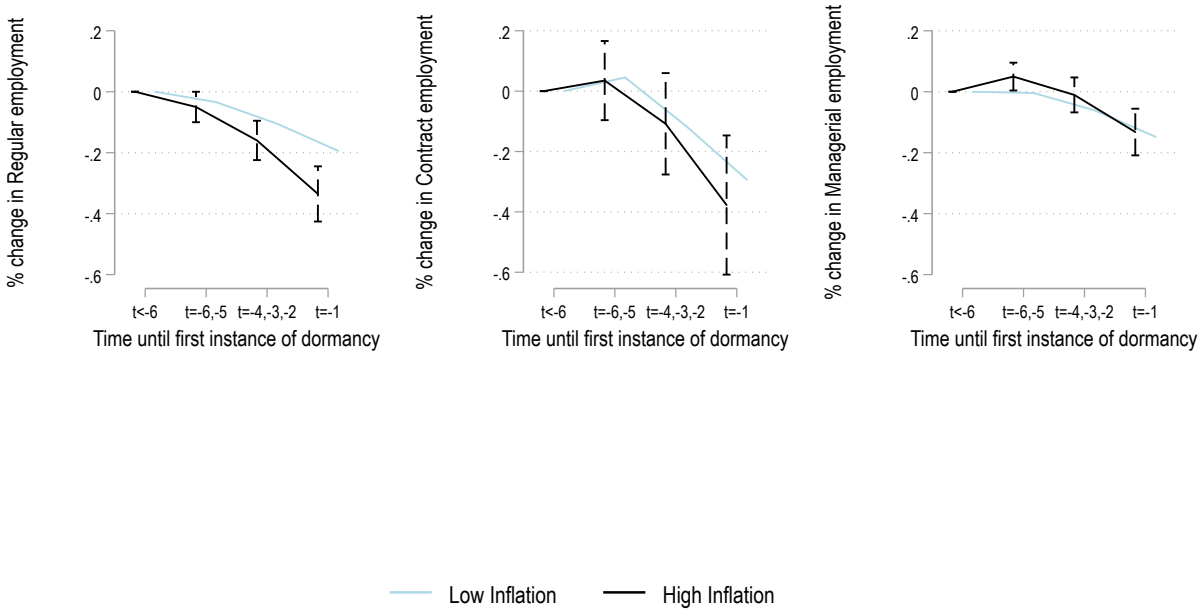


Figure 5: Labor Adjustment and Inflation

Figure 5 shows that manufacturing plants in India on the path toward dormancy reduce employment–regular, contract, and managers. Compared to 6 years prior to dormancy, these plants have 33.5% fewer regular workers, 37.7% fewer contract workers, and 13.2% fewer managers in the year just prior to dormancy. There is a differential response in this labor adjustment process only for regular workers. Plants are likely to reduce 14.1% and 5.4% more regular workers in the year prior and 2-4 years prior to dormancy during high inflation years as compared to normal years.

Next, in Figure 6, we show that this differential adjustment of regular workers during high inflation periods primarily happens in low-performance states where, presumably, labor adjustment costs are much higher.[18] We find no differential effects for contract workers and managers between high-performance and low-performance states (see Figures B.6 and B.7).

[18]We introduce triple interactions in the regression model with an indicator for low-performance states.

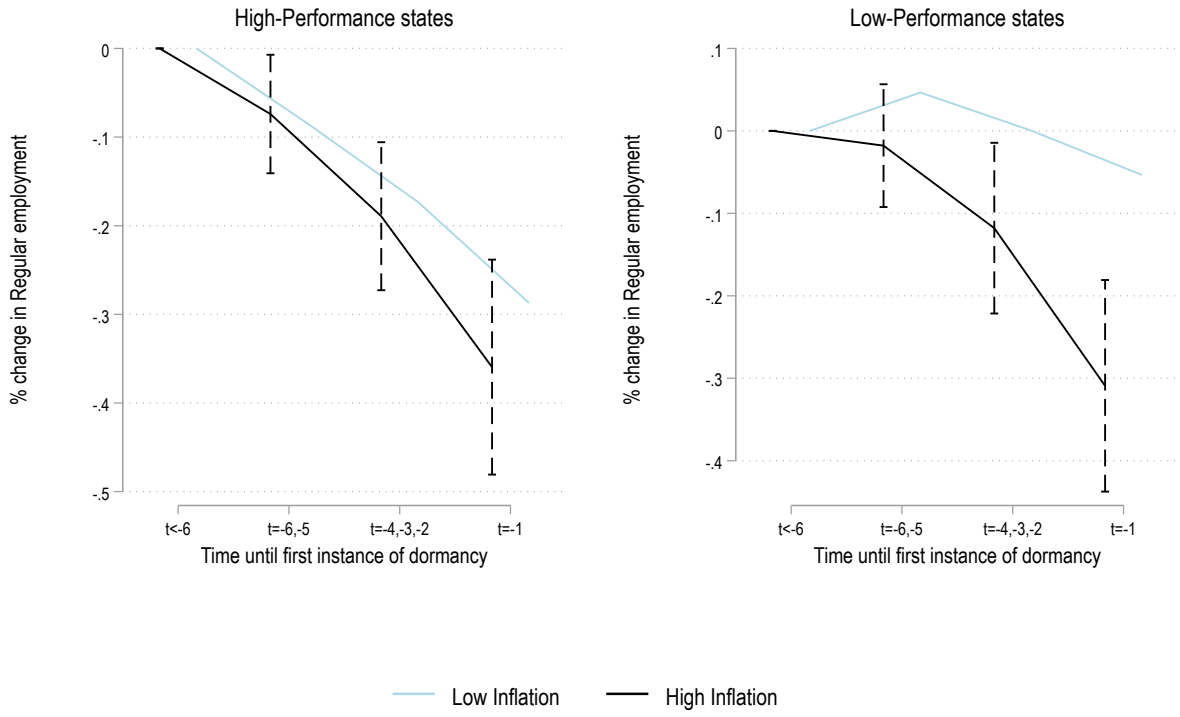


Figure 6: Adjustment of Regular Workers and Inflation

5 Model

In this section, we develop and quantify a theoretical model to estimate exit frictions and quantify their implications for aggregate productivity. We build on the models of firm dynamics (e.g. Roberts and Tybout, 1997; Melitz, 2003; Das et al., 2007; Aw et al., 2008), models of labor market frictions (e.g. Hopenhayn and Rogerson, 1993; Poschke, 2009; Cooper and Willis, 2009; Cooper and Haltiwanger, 2006), and models of firm exit (e.g. Ryan, 2012; Dunne et al., 2013; Golombek and Raknerud, 2018).

The basic structure of our model is as follows. At the beginning of each period, new firms pay a fixed cost to enter. Both new entrants and incumbents then realize their productivity levels and scrap values. In our model, firms are heterogeneous in their productivity, which evolves according to an AR(1) process. Knowing their realizations of scrap value and productivity, firms can compare their expected payoff from staying versus exiting and choose their better option. If they choose to stay, they choose their target input levels knowing there are convex adjustment costs. These targeted levels need not be attained due to uncertainty. Following this, firms realize their actual input levels and the fixed cost of production. Based on these, they choose either to pay this fixed cost and produce output or not pay and remain dormant. Then, we move to the beginning of the next period. Figure 7 shows the timing of events in each period.

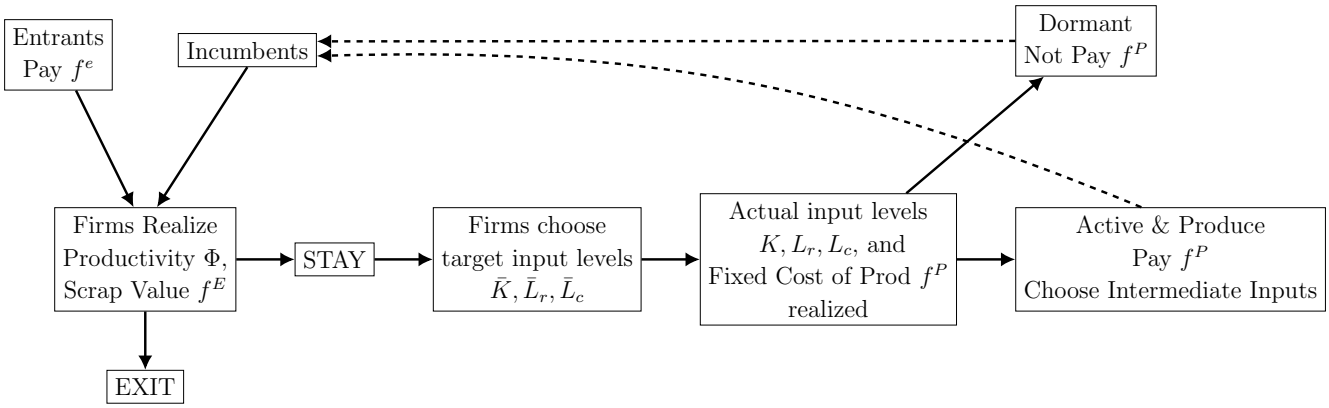


Figure 7: Timing of Events

Thus, we divide firms' decision-making into a static component, where the firms maximize their short-run profits by sourcing intermediate inputs, and a dynamic component, where they choose to be dormant or exit in the presence of exit costs, make production decisions in the presence of fixed costs, and adjust inputs, knowing that input adjustment costs are convex.

Two frictions distort resource allocation. First, low-productivity firms shed factors gradually due to convex input adjustment costs, which distorts the allocation of factors away from efficient firms. Second, convex adjustment costs and additional exit costs make firms stay in the market longer, albeit dormant, as they search for a path to exit. These dormant firms, sometimes called Zombie firms, prevent scarce resources, such as capital and land, from reallocating to more productive

firms.

We provide formal details of the model next.

5.1 Production

Firms use labor, capital, and intermediate inputs to produce output. Motivated by the institutional context and the reduced-form evidence that regular workers are harder to fire than contract workers and managers, we differentiate between regular labor (i.e. regular non-managerial workers, denoted by L_{rt}) and non-regular labor (contract workers and managers, denoted by L_{ct}).[19] The two types of labor are imperfect substitutes and both are subject to hiring and firing costs.

In addition, firms can adjust their capital, K_t, subject to convex adjustment costs, but intermediate inputs, I_t, are freely chosen in every period. Wages of both types of labor (w_r, w_c) and the price of intermediate inputs, r_I, are exogenously determined.

The production function is Cobb-Douglas in the three inputs, and firms are heterogeneous in their productivity, ϕ_{it}. A firm's output is given by

$$Y_{it} = \phi_{it} L_{it}^{\alpha_L} I_{it}^{\alpha_I} K_{it}^{\alpha_K}, \qquad \alpha_L + \alpha_I + \alpha_K = 1, \tag{2}$$

where $L_{it} = L_{cit}^{\alpha_{Lc}} L_{rit}^{\alpha_{Lr}}$, is an index of the two types of labor. Further, we assume that a firm's productivity evolves over time according to an AR(1) process:

$$\ln \phi_{it} = \gamma_0 + \gamma_1 \ln \phi_{it-1} + \epsilon_{it}. \tag{3}$$

5.2 Static Decisions

The market structure is monopolistic competition, and firms face a demand function with a constant elasticity σ,

$$D(p) = p^{-\sigma} E. \tag{4}$$

Here, E is the aggregate demand[20], and p is the price charged by the firm.

In each period, given labor, L_{ct}, L_{rt}, and capital, K_t, firms make a static decision to maximize profits by choosing intermediate inputs and price.

$$\begin{aligned} \max_{I_{it}, p} \quad & p^{1-\sigma} E - r_I I_{it} \\ \text{s.t.} \quad & p^{-\sigma} E = \phi_{it} L_{it}^{\alpha_L} I_{it}^{\alpha_I} K_{it}^{\alpha_K}. \end{aligned}$$

After solving for the optimal choice of I_{it}, we substitute it back and get the per period value

[19] This classification also makes it easier to deal with the fact that many firms have no contract workers which would otherwise create problems given the Cobb Douglas form of the production function used.

[20] E can be normalized to 1 with no harm.

added as a function of L_{ct}, L_{rt}, and K_t takes the following form in Equ (5)

$$VA(\phi_{it}, L_{c,it}, L_{r,it}, K_{it}) = \Gamma \left(E^{\frac{1}{\sigma-1}} \phi_{it} L_{it}^{\alpha_L} K_{it}^{\alpha_K} \right)^{\frac{\frac{\sigma-1}{\sigma}}{1-\alpha_I \frac{\sigma-1}{\sigma}}} . \tag{5}$$

Here, Γ is a constant.[21] The per period value added of firm i is increasing in its productivity ϕ_{it}, labor employment L_{it}, and capital K_{it}. Define, $\tilde{\phi}_{it}$, be the profitability of firm i at t, $\tilde{\phi}_{it} = \Gamma \left(E^{\frac{1}{\sigma-1}} \phi_{it} \right)^{\frac{\frac{\sigma-1}{\sigma}}{1-\alpha_I \frac{\sigma-1}{\sigma}}}$. The evolution of profitability to be estimated is the following.

$$\ln \tilde{\phi}_{it} = \tilde{\gamma}_0 + \tilde{\gamma}_1 \ln \tilde{\phi}_{it-1} + \tilde{\varepsilon}_{it} \tag{6}$$

5.3 Dynamic Decisions

5.3.1 Labor Adjustment and its Costs

The data indicates that labor adjustment costs are convex. In particular, we showed that labor adjusts gradually in response to shocks in Section 4. Hence, we assume a quadratic functional form for labor adjustment costs. If the targeted employment level of the firm is $\left(\bar{L}\right)$ and the employment in the last period is (L_{t-1}), then adjustment costs take the following functional form:

$$A \times \left(\frac{\bar{L}_t}{L_{t-1}} - 1 \right)^2 . \tag{7}$$

The quadratic term captures that hiring or firing a large proportion of the workforce at one time is harder. As specified below, A will be allowed to differ across firms above the IDA threshold and below it, and across regular and contract workers, and whether workers are being hired or fired. This will permit adjustment costs to differ by worker type (regular or contract), firm size (large and small), and the kind of adjustment, up or down.

Hiring Costs: Hiring costs reflect the cost for firms to post vacancies and find and hire the best-qualified workers. For existing firms, hiring costs of regular $(j = r)$ and non-regular $(j = c)$ workers take the following form[22]:

$$\underbrace{[c_{Hj} \log (1 + L_{jt-1})]}_{H_j} \left(\frac{\bar{L}_{jt}}{L_{jt-1}} - 1 \right)^2 , \qquad j = r, c, \tag{8}$$

where, c_{Hr} and c_{Hc} are parameters. As regular and non-regular workers are employed through different channels, their hiring costs are potentially different. The term in square brackets, H_j,

[21] $\Gamma = \left(1 - \alpha_I \frac{\sigma-1}{\sigma}\right) \left(r \alpha_I \frac{\sigma-1}{\sigma}\right)^{\frac{\alpha_I \frac{\sigma-1}{\sigma}}{1-\alpha_I \frac{\sigma-1}{\sigma}}}$.

[22] For entrants, we assume that the hiring cost is zero, that is, $H_j = 0$.

allows (1) the hiring cost to depend on firm size and (2) to be different for regular and non-regular workers.

Firing costs: Firing costs are meant to reflect the frictions arising from various factors like, but not limited to, size-based labor laws, the presence of labor unions, local politics, etc. Though contract labor and managers (non-regular workers) are not protected by the labor laws[23], firing them successfully can take time as workers adapt many strategies[24] to retain their jobs. The firing cost of non-regular workers takes the same form as hiring costs:

$$\underbrace{[c_{Fc}\log(1+L_{ct-1})]}_{F_c}\left(\frac{\bar{L}_{ct}}{L_{ct-1}}-1\right)^2. \tag{9}$$

The above functional form ensures that for a given proportional change in workers, larger firms have higher firing costs. Since regular workers in firms with more than 100 regular workers are additionally protected by labor laws, we allow firing costs for regular workers to be discretely different at that threshold. In particular, the term multiplying the quadratic term is defined as:

$$F_r = \begin{cases} c^L_{Fr}\log(1+L_{rt-1}) & \text{if } L_{rt-1}\geq 100 \\ c^S_{Fr}\log(1+L_{rt-1}) & \text{if } L_{rt-1}<100 \end{cases} \tag{10}$$

In equations (8), (9), and (10), the little c's are parameters that we will estimate.

Realized Employment: The realized employment is subject to an employment shock that captures uncertainties in factor adjustment beyond the firm's control: workers leaving for personal reasons or not all job offers being accepted. We assume that the log actual employment of regular and non-regular workers is distributed log-normally with means $log(\bar{L}_{ct})$ and $log(\bar{L}_{rt})$, and standard deviations $\sigma^{\varepsilon}_{Lc}$ and $\sigma^{\varepsilon}_{Lr}$ respectively. Thus, implicitly, the targeted employment level of firms is the median realized employment.

$$\log L_{jt}\sim\mathcal{N}(\log(\bar{L}_{jt}),\sigma^{\varepsilon}_{Lj}) \qquad j=r,c. \tag{11}$$

5.3.2 Capital Adjustment and its Costs

Capital adjustment costs take the same functional form as labor adjustment cost. They are:

$$\begin{cases} c_{HK}\log(1+K_{t-1})\left(\frac{\bar{K}_t}{K_{t-1}}-1\right)^2 & \text{if } \bar{K}_t\geq K_{t-1}, \\ c_{FK}\log(1+K_{t-1})\left(\frac{\bar{K}_t}{K_{t-1}}-1\right)^2 & \text{if } \bar{K}_t< K_{t-1}. \end{cases} \tag{12}$$

[23]The Industrial Disputes Act of 1947, in particular.

[24]As discussed before, fired workers usually approach the court which takes time to adjudicate matters, many a times courts reclassify contract workers as regular workers and reinstate them, and workers go on a strike etc.

Here, $\bar{K}_t$ denotes the target level of capital stock. Further, as before, we will estimate separate parameters c_{HK}, and c_{FK} for hiring and firing capital, respectively. Finally, as with labor, we assume that log of realized capital is distributed log-normally with mean $log(\bar{K}_t)$ and standard deviation σ_K^{ε}.

5.3.3 Dormancy vs Production, and their Costs

After firms realize their levels of capital and labor, they must decide whether to produce or be dormant. This depends on a stochastic draw of the fixed cost of production, in addition to realized input and productivity levels. The fixed production cost depends on the firm's state in the previous period. Denote these fixed costs as f^{DP} and f^{PP} depending on whether the firms were dormant or active in the last period. We assume that f^{DP} and f^{PP} are independent and log-normally distributed with means μ_f^{PP} and μ_f^{DP}, and variance σ_P^2.

Depending on input levels and the fixed cost shock, the firm will choose to pay the fixed cost and produce or be dormant and not pay this cost. Dormant firms must still pay their factors of production.

Dormancy has two roles. First, firms can adjust their labor employment gradually during dormancy, thereby avoiding the large firing cost of laying off all their workers. Second, staying in dormancy gives firms who have received a large negative shock but who have hopes that this is temporary, the option of becoming active when times improve.[25]

5.3.4 Entry and Exit

At the beginning of each period, a mass of firms M^e pay an entry cost f^e to enter the market. After a firm enters the market, it behaves as an incumbent. They realize their productivity level, ϕ, and scrap value f^E. If firms exit, they get their scrap value net of adjustment costs. Hence, a low f^E reduces the likelihood of exit. Firms exit when they realize a high enough scrap value draw f^E net of adjustment costs relative to expected future profits. When firms exit, they lay off workers and sell their capital subject to the same adjustment cost specified in Section 5.3 but with potentially different parameter values c_{Fr}^E, c_{Fc}^E, and c_{FK}^E. Hence, upon exiting, firms get their realized scrap value, plus the value of the sale of depreciated capital, net of adjustment costs incurred denoted by $\tilde{f}^E$. This includes the

$$\tilde{f}^E = f^E + p_K \delta^K K_{t-1} - c_{FK}^E \log\left(1 + K_{t-1}\right) - c_{Fc}^E \log\left(1 + L_{ct-1}\right) - c_{Fr}^E \log\left(1 + L_{rt-1}\right) \tag{13}$$

Allowing exiting firms to have different exit costs helps accommodate the possibility of distress

[25] In the data, the transition from dormancy without workers to being active is about 3 percent. Transition from either kind of dormancy to active is about 12 percent in the data. Firms dormant without workers for three years are dropped from the data, and such firms will be even worse than those dormant without workers for no more than three years. Hence, their probability of becoming active after being dropped will most likely be lower than 3 percent.

sales, etc. We assume that the scrap value draw, f^E, follows a logistic distribution with mean μ_f^E and scale parameter σ_E. These shocks help us better match reality in which similar firms may make different exit choices for reasons outside our model. For example, a distressed firm might suddenly get lucky because of a sudden offer for its brand or an unexpected court judgment, thereby reducing its exit costs.

If firms choose to stay, they choose target labor and capital levels, taking into account the relevant adjustment costs. After subsequent realizations of actual input levels and fixed production costs, firms choose to produce or be dormant and in both cases, start the next period as incumbents.

Firms enter till the expected profits from doing so are zero. We assume that the capital stock in the economy is fixed at $\bar{K}$.[26] Thus, the mass of entrants M^e and price of capital p_K are endogenous. A larger number of entrants increases the demand for capital and thus pushes up the cost of acquiring capital, p_K. In equilibrium, this price p_K is such that the demand for capital equals the total stock of capital in the market. The mass of firms that enter is therefore pinned down by a zero ex-ante profits condition. In our counterfactuals below we explore how sensitive our counterfactuals will be to raising this elasticity upwards from zero.

5.4 Value Functions

Given the structure of the model, we can now describe the value functions of firms and their policy functions. Let s_t be the state of the firm: $s_t = (\tilde{\phi}_t, L_{ct-1}, L_{rt-1}, K_{t-1}, S_{t-1})$. Here, S_t is the status of the firm in period t, which can be either active and producing (P) or dormant (D).

We begin by describing the value function for any period $t \geq 1$ and then derive the value function at period $t = 0$ by backwards induction.

For period $t \geq 1$

For any period $t \geq 1$, the value function of a firm, denoted by V, is the maximum of what it obtains if the firm stays or exits. If a firm exits, it obtains its realized scrap value plus the value of its capital, net of adjustment costs ($\tilde{f}^E$). Let the firm's value from staying be $V^S(s_t)$. Then,

$$V(s_t) = \mathbb{E}_{\{f^E\}} \left\{ \max_{d=E,S} \{\tilde{f}^E, V^S(s_t)\} \right\} \tag{14}$$

[26] Note that this assumption does not affect our estimates.

and,

$$
\begin{aligned}
V^S(s_t) \;=\; \max_{S_t,\bar{L}_{ct},\bar{L}_{rt},\bar{K}} \Big\{ & \mathbb{E}_{\{L_{ct},L_{rt},K_t\}}\big[R(\tilde{\phi}_t, L_{ct}, L_{rt}, K_t, S_t, S_{t-1}) - w_c L_{ct} - w_r L_{rt} + \delta^V \mathbb{E}_{\tilde{\phi}_{ft+1}|\tilde{\phi}_{ft}} V(s_{t+1})\big] \\
& - H_c \times \left(\frac{\bar{L}_{ct}}{L_{ct-1}} - 1\right)^2 \times \mathbb{1}\{\bar{L}_{ct} \geq L_{ct-1}\} - F_c \times \left(\frac{L_{ct-1}}{\bar{L}_{ct}} - 1\right)^2 \times \mathbb{1}\{\bar{L}_{ct} < L_{ct-1}\} \\
& - H_r \times \left(\frac{\bar{L}_{rt}}{L_{rt-1}} - 1\right)^2 \times \mathbb{1}\{\bar{L}_{rt} \geq L_{rt-1}\} - F_r \times \left(\frac{\bar{L}_{rt}}{L_{rt-1}} - 1\right)^2 \times \mathbb{1}\{\bar{L}_{rt} < L_{rt-1}\} \\
& - H_K \times \left(\frac{\bar{K}_t}{K_{t-1}} - 1\right)^2 \times \mathbb{1}\{\bar{K}_t \geq K_{t-1}\} - F_K \times \left(\frac{\bar{K}_t}{K_{t-1}} - 1\right)^2 \times \mathbb{1}\{\bar{K}_t < K_{t-1}\} \\
& + p_K(\delta^K K_{t-1} - \bar{K}_t)\Big\}.
\end{aligned}
$$

The firm chooses its target levels of inputs denoted by $\bar{L}_{rt}, \bar{L}_{ct}, \bar{K}_t$. We integrate over the randomness in the realization of input levels. Once the actual levels are realized, it chooses whether to produce or be dormant. $R(\cdot)$ is the value-added net of fixed production cost. S_{t-1} indicates the status in the previous period, either production $S_{t-1} = P$ or dormancy $S_{t-1} = D$.[27]

$$
R(\tilde{\phi}_t, L_{ct}, L_{rt}, K_t, S_t, S_{t-1}) = \mathbb{1}\{S_t = P\}\{VA(\tilde{\phi}_t, L_{ct}, L_{rt}, K_t) - \mathbb{1}\{S_{t-1} = P\} f^{PP} - \mathbb{1}\{S_{t-1} = D\} f^{DP}\}
$$

For period $t = 0$

Firms pay the entry cost f^e before their productivity is realized. We assume that the initial productivity $\tilde{\phi}_0$ is drawn from a initial log-normal distribution with a mean $\frac{\tilde{\gamma}_0}{1-\tilde{\gamma}_1}$ and a variance $\frac{\left(\sigma_\gamma^\varepsilon\right)^2}{1-\tilde{\gamma}_1^2}$. In period 0, the value function of a firm is V_0 is

$$
V_0(\tilde{\phi}_0) = \max_{d=E,S} \Big\{0, \max_{L_r,L_c,K} \{VA(\tilde{\phi}_0, L_c, L_r, K) + \delta^V \mathbb{E}_{\tilde{\phi}_1|\tilde{\phi}_0} V(s_1)\}\Big\}
$$

Firms choose to stay in the market ($d = S$) when the value of doing so is greater than zero, otherwise, firms exit the market immediately. We assume zero ex-ante profits because of free entry. Therefore, the expected payoff of entry equals the entry cost.

$$
f^e = \int_{\tilde{\phi}_0} V_0(\tilde{\phi}_0) dG_0(\tilde{\phi}_0)
$$

6 Estimating the Model

The full set of model parameters includes the discount factor δ^V, the capital depreciation factor δ^K, demand elasticity σ, per period factor prices w_c, w_r, the price of acquiring capital, p_K, the input

[27] The value-added is defined in equation (5).

shares in production, α_L, α_I, α_K, α_{Lc} and α_{Lr}, labor and capital adjustment cost parameters c_{Hc}, c_{Fc}, c_{Hr}, c^L_{Fr}, c^S_{Fr}, c_{HK}, and c_{FK}, parameters of the distributions of shocks to labor and capital σ^{ε}_K, $\sigma^{\varepsilon}_{Lr}$, $\sigma^{\varepsilon}_{Lc}$, the mean and variance of the fixed cost of production draws, and the mean and variance of the scrap value distributions and the firing cost of capital when the firm exits. μ^{PP}_f, μ^{DP}_f, σ^2_P, μ^E_f, σ^2_E, c^E_{FK}, c^E_{Fr},c^E_{Fc}, productivity evolution parameters $\tilde{\gamma}_0$, $\tilde{\gamma}_1$, $\tilde{\sigma}^{\varepsilon}_{\gamma}$.

Of these we calibrate δ^V, δ^K, the input shares α's, factor prices w_c and w_r, and the demand elasticity σ. The remaining 21 parameters, i.e.,

$$\theta = \{\tilde{\gamma}_0, \tilde{\gamma}_1, \tilde{\sigma}^{\varepsilon}_{\gamma}, c_{Hc}, c_{Fc}, c_{Hr}, c^L_{Fr}, c^S_{Fr}, c_{HK}, c_{FK}, \sigma^{\varepsilon}_{Lc}, \sigma^{\varepsilon}_{Lr}, \sigma^{\varepsilon}_K, \mu^{PP}_f, \mu^{DP}_f, \sigma_P, c^E_{FK}, c^E_{Fr}, c^E_{Fc}, \mu^E_f, \sigma_E\}$$

are estimated using the dynamic model.

We want to capture key differences in institutions and economic conditions between the high-performing and low-performing states.[28] Hence, we allow some key parameters to be different between these regions. These are the wages of workers (as wages are higher in high-performance states), the intercept of the profitability process (as productivity is likely to evolve differently in well run and poorly run states), firing costs of regular and non-regular workers, (as there may be differences in implementing the law across these groups of states), and the mean of the scrap value draws (as their economic climate may differ). We are guided by the data and the empirical patterns as reported in Section 4 in making this choice, while trying to minimize the number of parameters in the model.

For estimation we setup the data as follows. We only use the data from 1999-2008. This is because we want to avoid contamination of the model from any shocks due to the global financial crisis. Since we need historical information of productivity, which can only be inferred from active firms, we include firms in our data only when they start producing. In other words, we ignore dormant firms until they become active for the first time. We also drop the firms that appear in the data only once as our estimation procedure relies on having at least two years of data on a firm. To deal with the macro shocks such as inflation, and differences across industries, we homogenize the data by removing industry-year fixed effects from log value added.

6.1 Estimation Procedure

Since models of firm dynamics can usually not be solved in closed form and hence cannot be directly estimated, indirect inference procedures are typically used (e.g. Cooper and Haltiwanger, 2006). This involves specifying an auxiliary model[29] that mimic the structural model. Next, data

[28] Ideally we would want to capture the heterogeneity between all states of India and estimate different parameters for each state as that is the administrative level at which many policies are formulated. However, we do not have enough data, especially in states where manufacturing is not a large part of the economy, to credibly estimate model parameters at this level of disaggregation.

[29] Auxiliary models can range from simple data moments like mean and variance to more complicated regression models. Consistent estimation of structural parameters can be achieved as long as the auxiliary model captures the key data features (Gourieroux et al., 1993)

is simulated from the structural model using an initial guess ($\hat{\theta}_0$) of the structural parameters (θ). Then, the estimation objective is to search for values of structural parameters such that the auxiliary parameters (θ^a), i.e., parameters of the auxiliary model, when estimated using actual data versus simulated data, are very close to each other. This general procedure is outlined in the first two columns of Figure 8.

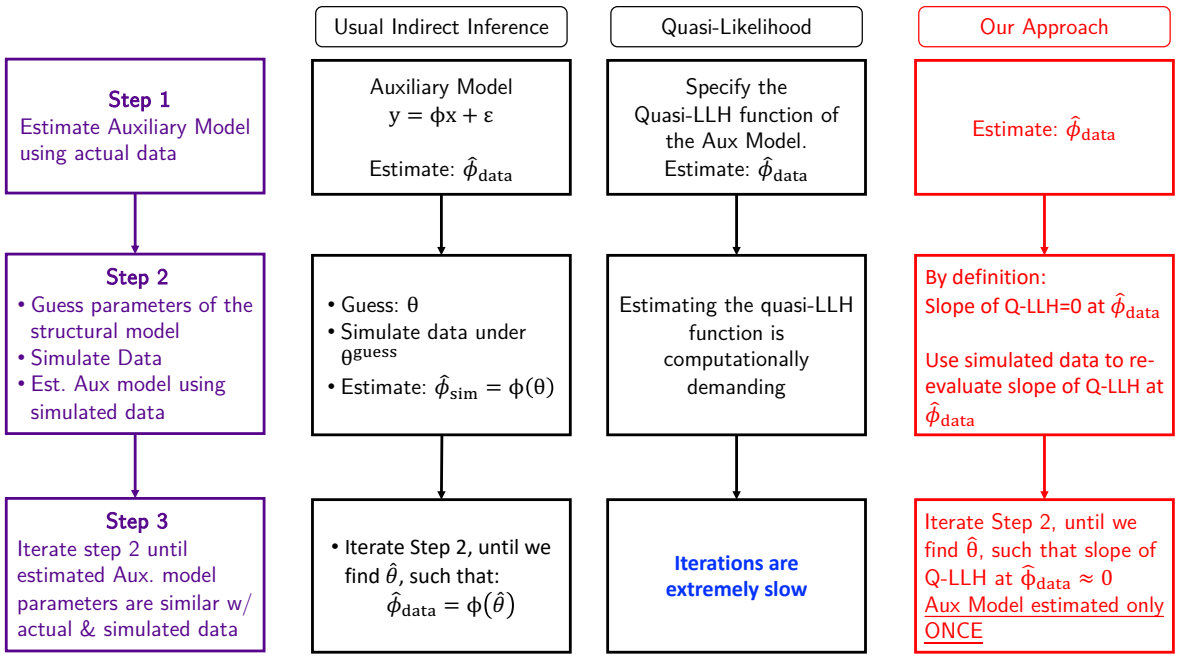


Figure 8: The Procedure of Indirect Inference

Implementing such a procedure for our model is challenging for two reasons. First, estimating auxiliary parameters related to firm dynamics is computationally very intensive since this involves repeatedly solving the Bellman equation and the policy functions. Thus, this brute force approach would be extremely slow and costly. Second, in our set-up firms face discrete (active, dormant, exit) and continuous choices (how much labor and capital to employ). In such an environment, small changes in parameters, like the fixed production costs, could result in discrete changes in the simulated data. A fall in fixed production costs could result in a lot of firms choosing not to become dormant and discrete changes in the simulated data. This would preclude us from using gradient-based optimization methods, further slowing estimation. Therefore, to estimate the model parameters, we adapt the strategy proposed by Golombek and Raknerud (2018), which utilizes the smoothing properties of the conditional expectations operator.

To address these challenges, we specify an auxiliary model with the same parameters as the true parameters in the structural model. We then derive a likelihood function to estimate the auxiliary parameters (we need not worry about any biases in the estimation as we will be constructing the same, possibly biased, moments from the simulated data.) In econometrics parlance, we perform maximum quasi-likelihood estimation (Q-MLE).

Our approach has two key steps. First, we estimate the parameters of the auxiliary model from the data just once and get $\hat{\theta}^a$. Q-MLE implies a score condition (i.e. the sum of the squares of derivatives of the quasi-likelihood function is as close to zero as possible) that is satisfied by actual data and the estimated auxiliary parameters ($\hat{\theta}^a$). Instead of matching moments or parameters, we set the objective to find structural parameters ($\hat{\theta}$) such that the score function is also satisfied with simulated data at the estimated auxiliary parameters ($\hat{\theta}^a$). Intuitively, this is when the simulated data is very close to the actual data, but we don't have to re-estimate the auxiliary model in each search iteration.

Second, we simulate firm trajectories from the structural model to check whether the score condition is satisfied. Here, we simulate *probabilities* of a firm's exiting, dormancy, and production in any period rather than its binary decisions. The probabilities are essentially the conditional expectations of the binary decisions and, hence, smooth.

6.1.1 Parameter Partitions and the Auxiliary Models

As described above in section 6.1, we begin by estimating the auxiliary parameters corresponding to the structural parameters. Even though we have to estimate the auxiliary models only once, this is still computationally intensive as each iteration of the optimization algorithm requires resolving the Bellman equation and the policy functions. Following Golombek and Raknerud (2018), we partition the the set of θ parameters that we estimate into three sets. Parameters that govern (a) the firm's static choices include prices and intermediate inputs, (b) the decision to produce or be dormant within each period, and (c) the dynamic decisions of the firm, e.g. labor and capital, and the decision to exit or stay. It is the third set of parameters that is computationally most intensive to estimate, and reducing that set is efficient. We estimate the quasi-likelihood function for each set of the parameters as elaborated as follows. For specific details, see Appendix xx; here, we present a brief overview.

Parameter Group 1: $\theta_1 = \{\tilde{\gamma}_0, \tilde{\gamma}_1, \sigma_\gamma^\varepsilon\}$

Note from equations (5) and (6) that if we treat current and past choices of firms about labor and capital as exogenous, then the likelihood of observing a certain value added in the data depends only on θ_1 and calibrated parameters. This likelihood function assumes that labor and capital are exogenous and violate the structural model, and hence is a quasi-likelihood function rather than a component of the likelihood function. It allows us to estimate θ_1^a.

Parameter Group 2: $\theta_2 = \{\mu_f^{PP}, \mu_f^{DP}, \sigma_P\}$

These parameters only govern the firm's choice to produce or be dormant. This choice is made after labor, capital, and fixed cost shocks have occurred, and subsequent factor payments do not depend on it. From equation (5) and given $\hat{\theta}_1^a$ from step 1, we can construct a approximation of $\tilde{\phi}_{it}$ as $\hat{\tilde{\phi}}_{it} = \frac{VA_{it}}{L_{i,t}^{\alpha_L} K_{i,t}^{\alpha_K}}$. The quasi log-likelihood function of θ_2 is constructed based on whether firms

find profitable to produce or not after paying the fixed production cost. Strictly speaking, the choice of production or dormancy also affects firms' future value function through the hysteresis of production cost. To reduce the computation burden, we ignore the hysteresis of the production cost when we construct the quasi-likelihood function for θ_2. Therefore, the quasi log-likelihood function of θ_2 is the following, which basically reflects probabilities to produce and be dormant, allows us to estimate θ_2^a

$$\log l_2(\theta_2^a; \tilde{\phi}_{it}, L_{i,ct}, L_{i,rt}, K_{it}, \hat{\theta}_1^a) = \log \Pr\{VA(\tilde{\phi}_{it}, L_{i,ct}, L_{i,rt}, K_{it}) - \mathbb{1}\{S_{it-1} = P\} f^{PP} - \mathbb{1}\{S_{it-1} = D\} f^{DP} > 0\} \tag{15}$$

Parameter Group 3: $\theta_3 = \{c_{Hc}, c_{Fc}, c_{Hr}, c_{Fr}^L, c_{Fr}^S, c_{HK}, c_{FK}, \sigma_{Lc}^{\varepsilon}, \sigma_{Lr}^{\varepsilon}, \sigma_K^{\varepsilon}, c_{FK}^E, c_{Fr}^E, c_{Fc}^E, \mu_f^E, \sigma_E\}$

These remaining 15 parameters pertain to various adjustment costs, shocks to inputs, and scrap values. They govern the firms' dynamic choices and can be estimated using a likelihood function for observing values of labor and capital and exit choices that we see in the data. This step is computationally the most demanding part of our estimation procedure as it requires re-estimating the value function for each trial value of θ_3^a

6.1.2 Indirect Inference

We show in the appendix that the partial quasi-likelihood estimator $\hat{\theta}^a = \left(\hat{\theta}_1^a, \hat{\theta}_2^a, \hat{\theta}_3^a\right)$ satisfies a score moment condition which is the derivative of the sum of the three quasi-likelihood functions above with respect to θ^a. The final step for us is to simulate smooth trajectories of firms for a given value of the structural parameter vector θ. We take the data of the first year of each firm as given, and simulate smooth trajectories of each firm until 2018, which is the last year of data we use. We will use the same sample period to construct the score moment condition for the structural parameter vector θ. The indirect inference estimator $\hat{\theta}$, is that value of θ such that the simulated data from the model yields the lowest value of the score moment condition at $\hat{\theta}^a$.

6.1.3 Incorporating Missing Data into the Estimation

There is a further problem with the data, namely, that we have holes (missing data) in the Annual Survey of Industries data. The dataset is a census only for firms with over 100 workers, so small firms need not be sampled each year. Further, firms may be missing from the data if they do not comply with the survey which they often do.

If we do not deal with the missing data issue, the holes in the data will affect our estimation. First, in the estimation of the auxiliary model, we will miscalculate the transition of firms' status from production/dormancy to exit as we will have trouble identifying if firms which are disappearing from the data are truly exiting or not because of these missing data issues. Second, in the second step of the indirect inference, the simulated firm trajectories will not match the actual data. For

example, the probability of firms exiting in the simulated data without accounting for the missing probabilities will be lower than that in the actual data.

To deal with such gaps in the data, we adapt the simulation procedure to mimic missing patterns in the real data. We first use actual data to estimate the probability that data will be missing conditional on employment, capital, production status, industry, state and year.[30] For example, if there is a hole in the data for a firm, we would look at whether it reappeared later. If it did, that hole would be because it was missing. If the firm does not reappear, it could either be missing or it could have exited. The longer the time period of data we have in the future, the more confident we are that the hole in this event is because a firm has exited. From this information, and the assumption of independence between being missing and exiting, we can back out the probability of exit. [31] In the second step of the indirect inference (i.e., simulating the data), we use the estimated missing probabilities to drop data from the simulated dataset such that it mimics the patterns of holes in the actual data.

6.1.4 Identification

We now discuss the intuition behind the identification of the key parameters in the model. These are the means and variances of the fixed production cost shocks $\left(\mu_f^{PP}, \mu_f^{DP}, \sigma_P^2\right)$[32], and the parameters governing the scrap value distribution $\left(\mu_f^E, \sigma_E^2\right)$.

Recall that firms need to pay fixed costs to produce and can avoid them by going dormant. Thus, the probability of production given state variables, i.e., productivity and labor employment, helps identify the production cost shock parameters. In particular, the $\mu_f^{\cdot P}$'s adjusts to match the average probability of production across firms and σ_P^2 will adjust to match the range of productive firms that end up producing in the data.

The intuition is the following. A higher $\mu_f^{\cdot P}$ increases the probability of relatively larger shocks, thereby reducing the average probability of production. On the other hand, an increase in σ_P^2 increases the likelihood of both small and large draws.[33] Ceteris paribus, this will broaden the spectrum of productivity levels among firms choosing to produce as some low-productivity firms get lucky and draw low-cost shocks.

Similarly, a higher average exit rate among firms will be consistent with a higher mean of the scrap value distribution, μ_f^E. Conditional on the exit rate, the broader the productivity spectrum of the exiting firms, the higher σ_E^2 has to be. Hypothetically, if all firms got the same scrap value

[30] This can be made as flexible as desired. For example, we assume the polynomial function form of capital and employment when estimating the missing probability. It can be made conditional on the number of years of dormancy in the past or another variable that might matter.

[31] The probability that the firm has not reappeared (which is data) is the probability he exited in the first period, plus the probability he was missing (which we know) in the first period and exited in the second, .. plus the probability he was missing for the entire data set. With our assumption of independence, this gives us one equation in one unknown, the probability of having exited which we can solve for.

[32] Note that the μ's and σ^2 are not the means and variances. The distributions are log-normal so that the log of the variable has this mean and variance.

[33] Compare the different distributions in figure D.8 in Appendix D for a visual intuition.

($\sigma_E^2 = 0$), all firms below a threshold productivity would exit. If the average exit rate does not change, the only reason why some productive firms would exit and some relatively un-productive firms would stay is if the variance of the shocks is higher.

The hiring and firing costs are, as is usual, identified through the transition of employment over states. A small increase in employment in response to a positive productivity shock implies a larger hiring cost, and a small decrease with a negative productivity shock implies a larger firing cost. Greater variance in employment, conditional on the state, s_t, indicates larger deviations from firms' targeted employment levels, i.e., larger employment shocks ($\sigma^{\varepsilon}_{Lc}$, $\sigma^{\varepsilon}_{Lr}$). Similarly, the transition of capital over time identifies the capital adjustment costs and capital shocks. The mean and transition matrix of productivity $\tilde{\phi}_{ft}$ help identify the process of productivity evolution $\tilde{\gamma}_0$, $\tilde{\gamma}_1$, $\sigma^{\varepsilon}_{\gamma}$. Note that we allow different firing costs of capital and labor for exiting firms. We do so as firms could be held up by workers once it is clear they want to exit, or alternatively, it could be easier to negotiate with workers in a collective manner when the workers know the firm is in dire straits and needs to exit. We find that adjustment cost of both labor and capital are lower when firms want to exit. This makes sense as in the data firms rarely downsize capital such as buildings and land or their labor force when they stay in the market.[34]

Once θ is estimated, we solve out the entry cost f^e such that firms have zero expected profits by entering the market.

6.2 Estimates of Structural Parameters

In this section, we report and discuss the magnitudes of our parameter estimates. Let's begin with the 9 parameters that we calibrate. These are reported in 3. The factor shares (α's), and the wages are based on simple averages of the corresponding numbers in the ASI data. The wage of non-regular workers is higher than that of regular workers because this includes contract workers and managers.[35]

We set the discount factor and the capital depreciation rate to 0.9. Discount factors are notoriously hard to estimate and we choose this number as interest rates in India were around 7-9 % in the period we consider. The demand elasticity is set to 3.94, which is the median value reported in De Loecker et al. (2016).

[34]Allowing this flexibility also lets us match the transition matrix in the data to that in the simulated data. In particular, firms as the adjustment costs differ more for capital than for labor, not allowing for it would bias the estimates of the transition to dormancy, especially for firms with a lot of capital.

[35]Contract workers make 37,000 rupees on average in high-performance states and 34,000 in low-performance states. This is what the firms pay for them so that the worker would get even less given the agency supplying contract workers would take a cut. This suggests contract workers are different (less skilled) compared to regular workers. Managers make Rs. 165,000 in high-performance states and 141,000 in low-performance states.

Table 3: Calibrated Parameters

Panel 1: Parameters Common to All Sectors and States		
δ^V	0.9	
δ^K	0.9	
σ	3.94	
Panel 2: Parameters for Labor and Capital Intensive Sectors		
	Labor Intensive	Capital Intensive
α_I	0.66	0.73
α_K	0.26	0.22
α_{Lr}	0.66	0.56
α_{Lc}	0.34	0.44
Panel 3: Parameters for High- and Low-performance States		
	HP States	LP States
w_r (1000 rupees)	50	43
w_c (1000 rupees)	143	121

The structurally estimated parameters are reported in Table 4. We estimate a high degree of persistence in the profitability process, $\tilde{\gamma}_1 = 0.9$. So, a firm with very low profitability should expect to be in that state in the future. Hence, the only reason for such a firm not to exit would be exit costs.

The parameters on fixed costs of production from panel 2 suggest that restarting production after dormancy is, on average, harder than continuing to produce. In fact, $\mu_f^{PP} < \mu_f^{DP}$ implies that there are significant advantages to keeping the plant active. In hypothetical simulations based on these parameters, we find that firms pay about 1% of their annual value added in fixed production costs.

Estimates on hiring and firing costs are reported in panels 4 and 5. A few things to note. First, hiring is easier than firing any type of worker. Second, hiring non-regular workers is easier than hiring regular workers. The median firm pays 13.3% vs 165% of the annual wage to hire non-regular vs a regular worker. This is consistent with the reality that hiring contract workers involves less paperwork and fewer formalities and is usually done via a third party.

Third, firing regular workers is much harder than firing contract workers. The costs are 2.7-5.4 times as much. Fourth, firing regular workers is harder in low-performance states than high-performance states and harder in larger firms than smaller firms. These estimates are consistent with the literature (e.g. Besley and Burgess, 2004; Chaurey, 2015) and with the empirical evidence in we report in Section 4.

In terms of quantitative magnitudes, these estimates correspond to the median firm in high- and low-performance states bearing 40% and 47% respectively, of the annual wage in their region to fire a non-regular worker. The analogous firing cost of regular workers is 207% and 284% in the two regions.

Finally, the exit cost parameters in panel 7 suggest that the net scrap value, $\tilde{f}^E$, defined in equation (13) is very low. In fact, it is negative for most firms, implying that, on average, firms must "pay" to exit. In simulations, we find that in high-performance states, this is about 79% and 140% of annual sales in high- and low-performance states, respectively.

Table 4: Parameter Estimates

	High-Performance States	Low-Performance States
Panel 1: Profitability Process		
$\tilde{\gamma}_0$	0.15	0.16
$\tilde{\gamma}_1$	0.90	
$\sigma_\gamma^\varepsilon$	0.79	
Panel 2: Fixed Production Cost		
μ_f^{PP}	-18.21	
μ_f^{DP}	8.49	
σ_P	13.70	
Panel 3: Adjustment Cost of Capital		
c_{HK}	186.08	
c_{FK}	1665.96	
Panel 4: Adjustment Cost of Regular Workers		
c_{Hr}	185.50	
c_{Fr}^L	240.74	298.01
c_{Fr}^S	186.79	245.00
Panel 5: Adjustment Cost of Non-regular Workers		
c_{Hc}	21.28	
c_{Fc}	69.26	55.59
Panel 6: Shocks to Factor Employment		
σ_K^ε	0.52	
σ_{Lr}^ε	0.61	
σ_{Lc}^ε	0.82	
Panel 7: Exit Costs		
c_{FK}^E	49.97	
c_{Fr}^E	62.83	
c_{Fc}^E	66.13	
μ_f^E	-491.71	-665.94
σ_E	516.83	

7 Counterfactual Exercises

Our quantified model allows us to compute the aggregate effects of increased firm exit on productivity, value-added, firm entry, employment, and the price index. In particular, we have two policy instruments to facilitate firm exit—(a) a reduction in factor adjustment costs and (b) reducing exit costs (or increasing the scrap value). Intuitively, the broad term "exit costs" here refers to institutional bottlenecks. So a reduction in them could come from a better performing and less uncertain judiciary, streamlining clearance requirements and approvals, etc. The model also allows us to study the similarities and complementarities between the two policies.

We proceed in steps with our counterfactual simulations. We have grouped firms into four categories for the counterfactual exercises: labor- and non-labor-intensive industries in high-performance and low-performance states. In the first counterfactual, we use our policy instruments to match the average exit rates in each of the four categories to the average exit rate among manufacturing firms in the US, i.e. 9%. This allows us to study the average impact on the aggregate economy and quantitatively compare both policy instruments.

However, these effects would be heterogeneous since low-performance states and labor-intensive industries have much lower baseline exit rates. We explore these heterogeneities next.

Matching the US firm exit rate may seem unrealistic for a large emerging economy like India, which has an overworked bureaucracy and limited state capacity. Although it is not entirely infeasible, as India has previously achieved difficult goals (Kapur, 2020). In that context, at the very minimum, these counterfactuals help us understand the maximum gains (or losses) in store. A more realistic goal would be for low-performance states to achieve the exit rates of high-performance states. So, if institutions in Uttar Pradesh and Madhya Pradesh could look like those in Maharashtra and Gujarat. The third set of counterfactuals examines this question.

In a fourth exercise, we study the synergies between the two policy instruments and show that the combined effects of the two policies exceed the sum of the effects of using them individually.

Lastly, in the final exercise, we compare the effects of using a fixed amount of resources to reduce entry vs. exit costs. Most governments make great efforts to design policies that lower entry costs to attract firms. These policies include tax holidays, creating special economic zones, infrastructure building, etc. Our attempt here is not to reduce the importance of these policies, as things like infrastructure are important for long-term growth and development. We want to illustrate that (a) in terms of magnitudes, exit costs are equally important, and (b) there are margins where improving entry alone is not sufficient.

Besides the quantitative magnitudes, our counterfactuals have an important qualitative insight. We'll see that a reduction in exit costs could reduce net employment even if aggregate value added goes up in an economy where the capital stock is fixed. In such an economy, therefore, labor laws do indeed protect jobs if that is the aim. However, the first best solution would be to increase the supply of capital.

7.1 Matching U.S. Firm Exit Rate

In the following subsections, we will conduct a set of counterfactual exercises. First, we will assume that the total capital available is fixed and look at the outcomes. This extremely conservative assumption will highlight that even in this case, reducing exit costs (raising scrap value) can have positive output and employment effects. We will look at the effects of increasing scrap value and reducing firing costs on overall outcomes. We will zoom in on the effect when the exit rate in the counterfactual is moved to 70% of the U.S. one and when it is moved to that in high-performing states. Then we consider where these aggregate effects are coming from by state groups and industry groups. We consider four groups from the two-way classification of states as high-performing and low-performing ones and industries as being labor-intensive and capital-intensive. All the results above are summarized in Table 5.

We begin by studying the effects on the simulated exit rates of either increasing scrap value (by increasing the mean of the distributions firms draw from by a given amount) or decreasing firing costs (by a given percentage) for all firms. The real-world analogue of raising scrap value would be policies that like making courts more efficient and having a well-laid-out path to bankruptcy. Raising the worker limit at which the IDA would kick in would be an example of reducing labor adjustment cost.

Table 5: Summary of Counterfactual Exercises

	Target	Policy Instrument	Category*	Value Added	Productivity (%)			Employment	Mass of Frims	Dormancy Length	Age	Price Index
	Exit Rate			(%)	Aggregate	Entrants	Exiters	(%)	(%)	(Δ years)	(Δ years)	(%)
1	70% of U.S.6.3%	Exit Cost	Aggregate	13.17	3.27	-1.71	13.60	3.13	13.14	0.22	2.14	-4.21
2			LI / HP	5.99	3.06	-1.18	6.05	-1.13	5.15	-0.17	-1.62	-2.00
3			LI / LP	13.34	7.43	-2.73	19.20	-3.23	10.35	-0.39	-3.86	-4.08
4			CI / HP	2.54	0.49	-0.34	2.49	0.25	2.98	-0.034	-0.37	-0.87
5			CI / LP	17.16	3.12	-2.13	17.40	2.28	20.74	-0.27	-2.53	-5.26
6		Labor Adj Cost	Aggregate	12.87	2.54	-0.94	15.23	-25.28	14.16	0.22	2.14	-4.11
7			LI / HP	6.68	3.10	-0.69	9.31	-15.34	5.70	1.23	12.65	-2.14
8			LI / LP	15.38	5.39	-1.72	27.32	-38.15	17.87	1.30	13.17	-4.29
9			CI / HP	2.18	0.54	-0.17	3.18	-4.22	2.00	1.29	12.22	-0.81
10			CI / LP	16.00	2.91	-1.16	20.07	-31.62	18.14	1.30	12.14	-5.02
11	HP States	Exit Cost	LI	6.68	3.91	-1.57	12.32	-1.74	5.54	-0.23	-2.24	-1.84
12			CI	14.25	2.80	-1.81	14.27	1.89	17.02	-0.23	-2.16	-4.45
13		Labor Adj. Cost	LI	7.87	4.18	-0.92	13.54	-18.69	6.30	1.40	14.28	-2.36
14			CI	12.99	2.56	-0.95	15.34	-25.67	14.27	1.34	12.51	-4.15

Note: LP: Low-performance States, HP: High-performance states, LI: Labor-Intensive Industries, CI: Capital-Intensive Industries.

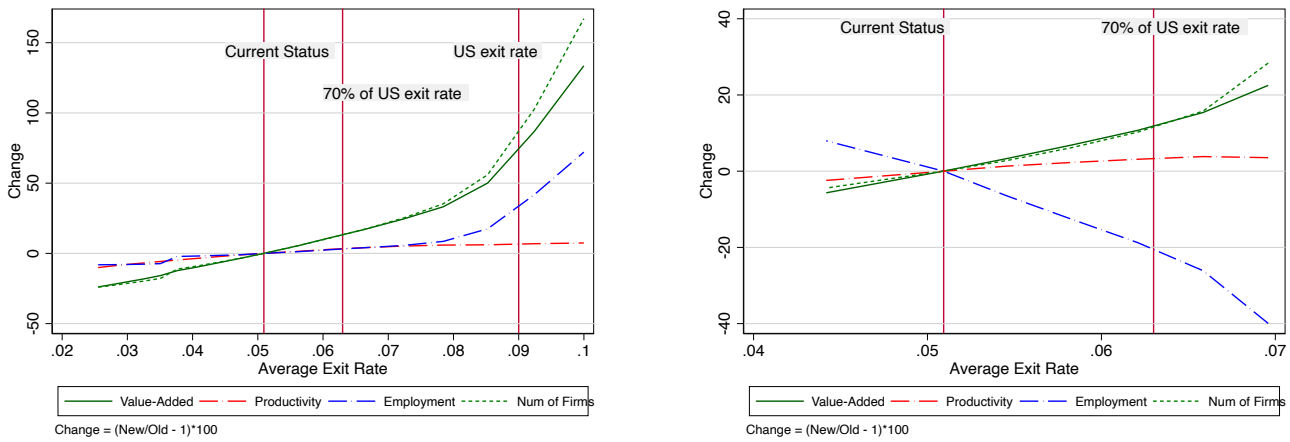
7.1.1 Changing the Scrap Value

What might we expect the effect of raising scrap value and thus reducing exit barriers? An increase in the scrap value results in more firms getting high enough scrap value draws to warrant exit. Low-productivity firms are naturally more affected by this, which works to raise average productivity. It also encourages entry as the present value of entry rises, and in terms of selection, would allow less productive firms among entering firms to remain, making the average entering firms less productive. This would work to reduce average productivity overall.

We perform the exercise for each of the four cases considered (Labor-intensive in high-performing states, labor-intensive in low-performing states, capital-intensive in high-performing states and

capital-intensive in low-performing states) and depict the weighted[36] average number for the variable in question.[37] These results are presented in row 1 of Table 5 and in Figure 9a. The way to read Figure 9 is as follows. The x-axis plots the various counterfactual exit rates that can be achieved by changing the policy. The y-axis plots the corresponding percentage change in firms' value-added, productivity, employment, and mass. Note that at the status-quo exit rate of 5.1%, there is, by definition, no change in any of the outcome variables. At the 70% of US exit rate (i.e. 6.3%), average value added and firm mass in the economy increase by about 13%.

Employment and productivity rise by far less, by only about 3%. The average productivity among firms that exit increases by 13% which raises the productivity of the non-exiting firms. The average productivity of entrants is lower by about 1.71%.[38] Thus, most of the gain in value added is coming from changes in the mass of firms, i.e., the extensive margin, rather than by employment or productivity. The average time firms spend in dormancy goes down from 1.5 years to 1.28 years. Welfare improves significantly as the price index falls by 4.21%. Another aspect of Figure 9 worth noting is that the effects are convex. A small initial increase in scrap value, and therefore the exit rate, does not yield big gains, but a large one does better.



(a) Policy: Exit Cost

(b) Policy: Labor Adjustment Cost

Figure 9: Aggregate Effects with Policies Changing Exit and Labor Adjustment Costs

Notes: Note that both the panels have different y-axis ranges.

7.1.2 Changing the Labor Adjustment Costs

How would outcomes differ if similar exit rates are achieved but by lowering labor adjustment costs instead? These numbers are reported in row 6 of Table 5 and plotted in Figure 9b.

[36] The weights correspond to the share of firms in each group in the simulated data.

[37] The four separate figures are presented in Figure E.9 and E.10 in Appendix Section E.1.

[38] This is to be expected because lower exit costs also mean lower entry costs.

Clearly, the magnitudes are much lower, enough so that the scale in this figure differs from that in Figure 5(a). [39] There is only a 12% increase in value-added and mass of firms. Productivity, however, rises. This comes from selection: exiting firms are high employment, low productivity ones who were staying in because it was too expensive to fire their workers. This dominates the selection effect on entry: entrants become less productive on average which reduces average productivity.

In addition, employment actually falls in this scenario by 20.8%. This is a key insight from our model. Employment falls because dormant and inefficient plants fire workers and exit. However, newer firms do not fully absorb all of them. This is because capital-in our baseline economy is fixed. If we made capital elastic so that an increase in its return, as would occur with an increase in the mass of firms, things would look very different. we explore the role of capital supply elasticity in Section 7.2 below.

7.1.3 Heterogeneities across State Group and Industries

The effects of facilitating exit, either via a reduction in firing costs or an increase in scrap value, have heterogeneous implications for different groups of states and industries depending on their baseline conditions. We explore this further in rows 2-5 and 7-10 of Table 5. First, consider the effect when scrap value is raised so that we attain 70% of the U.S. exit rate. It is worth noting that value-added, which rises substantially overall, increases in all four cases. It increases by more in low-performing states, as would be expected as we expect distortions to be more binding there.

Employment also increases overall but falls in labor-intensive sectors in both high and low-performing states, but rises in the capital-intensive ones. The change, whether positive or negative is larger in low-performing states. This makes sense as there is more pressure to exit in low-performing states and low-performing states also have a larger fraction of low-performing labor-intensive firms. As scrap value rises, firms, especially low-productive ones in the labor-intensive sector, release a lot of labor which is the force behind their fall in employment. As wages are fixed, these workers go to agriculture or services.

7.1.4 What if the Low-performance states were as good as the high-performance states?

Targeting the US firm exit rate may be a bit unrealistic, especially for low-performing states with limited state capacity. A more reasonable goal would be for policy to target the exit rates in the high-performance states. We have in mind how large the gains would be even if West Bengal, Uttar Pradesh, and Madhya Pradesh could develop institutions like Maharashtra and Tamil Nadu. These results are reported in rows 11-14 of Table 5. These are roughly a scaled-down version of the numbers discussed while considering attaining 70% of the U.S. exit rate as the curves are roughly linear in this region.

[39] Note that attaining 100% of the U.S. exit rate is not possible with positive firing costs, which is why this simulation curve only goes as far as 7%.

7.2 Elastic Capital Supply

All our counterfactual estimates are very sensitive to what we assume about the supply curve of capital. As reported below, see Table 6 and Table 7, higher elasticity of supply magnifies the effects considerably. Why? As we have seen, easing exit barriers in our baseline model can create net entry and raise both value added and employment when scrap value is increased. It need not always do so, as is the case when firing costs are reduced. In our baseline economy, firms have to work only with a fixed aggregate capital. Consequently, entry drives up the price of capital and chokes off further entry. If the supply elasticity of capital is positive, this is not so: an increase in entry raises the return to capital which attracts more capital, which attracts more entry, and so on. Note first that scaling up capital does not affect aggregate productivity or that of entrants and exiters. Had we just doubled the availability of capital, it would have just doubled all the outcomes leaving cutoffs unchanged. In other words, as wages are assumed fixed, there would be a pure scaling effect. Having elastic capital not only scales up the capital available but also raises the price of capital and hence its cost. However, it raises its resale value by the same amount. Thus, even adding increases in the price of capital does not affect cutoffs.[40] This is also why dormancy length and age are invariant to the elasticity.

Note, however, that value added, employment, and the mass of firms explode. Employment increases are a bit less than 300% while value added and the mass of firms less than doubled as elasticity rises to .5. The price index also falls in proportion to the mass of firms. In other words, even when we make the conservative assumption that a doubling of the return to capital only increases its supply by 50%, we get large effects. These counterfactuals are particularly encouraging in terms of how much labor could be absorbed by reducing exit costs coming from low scrap values, even if the price of capital rises in order to increase its supply.

Table 6: Changing the Scrap Value as in the Base Counterfactual with Elastic Capital Supply

Elasticity (ε_K)	Category*	Value Added	Productivity (%)			Employment	Mass of Firms	Dormancy Length	Age	Price Index
		(%)	Aggregate	Entrants	Exiters	(%)	(%)	(Δ years)	(Δ years)	(%)
0	Aggregate	13.17	3.27	-1.71	13.60	3.13	13.14	0.22	2.14	-4.21
0.1		14.98	3.27	-1.71	13.60	4.78	14.95	0.22	2.14	-4.73
0.2		16.82	3.27	-1.71	13.60	6.46	16.80	0.22	2.14	-5.24
0.5		22.56	3.27	-1.71	13.60	11.69	22.53	0.22	2.14	-6.77

Note: LP: Low-performance States, HP: High-performance states, LI: Labor-Intensive Industries, CI: Capital-Intensive Industries.

When we look at the effect of reducing firing costs as capital becomes more and more elastic, we see a less rosy picture. Again note that productivity, age, and the length of dormancy are unaffected by making capital elastic. As before, value added, employment, and the mass of firms are affected. Note that even with capital expanding, employment effects of reducing firing costs remain stubbornly negative. They fall in absolute terms, from -25.28% to -18.41%. This is due to

[40]We choose to model capital as we have done, rather than having a rental rate of capital and assuming firms rent the capital. Adjustment costs are at the heart of what we are doing and it makes no sense to think of firms capital decisions in this way. For example, firms build structures and acquire capital specifically tailored to their purposes. They cannot costlessly adjust them.

the same selection forces being in play. Having more capital scales up the system: but reducing firing costs still encourages low productivity labor-intensive firms to shed labor and the increase in the mass of firms is not enough to overcome this, though if capital is elastic enough, ultimately employment would rise when firing costs fell. Value added, the price index, and the mass of firms move in line with each other and less than double as elasticity rises to .5. In other words, even though employment is not positively affected, the economy grows, and the real income of workers rises. These counterfactuals are particularly discouraging in terms of how much labor could be absorbed by reducing exit costs coming from labor firing costs even when capital supply is not fixed.

Table 7: Changing Labor Adjustment Costs as in the Base Counterfactual with Elastic Capital Supply

Elasticity (ε_K)	Category*	Value Added	Productivity (%)			Employment	Mass of Firms	Dormancy Length	Age	Price Index
		(%)	Aggregate	Entrants	Exiters	(%)	(%)	(years)	(years)	(%)
0	Aggregate	12.87	2.54	-0.94	15.23	-25.28	14.16	0.22	2.14	-4.11
0.1		14.87	2.54	-0.94	15.23	-23.95	16.19	0.22	2.14	-4.68
0.2		16.91	2.54	-0.94	15.23	-22.60	18.25	0.22	2.14	-5.25
0.5		23.25	2.54	-0.94	15.23	-18.41	24.67	0.22	2.14	-6.94

Note: LP: Low-performance States, HP: High-performance states, LI: Labor-Intensive Industries, CI: Capital-Intensive Industries.

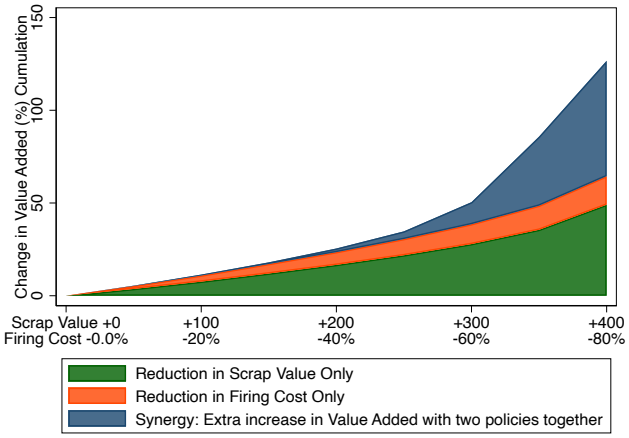
7.3 Synergies in Labor Adjustment and Exit Costs

Figure 10 presents the quantitative estimates of the synergies between our two policy instruments on value added. On the x-axis, we plot the different magnitudes of the policies, and the y-axis plots the corresponding change in value added.

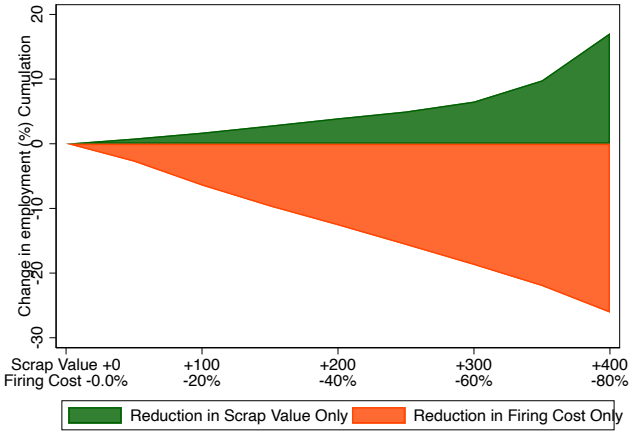
At any scrap value or firing cost level, the height of the green and the orange plots denote the percentage change in value added due to these policies, respectively, but implemented in isolation. For example, only increasing the mean of scrap value (μ_f^E) by 300 increases value added by 27.9%, and only reducing firing costs by 40% increases value added by about 10.7%. The height of the blue plot gives us the "extra" increase in value added if both the policies are implemented together; in the above example, the total value added would go up by about 50.5%, so an excess of 12 percentage points. Essentially, this occurs due to synergies between the two. Consider the effect of an increase in scrap value. This alone shifts up the expected ex-ante profits for any given mass of firms. This in turn increases the point at which expected profits are zero and so increases the mass of firms in the simulation. If labor firing costs fall, the same thing happens and by itself, this will increase the mass of firms as well. However, there will also be an interaction term. The presence of lower firing costs will shift the ex-ante profits from raising scrap value upwards and vice versa. Firms now realize that their response to each policy in isolation is too little: after all, reducing firing costs shifts up the profits from entering as a function of the mass of firms so even more firms would want to enter! This is what lies behind the synergy effects.

Also note that the larger the magnitude of the policies implemented, the greater the synergies. Similar patterns in the mass of firms, the price index, will be driven by the pattern in the mass of

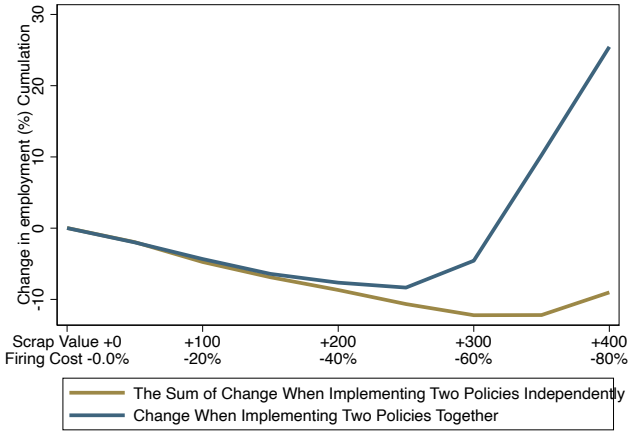
firms as cutoffs are invariant to the policies so that the mass of firms, the price index, and value added will follow each other exactly.



(a) Value Added



(b) Emp. Change of Two Independent Policies



(c) Emp. Change of Two Policies Jointly

Figure 10: Synergies in Policies

We have depicted the synergies between the two policies on value added. We now perform the same exercise for employment. As the effect of reducing firing costs of labor on employment, we depict the effect in two parts. In Figure 7(b) we depict the effect of raising scrap value in green and of reducing firing costs in orange. As the latter reduces employment, this curve lies below zero. In Figure 7(c) we depict the sum of the two policies, by the brown line. The gray curve gives the total effect when both policies are enacted simultaneously. Note that it lies above the brown one, i.e., there are synergies.[41] Also note that when firing costs are reduced by about 65% and the mean of the scrap value distribution is increased by about 320 million rupees (or about 8 million dollars

[41]The explanation of why these synergies exist is the same as that given previously.

using the exchange rate of 40 Rs. per dollar) total employment actually increases. It rises swiftly after that. This highlights the importance of combining the reforms. This is a consequence of there being multiple distortions at work in our setting.

8 Conclusion

Governments often focus on designing policies that lower entry costs to attract firms intending to boost productivity, employment, and development. In this paper, we show that focusing on exit is equally important. High exit costs can lock productive resources with low-productivity firms, dragging down overall productivity. In addition, since exit costs also act as entry barriers, they deter entry, further slowing down growth.

Exit costs are relevant for all economies, developed and developing. They are manifested primarily as bankruptcy costs in developed countries like the U.S. but in many additional ways in developing ones. Indian policymakers, in particular, have been concerned about exit barriers. The Government of India's annual Economic Survey in 2015-16 stated that *"India has made great strides in removing the barriers to the entry of firms, talent, and technology into the Indian economy. Less progress has been made in relation to exit. Thus, over the course of six decades, the Indian economy moved from 'socialism with limited entry to "marketism" without exit."*

Policymakers however have little to go on in terms of identifying the extent and variation across sectors and regions in the extent of exit barriers. Our research is designed to identify and quantify exactly this and aiding governments in formulating the right policies. However, this paper is only the first step in this regard.

Future work would include extending the model to a general equilibrium setting with multiple aggregate sectors (e.g. Hopenhayn 1992a) and including a spatial dimension (e.g. Caliendo and Parro 2015). The former would allow for feedback from greater employment in manufacturing to demand in all sectors and potentially magnify the impact of reducing adjustment costs. A spatial dimension would provide a better understanding of the location decisions of firms and labor as well as allow the study of spillovers across Indian states. Particular features that would be important in a full-blown quantitative exercise are allowing for internal transport costs (Redding and Rossi-Hansberg 2017), endogenizing the location choice of firms (Fajgelbaum et al. 2019; Head and Mayer 2014; Basile 2008), and migration decisions (Redding and Rossi-Hansberg 2017; Monte et al. 2018; Bryan et al. 2014; Desai and Chatterjee 2016; Keshri and Bhagat 2012; Rai 2018).

References

Adhvaryu, Achyuta, Amalavoyal V Chari, and Siddharth Sharma, "Firing costs and flexibility: evidence from firms' employment responses to shocks in India," *Review of Economics and Statistics*, 2013, *95* (3), 725–740.

Aghion, Philippe, Robin Burgess, Stephen J Redding, and Fabrizio Zilibotti, "The unequal effects of liberalization: Evidence from dismantling the License Raj in India," *American Economic Review*, 2008, *98* (4), 1397–1412.

Akcigit, Ufuk, Harun Alp, and Michael Peters, "Lack of selection and limits to delegation: firm dynamics in developing countries," *American Economic Review*, 2021, *111* (1), 231–275.

Amirapu, Amrit and Michael Gechter, "Labor regulations and the cost of corruption: Evidence from the Indian firm size distribution," *Review of Economics and Statistics*, 2020, *102* (1), 34–48.

Autor, David H, William R Kerr, and Adriana D Kugler, "Does employment protection reduce productivity? Evidence from US states," *The Economic Journal*, 2007, *117* (521), F189–F217.

Aw, Bee Yan, Mark J Roberts, and Daniel Yi Xu, "R&D investments, exporting, and the evolution of firm productivity," *American Economic Review*, 2008, *98* (2), 451–56.

Bartelsman, Eric, John Haltiwanger, and Stefano Scarpetta, "Measuring and analyzing cross-country differences in firm dynamics," in "Producer Dynamics: New Evidence from Micro Data," University of Chicago Press, 2009, pp. 15–76.

Basile, Roberto, "Regional economic growth in Europe: A semiparametric spatial dependence approach," *Papers in Regional Science*, 2008, *87* (4), 527–544.

Bento, Pedro and Diego Restuccia, "On average establishment size across sectors and countries," *Journal of Monetary Economics*, 2021, *117*, 220–242.

Bernstein, Shai, Emanuele Colonnelli, Xavier Giroud, and Benjamin Iverson, "Bankruptcy spillovers," *Journal of Financial Economics*, 2019, *133* (3), 608–633.

Bertrand, Marianne, Chang-Tai Hsieh, and Nick Tsivanidis, "Contract labor and firm growth in India," Technical Report, National Bureau of Economic Research 2021.

Besley, Timothy and Robin Burgess, "Can labor regulation hinder economic performance? Evidence from India," *The Quarterly Journal of Economics*, 2004, *119* (1), 91–134.

Bhattacharjea, Aditya, "Labour market regulation and industrial performance in India: A critical review of the empirical evidence," *Indian Journal of Labour Economics*, 2006, *49* (2), 211–232.

Bignon, Vincent and Jerome Sgard, "The two uses of bankruptcy law in 19th century France: dealing with the poor and restructuring capital," in "GEHN conference on Law and Economic Development, Utrecht" 2007.

Bryan, Gharad, Shyamal Chowdhury, and Ahmed Mushfiq Mobarak, "Underinvestment in a profitable technology: The case of seasonal migration in Bangladesh," *Econometrica*, 2014, *82* (5), 1671–1748.

Caliendo, Lorenzo and Fernando Parro, "Estimates of the Trade and Welfare Effects of NAFTA," *The Review of Economic Studies*, 2015, *82* (1), 1–44.

Chatterjee, Shoumitro and Arvind Subramanian, "India's inward (re) turn: Is it Warranted? Will it Work?," *Indian Economic Review*, 2023.

Chaurey, Ritam, "Labor regulations and contract labor use: Evidence from Indian firms," *Journal of Development Economics*, 2015, *114*, 224–232.

Chu, Tianshu, "Import substitution and export promotion: In search of a theory of economic development." PhD dissertation 2000.

Contractor, Lalit, "Contract labour and insurance within the establishment," 2022.

Cooper, Russell and John Haltiwanger, "On the nature of capital adjustment costs," *The Review of Economic Studies*, 2006, *73* (3), 611–633.

_ **and Jonathan Willis**, "The cost of labor adjustment: Inferences from the gap," *Review of Economic Dynamics*, 2009, *12* (4), 632–647.

Corbae, Dean and Pablo D'Erasmo, "Reorganization or liquidation: Bankruptcy choice and firm dynamics," *The Review of Economic Studies*, 2021, *88* (5), 2239–2274.

Crane, Leland D, Ryan A Decker, Aaron Flaaen, Adrian Hamins-Puertolas, and Christopher Kurz, "Business exit during the COVID-19 pandemic: Non-traditional measures in historical context," *Journal of Macroeconomics*, 2022, *72*, 103419.

Da-Rocha, José-María, Diego Restuccia, and Marina Mendes Tavares, "Firing costs, misallocation, and aggregate productivity," *Journal of Economic Dynamics and Control*, 2019, *98*, 60–81.

Das, Sanghamitra, Mark J Roberts, and James R Tybout, "Market entry costs, producer heterogeneity, and export dynamics," *Econometrica*, 2007, *75* (3), 837–873.

Desai, Sonalde and Esha Chatterjee, "Male migration from rural India: Divergent pathways to long-term and circular migration," *Population Association of America, Washington DC*, 2016.

Dunne, Timothy, Shawn D Klimek, Mark J Roberts, and Daniel Yi Xu, "Entry, exit, and the determinants of market structure," *The RAND Journal of Economics*, 2013, *44* (3), 462–487.

Fagereng, Andreas, Luigi Guiso, and Luigi Pistaferri, "Portfolio choices, firm shocks, and uninsurable wage risk," *The Review of Economic Studies*, 2018, *85* (1), 437–474.

Fajgelbaum, Pablo D, Eduardo Morales, Juan Carlos Suárez Serrato, and Owen Zidar, "State taxes and spatial misallocation," *The Review of Economic Studies*, 2019, *86* (1), 333–376.

Golombek, Rolf and Arvid Raknerud, "Exit dynamics of start-up firms: Structural estimation using indirect inference," *Journal of Econometrics*, 2018, *205* (1), 204–225.

Gourieroux, Christian, Alain Monfort, and Eric Renault, "Indirect Inference," *Journal of Applied Econometrics*, 1993, *8* (S1), S85–S118.

Guiso, Luigi, Luigi Pistaferri, and Fabiano Schivardi, "Insurance within the firm," *Journal of Political Economy*, 2005, *113* (5), 1054–1087.

Guner, Nezih, Gustavo Ventura, and Yi Xu, "Macroeconomic implications of size-dependent policies," *Review of Economic Dynamics*, 2008, *11* (4), 721–744.

Head, Keith and Thierry Mayer, "Gravity equations: Workhorse, toolkit, and cookbook," in "Handbook of International Economics," Vol. 4, Elsevier, 2014, pp. 131–195.

Hopenhayn, Hugo, "Entry, exit, and firm dynamics in long run equilibrium," *Econometrica: Journal of the Econometric Society*, 1992, pp. 1127–1150.

Hopenhayn, Hugo A., "Entry, Exit, and firm Dynamics in Long Run Equilibrium," *Econometrica*, 1992, *60* (5), 1127–1150.

Hopenhayn, Hugo and Richard Rogerson, "Job turnover and policy evaluation: A general equilibrium analysis," *Journal of Political Economy*, 1993, *101* (5), 915–938.

Hsieh, Chang-Tai and Peter J Klenow, "Misallocation and manufacturing TFP in China and India," *The Quarterly Journal of Economics*, 2009, *124* (4), 1403–1448.

_ and _ , "The life cycle of plants in India and Mexico," *The Quarterly Journal of Economics*, 2014, *129* (3), 1035–1084.

Kapur, Devesh, "Why does the Indian state both fail and succeed?," *Journal of Economic Perspectives*, 2020, *34* (1), 31–54.

Kaul, Bushan Tilak, "'INDUSTRY,"INDUSTRIAL DISPUTE,'AND'WORKMAN': CONCEPTUAL FRAMEWORK AND JUDICIAL ACTIVISM," *Journal of the Indian Law Institute*, 2008, *50* (1), 3–50.

Kaul, Vivek, *Bad money: Inside the NPA mess and how it threatens the Indian banking system*, Harper Collins, 2020.

Keshri, Kunal and Ram Bilash Bhagat, "Temporary and seasonal migration: Regional pattern, characteristics and associated factors," *Economic and Political Weekly*, 2012, pp. 81–88.

Kulkarni, Nirupama, "Resolving Zombie Lending with Collateral Reform," 2021.

Lapatinas, Athanasios, "Labour adjustment costs: Estimation of a dynamic discrete choice model using panel data for Greek manufacturing firms," *Labour Economics*, 2009, *16* (5), 521–533.

Li, Bo and Jacopo Ponticelli, "Going bankrupt in China," *Review of Finance*, 2022, *26* (3), 449–486.

Loecker, Jan De, Pinelopi K Goldberg, Amit K Khandelwal, and Nina Pavcnik, "Prices, markups, and trade reform," *Econometrica*, 2016, *84* (2), 445–510.

Lucas, Robert E., "On the Size Distribution of Business Firms," *The Bell Journal of Economics*, 1978, *9* (2), 508–523.

Martino, Paolo Di, "Approaching disaster: personal bankruptcy legislation in Italy and England, c. 1880–1939," *Business History*, 2005, *47* (1), 23–43.

Melitz, Marc J., "The impact of trade on intra-industry reallocations and aggregate industry productivity," *Econometrica*, 2003, *71* (6), 1695–1725.

Monte, Ferdinando, Stephen J Redding, and Esteban Rossi-Hansberg, "Commuting, migration, and local employment elasticities," *American Economic Review*, 2018, *108* (12), 3855–90.

Mukoyama, Toshihiko and Sophie Osotimehin, "Barriers to reallocation and economic growth: the effects of firing costs," *American Economic Journal: Macroeconomics*, 2019, *11* (4), 235–70.

Padmakumar, Kalyani, "Do Firms Always Bunch? Reassessing the impact of size based regulations on firms," Technical Report, Penn State University Working Paper 2022.

Poschke, Markus, "Employment protection, firm selection, and growth," *Journal of Monetary Economics*, 2009, *56* (8), 1074–1085.

Rai, Abhishek, "Temporary vs. Permanent Migration in A Spatial Economy: Evidence from India," Technical Report 2018.

Rao, Manaswini, "Judges, lenders, and the bottom line: Court-ing firm growth in India," Technical Report, Working Paper 2019.

_ , "Courts Redux: Micro-evidence from India," 2021.

Ravi, Aparna, "Indian insolvency regime in practice: An analysis of insolvency and debt recovery proceedings," *Economic and Political Weekly*, 2015, pp. 46–53.

Redding, Stephen J and Esteban Rossi-Hansberg, "Quantitative spatial economics," *Annual Review of Economics*, 2017, *9*, 21–58.

Roberts, Mark J and James R Tybout, "Industrial evolution in developing countries: Micro patterns of turnover, productivity, and market structure," 1996.

_ **and** _ , "The decision to export in Colombia: An empirical model of entry with sunk costs," *The American Economic Review*, 1997, pp. 545–564.

Rodrik, Dani, "Premature deindustrialization," *Journal of Economic Growth*, 2016, *21* (1), 1–33.

Ryan, Stephen P, "The costs of environmental regulation in a concentrated industry," *Econometrica*, 2012, *80* (3), 1019–1061.

Sarkar, Santanu, "How independent is India's labour law framework from the state's changing economic policies?," *The Economic and Labour Relations Review*, 2019, *30* (3), 422–440.

Sengupta, Rajeswari and Manish Singh, "Firm survival in India: Status of firms formed over the last 30 years," *Ideas for India*, 2019.

_ **, Anjali Sharma, Susan Thomas et al.**, "Evolution of the insolvency framework for non-financial firms in India," *Indira Gandhi Institute of Development Research, Mumbai, WP-2016-018, June, http://www. igidr. ac. in/pdf/publication/WP-2016-018. pdf*, 2016.

Sood, Aradhya, "Land Market Frictions in Developing Countries: Evidence from Manufacturing Firms in India," Technical Report, Mimeo. https://aradhyasood.github.io/Sood_Land_Frictions_India1. pdf 2020.

Sundar, KR Shyam, "Critiquing the Industrial Relations Code Bill, 2019," *and Democracy*, 2020, p. 45.

White, Michelle J, "Small business bankruptcy," *Annual Review of Financial Economics*, 2016, *8*, 317–336.

Appendix

A Institutional History

Firms take a long time to exit in India. Even if a firm is not embroiled in any litigation or dispute and all relevant paperwork is in place, its voluntary closure takes approximately 4.3 years. 2.8 years are spent alone on obtaining clearances and security refunds from various government departments like Income Tax, Provident Fund, Goods and Services Tax, etc. In contrast, voluntary liquidation takes about 12 months in Singapore, 12- 24 months in Germany, and 15 months in the United Kingdom (Economic Survey of India 2020-21). Since the efficiency of government departments vary by state, the time taken to obtain these clearances can also vary a lot by state.

In addition to the above, if a firm gets entangled in legal disputes then it substantially increases the time to exit (see Section 2.1 for an example). As worker retrenchment and firm liquidation are regulated by various federal and state laws, their history, intent, and interpretation by courts shape the frictions to exit. Moreover, both the laws and their interpretation by courts evolve over time, giving rise to uncertainty in judicial outcomes. We illustrate the challenges to exit first through a specific case study. Then we discuss the history and complexities in the implementation of the most important labor and bankruptcy laws in India.

A.1 The Exit of Nokia's Largest Factory: A Case Study

Nokia announced its plan to set up a plant in India on December 2004. At that point it sold about a million phones a month in India, all imported from China. Its goal was to increase this to six to seven million a month by reducing transaction and adjustment costs. Soon various state governments started to woo the company by offering them various incentive packages. In the end, Tamil Nadu won because of two reasons in addition to the tax holiday. First, the Chennai International Airport was only 33km away from the proposed special economic zone in Sriperumbudur. Second, the party in power (AIADMK) in the state was in coalition with the ruling party (Congress) at the center and the national Minister of Communications and IT belonged to AIADMK. Thus, the project had the blessing of both the central and state political rulers. Production started in 2006.

Between 2006–2012 this factory became the poster child of capitalism. This was Nokia's largest operation anywhere in the world. At its peak, the factory employed close to 20,000 employees and produced 15 million phones a month which were exported to 80 countries. About 70% of these employees were women.

Troubles started in 2013. Labor held strikes and lockouts demanding better working conditions and expecting a raise. The death on the job of a female assembly operator further fuelled discontent. The success of the factory attracted political attention as they saw the employees as a vote bank. A DMK-backed (the party in opposition to AIADMK) labor union gained ground around 2010.

There was tough competition in the international market as well. As the tax holiday came to an end, the incentives provided by Vietnam made it an even more attractive production destination.

Moreover, cellphone technology was rapidly changing toward smartphones. The nail in the coffin was perhaps two tax evasion cases against Nokia – one by state authorities and the other by central authorities. While the Madras High Court later set aside the demands by state authorities, Nokia's assets linked to this factory were frozen by the Supreme Court of India in October 2013 due to the latter tax case.

Meanwhile, given the churn in cellphone technology and the global market, Nokia sold its devices and services business to Microsoft for USD 7.2 billion in April 2014 but the Indian factory was excluded from the deal owing to the legal challenges it was embroiled in. Initially, Microsoft wanted to use the factory as a contract manufacturer for low-cost cell phones but soon decided against it and production came to a grinding halt.

At the factory, several contract workers not protected by labor laws were laid off. However, the permanent workers couldn't be. With the asset freeze in place, Nokia could not sell the factory either so was required to pay the workers as long as the tax dispute continued. Some permanent workers took voluntary retirement and severance payments by offered by the company. Nokia did this because once the tax dispute got resolved, in order to close the factory it would need approvals from the government and an agreement with the labor unions. Lawyers say that "7 or 8 out of 10 such cases are rejected" as "welfare statutes look out for the interest of employees". They advise that getting these permissions are easier if the employee headcount is low before the firm seeks government approval.

Nokia settled the tax dispute in 2018 by paying a penalty of 202 million euros, but even 4 years after production stopped it was uncertain whether it would be able to sell its factory owing to some other litigation that arose in the interim years. Finally, in 2020, after a gap of 6 years, the Chinese firm Salcomp bought and started manufacturing cell phone chargers with 1000 workers in the factory that was once the globally most productive cellphone factory.

This example illustrates three things. First, there is a great deal of political, judicial, and institutional complexity and uncertainty related to firm exit. Second, it illustrates the gargantuan delays in the administrative processes. Third, that this happened in the state of Tamil Nadu – a pro-employer state according to the Besley-Burgess measure – suggests that it might have been even worse in pro-labor states and that the letter of the law alone cannot be used as a measure of exit costs.

A.2 Labor Laws, Hiring, and Firing Labor

The Industrial Dispute Act (IDA) of 1947 is one of the many laws regulating labor in India and has been the subject of much research in economics. In this section, we provide some clarifications regarding the IDA and labor regulations. First, the IDA is not the only law regulating labor in India. The origin of labor laws goes back to the pre-Independence British Raj.

Many important laws that form the backbone of the labor law system today were formulated in the 1920s. These include the Factories Act of 1922, the Mines Act of 1922, the Workmen's Compensation Act of 1923, the Trade Union's Act of 1926, and the Trade Disputes Act of 1929.

Since labor is a topic under the concurrent list[42] of the constitution, both the central and state governments are competent authorities to enact legislation pertaining to labor. In the state of Maharashtra for example, 48 state and national laws regulate labor.[43] West Bengal has 31 acts,[44] and Telengana has 47. Over time the IDA itself has been differentially amended by various states creating variation in the legal environment across states and that variation has been used for research starting with the seminal work by Besley and Burgess (2004).

However, the letter of the law is an incomplete assessment of how it is actually implemented. For example, one of the most stringent provisions in the IDA is the requirement for firms to report to the government if they retrench workers and the need to obtain prior permission if firms are above a certain threshold (was 100 workers and is now 300 workers after the 2021 reforms). It is not straightforward to obtain such permission, and a lot is left to the discretion of the authorities making outcomes uncertain.

The second complication is related to judicial efficiency and outcomes. With only 1 court per 500,000 workers, courts are heavily backlogged and cases can take years to get resolved. The number of cases pending before Labour Courts as of October 2020 was over 100,000 - 35% of these cases had been pending for over a year and out of these 37% had been pending for more than 3 years.[45] Rao (2021) has shown that there is substantial variation across states in court efficiency. Hence, costs of adjustment could vary not only because of the law but also due to the speed of dispute resolution in courts. In principle, these may go in opposite directions.

The biggest hurdle, however, comes from the uncertainty that firms face while making decisions, should they get dragged into a labor court. The court's interpretation of the laws has evolved. Sarkar (2019) documents that while many specific statutes did not greatly change over time, the judiciary's interpretations of them changed over the last six decades based on the dominant socio-political currents and government economic policies. As India embraced free markets, so did her courts. Furthermore, even within a short span of time, courts often give contradictory judgments across cases that prima facie appear similar. Kaul (2008) provides extensive documentation. Here, we provide a few noteworthy examples.

Broadly when a labor retrenchment case goes to court it has to decide whether the aggrieved worker is entitled to protection of the IDA. For that, the court has to interpret what is an "industry" under the IDA. For example, are hospitals an industry and so are doctors and nurses protected from being fired? Second, the IDA protects "workmen" in an industry as opposed to managers. The

[42]The Indian constitution divides legislation topics into three lists–central, state, and concurrent. International Trade for example is in the central list and only the national parliament can enact laws related to international trade (e.g. decide tariff duties). Agriculture on the other hand is a state subject. Labor, internal trade, and commerce are concurrent subjects allowing both the national parliament and the state legislatures to enact laws on these matters.

[43]https://mahakamgar.maharashtra.gov.in/acts-rules.htm

[44]https://wblc.gov.in/acts-rules

[45]In response to a query about this situation, the Union Labour Minister gave three reasons: "(i) Absence of affected parties at the time of the hearing; (ii) Seeking of frequent adjournments by the parties to file documents; and (iii) Parties approaching the High Courts challenging orders of reference issued by the appropriate government as well as orders issued by the Tribunals on preliminary points;..." (Sundar, 2020; Teamlease Services Report (2006) Link

question is who is a workman? Are airline pilots and software engineers workmen? Are contract workers eligible for protection although the IDA does not directly protect them?

One of the earliest such cases was the Hospital Mazdoor Sabha[46] case in 1960 that involved payment of retrenchment compensation to ward servants in JJ Hospitals, Mumbai. Initially, the Bombay high court dismissed the petition of the workers. Later when the case went to the Supreme Court, the management again pleaded that the Hospital was not involved in any trade or business. and hence, they are not an industry. The court framed a working principle that any systematic activity for the production or distribution of goods or services done with the help of employees in the manner of a trade or business is an industry. The services in the hospital were held to be material services and hence it ruled that hospitals are "industry" under the IDA. However, the court went to contradict itself seven years later in a 1967 case involving Safdurjung Hospital[47]. Since "Safdurjung Hospital is not embarked on an economic activity which can be said to be analogous to trade or business. There is no evidence that it is more than a place where persons get treated. ...It cannot, therefore, be said to be an industry..." Similarly, in a 1963 case[48] involving the University of Delhi in 1963 the court had ruled that educational institutions do not fall under the definition of industry. Over the years however, the court has changed its view and expanded the definition to cover "any economic activity ... for production and/or distribution of goods and services calculated to satisfy human wants" even in the "absence of profit". Thus, philanthropies, educational institutions, government departments, public utilities, and hospitals were no longer necessarily excluded from being an "industry".

One of the other contentious points has been determining who is a "workman". The act defines a workman to be "any person employed in any industry, to do any skilled or unskilled manual or clerical work, for hire or reward" excluding supervisors, managers, and certain professions like the military and police. Since contract workers do not have direct contracts with the "firm" but are hired via a third-party contractor, it is assumed that they are not covered under the IDA. However, courts have differed in their judgments.

One of the earliest cases that dealt with this question was Shivnandan Sharma v. Punjab National Bank Ltd.[49] The Punjab National Bank shut down a particular branch office in November 1951. The bank had outsourced the management of the cash department to external treasurers. Mr. Shivnandan Sharma, the head cashier appointed and paid by the treasurers appealed to the court citing wrongful termination. In this case, the Supreme Court held that the treasurers and therefore their nominees are servants of the bank and therefore entitled to protection under the IDA.

The large country-made cigarette (beedi) industry in India employs a large army of non-regular workers who roll the cigarettes. Courts have differed in their judgment across cases within this industry as to whether these workers are "workmen" of the firm depending on the facts of each case.

[46]AIR 1960 SC 610
[47](1970) 1 SCC 735. Safdurjung Hospital v. Kuldeep Singh
[48]AIR 1963 SC 1873. University of Delhi v. Ram Nath.
[49]AIR 1955 SC 404

In Birdhichand Sharma v. First Civil Judge, Nagpur[50], the court ruled that although the workers were paid on a per-piece basis because the workers did not have the freedom to work from home, their attendance was taken at the factory, they wouldn't be allowed to work if they came late and their products could be rejected if it did not meet standards, they were "workmen". In another case, Shankar Balaji Waje v. State of Maharashtra[51] merely since the worker was not bound to attend the factory for rolling cigarettes and had the freedom to come and go as he liked it was deemed that he is not a "workman". However, this judgment was passed by a majority vote of 2-1. The dissenting judge was of the view that since the management rejected products that were below a certain standard that established an employer-workman relationship. This was used later while adjudicating the Mohideen Sahib & Sons v. Industrial Tribunal, Madras[52] case, where the workers had been hired via a third-party contractor. It was held that the system of rejecting defective cigarettes established a supervisory role of the firm over the workers and thus the contractors were deemed to be mere managers of the firm. Hence, the court ruled the workers to workmen of the cigarette company under the IDA.

The disagreements between various Supreme Court justices have been far too frequent. In three cases in the late 1960s[53] the Supreme Court excluded workers not doing manual, clerical, supervisory or technical work from being "workmen". As against this, in a set of cases[54] in the early 1980s the court held that the workers whose job profile does not fall into one of the four categories cannot be necessarily excluded. From interviews we conducted with HR managers in leading tech firms and oil companies in India, the consensus that emerges is that it is hard to predict the outcome of labor disputes once they enter courts. Big companies usually try to offer high severance packages in order to disincentivize workers from going to court. However, financially distressed firms are in no position to do that. In summary, we conclude that the legal flexibility of hiring and firing labor in India is quite uncertain and hard to infer just from the letter of the law. Given common-law practices, the laws are open to interpretation by courts. The interpretation varies greatly over time, across states, and across industries and depends as much on the current polity and mood of the society. Along with the content, we suggest that the uncertainty surrounding the interpretation of the laws contributes to shaping exit costs.

A.3 Bankruptcy Laws

Unsurprising like labor laws, bankruptcy laws were also derived from English laws. In India, the necessity for an insolvency law was first felt in the three Presidency towns of Calcutta, Bombay, and

[50]AIR 1961 SC 644

[51]AIR 1962 SC 517

[52]AIR 1966 SC 370

[53]May & Baker (India) Ltd. v. Workmen. AIR 1967 SC 678; Western India Match Co. Ltd. v. Workmen (1964) 3 SCR 560; and Burmah Shell Oil Storage & Distribution Co. of India v. Burmah Shell Management Staff Association (1970) 3 SCC 378

[54]S.K. Verma v. Mahesh Chandra, (1983) 4 SCC 214; Ved Prakash Gupta v. Delton Cable India (P) Ltd. (1984) 2 SCC 569; and Arkal Govin Raj Rao v. Ciba Geigy India Ltd. (1985) 3 SCC 371

Madras where the British carried on their trade. The earliest rudiments of insolvency legislation can be traced to Sections 23 and 24 of the Government of India Act, 1800 (39 and 40 Geo. III c. 79), which conferred insolvency jurisdiction on the Supreme Court at Fort William and Madras and the Recorder's Court at Bombay. The enactment of Statute 9 (Geo. IV c. 73) in 1828 is understood to be the beginning of the special insolvency legislation in India. The British later enacted the Presidency Towns Insolvency Act of 1909 to deal with insolvency in the Presidency towns and the Provincial Insolvency Act of 1920 for other places. Bankruptcy proceedings for individuals even today are regulated under these two acts.

Historically though the enforcement of creditor rights in India has been met with significant judicial delay. Partly this has been because insolvency procedures have been complex and fragmented across multiple legislations like the Companies Act, 1956 and the Sick Industrial Companies (Special Provisions) Act of 1985. Since the early 90s, governments have attempted various reforms with limited success. In 1993, for example, Debt Recovery Tribunals (DRTs) were set up. These were quasi-judicial institutions that streamlined the legal process and allowed speedy adjudication and swift execution of judgments (Visaria 2009). However, overtime shortage of infrastructure and recovery personnel ended up clogging these tribunals. Legal loopholes also allowed firms to file cases using alternate routes to stall the banks from recovering their debts.

A major reform came in 2002 when the Indian government enacted the Securitization and Reconstruction of Financial Assets and Enforcement of Security Interests Act (SARFAESI). This permitted secured creditors to take possession of secured assets within 60 days of notice on a non-performing asset loan, allowing them to circumvent the lengthy judicial process. SARFAESI was a huge success initially (Kulkarni, 2021). However, over time as courts have interpreted and reinterpreted the Act, its power has gotten diluted. For example, now the law permits the borrowers a right to appeal – a measure that dilutes loan recovery. There has been a lack of clarity regarding the boundaries of jurisdiction. Once a bank starts recovery proceedings under the SARFAESI Act, high courts cannot intervene. However, High Courts often stay recovery proceedings, requiring intervention by the Supreme Court delaying the process.[55]

Another issue with SARFAESI is that there are no clear guidelines on the order in which debts have to be paid when a firm defaults. There were separate laws that defined the rights of secured creditors, unsecured creditors, and operational creditors in the event of default by the firm, and these involved proceedings in multiple fora. With one forum deciding on the rights of one category of creditors and another deciding on the rights of a competing party, decisions are usually appealed against in the higher courts and they would get stuck there.

An excerpt from Ravi (2015) highlights the extent of the problem:

"*The case of BHEL v. Arunachalam Sugar Mills ("ASM") that was decided by the Madras High Court in 2011 provides a good illustration of this. ASM and its sister concern defaulted on their credit facilities which gave rise to numerous proceedings by secured and unsecured creditors alike. A*

[55]Singh, S."SC asks HCs not to interfere with debt recovery proceeding", The Economic Times, Aug 3, 2010. [Link].

bank, the main secured creditor, filed an application in the Debt Recovery Tribunal for debt recovery. Another creditor filed a petition under the Companies Act, 1956 for the winding up of ASM..... A company that had leased machinery to ASM, initiated proceedings invoking the arbitration clause in the agreement and filed an application in the High Court restraining ASM from transferring/ selling its assets. A secured creditor of ASM's sister concern initiated proceedings under SARFAESI Act, took possession of its assets, and sold the same by auction. An unsecured creditor, which had supplied a boiler to ASM, filed a civil suit against ASM for recovery of money due to it by the sale of immovable properties of ASM.....While this might be at the extreme end of the spectrum in terms of the number of parallel proceedings, almost all of the cases reviewed involved proceedings in at least two fora and more often than not proceedings going on in parallel."

Courts also do not have the expertise to distinguish between viable and non-viable firms. They usually follow a pro-debtor stance and they are reluctant to order the liquidation of non-viable businesses (Ravi, 2015; BLRC Report, 2015[56]). Thus, even with SARFESI large cases took an average of 6 years to resolve (Sengupta et al., 2016), and recovery rates averaged 26% – among the lowest in the world (Patel 2020). As a result, resources get trapped in inefficient firms which could adversely affect manufacturing TFP.

In 2016, by enacting the Insolvency and Bankruptcy Code (IBC) the government tried to streamline things further. Most importantly, the act changed the judicial stance from "debtor in possession" to "creditor in possession" of assets as soon as the creditor initiates insolvency proceedings. The IBC tried to replace many overlapping provisions in various previous laws and most importantly extended beyond secured creditors to unsecured creditors and non-banking financial companies. Under this law, once a case is admitted to the National Company Law Tribunal (NCLT), a resolution professional and trustee is appointed who takes possession of assets. Resolution plans are solicited from prospective buyers which the creditor's committee can select from by a super-majority vote. If no plan is selected, liquidation procedures commence.

However, even the IBC has very limited success due to several judicial bottlenecks and court congestion[57]. Despite these issues, there is little work on the extent of exit barriers and how these vary across states, and the effect they seem to have on firms, firm dynamics, and productivity in India.

[56]See the [Link]

[57]For a vivid account read India is No Country for Dying Firms by Andy Mukherjee in The Washington Post (Aug 23, 2021) [Link] and Three years later, India's bankruptcy reform languishes in courts in the Reuters (Jan 27, 2019) [Link]

B More Data Facts

B.1 Classification of states into High- and Low-performance

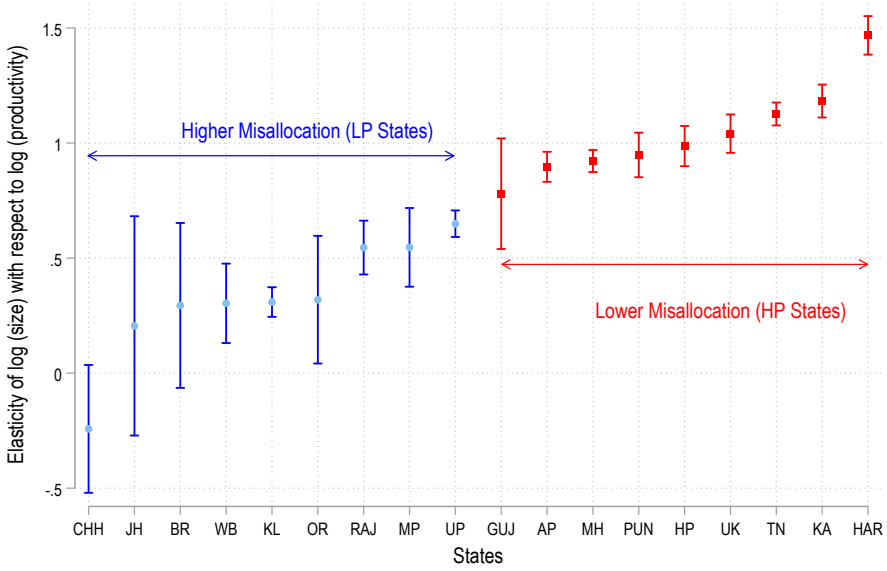


Figure B.1: Elasticity of size with respect to productivity

B.2 Persistence of Entry Shares Over Time

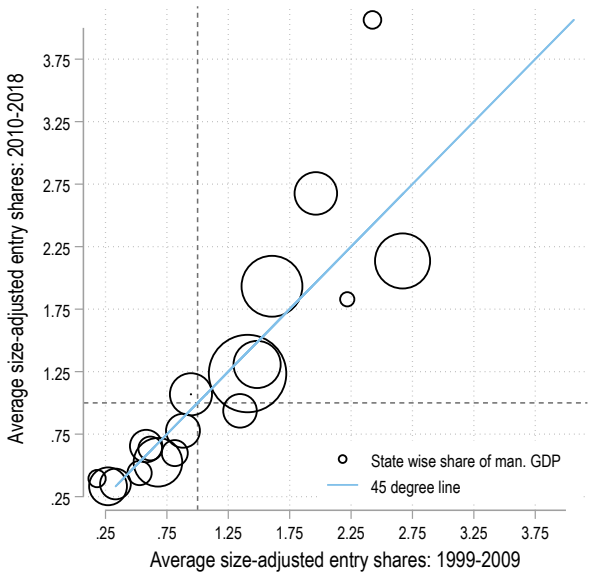


Figure B.2: Persistence of size-adjusted entry shares over time

Notes: Size-adjusted entry share of state s at time t: entry share of state s at time t normalized by its population share. The above figure plots the relationship between size-adjusted entry shares averaged from 1999-2009 and size-adjusted entry shares averaged from 2010-2018. Each circle represents a state; size of the circle is determined by state-wise share of overall manufacturing GDP.

B.3 Entry Shares versus Exit Shares

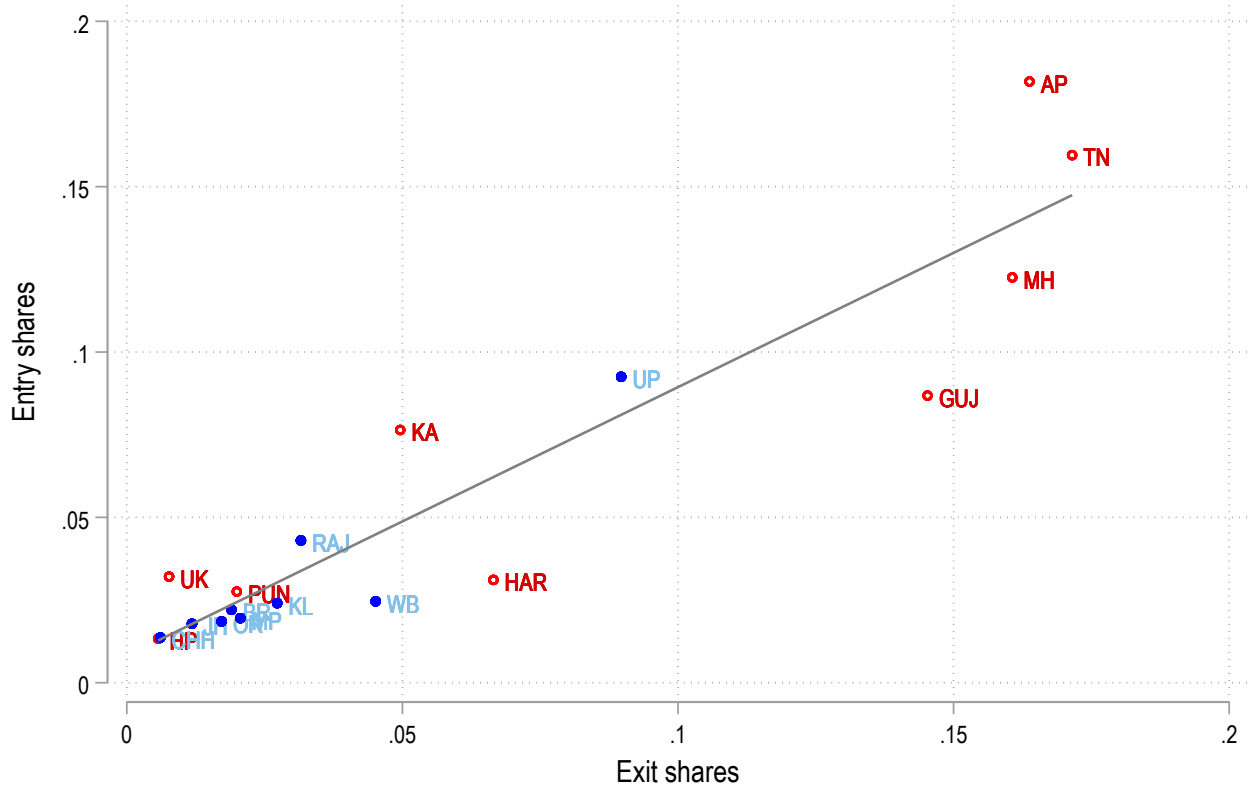


Figure B.3: State-wise entry versus exit shares

Notes: This figure plots the relationship between un-adjusted entry and exit shares across states. The correlation between the two is 0.93.

B.4 Entry Shares versus Labor Unrest

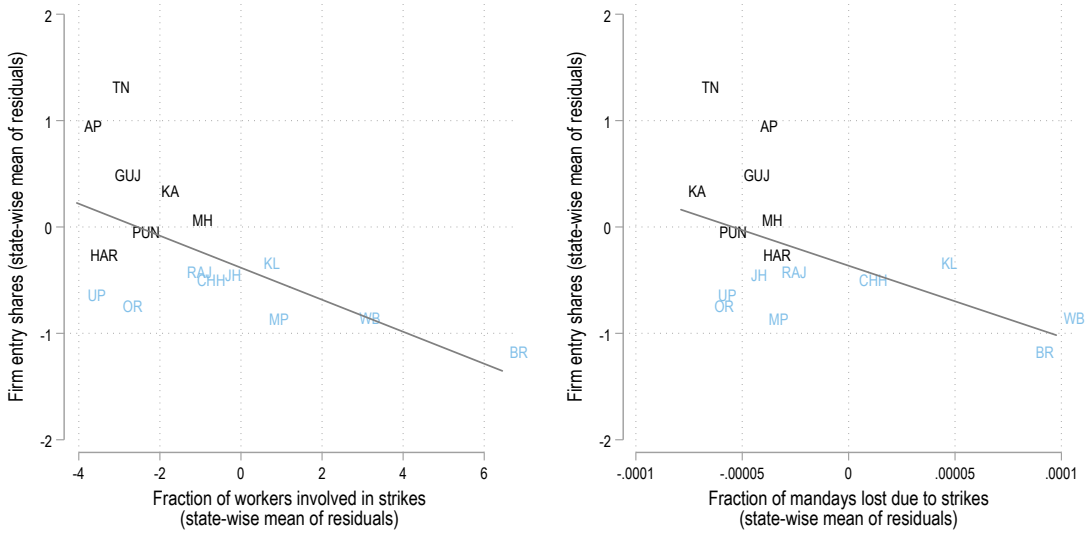
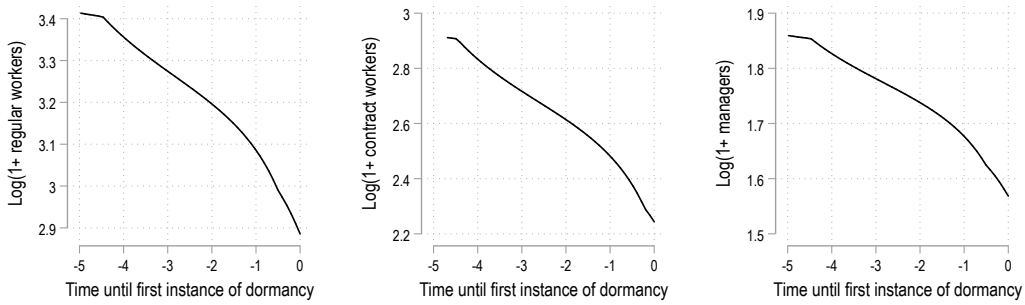


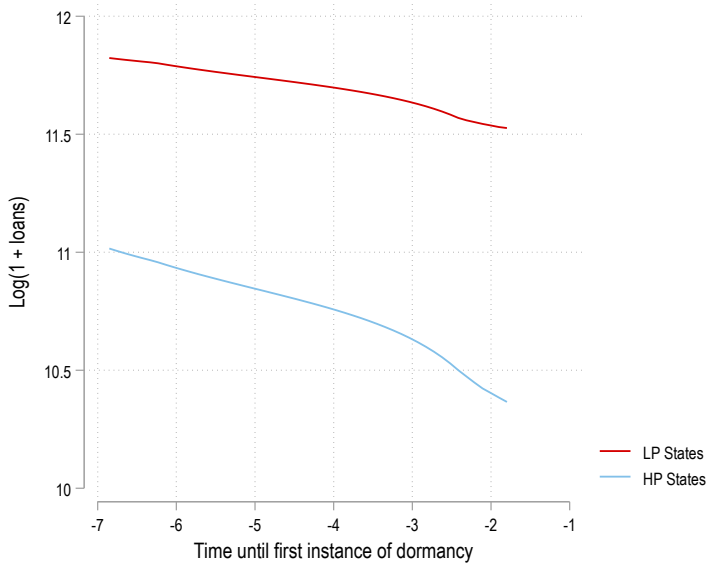
Figure B.4: Entry Shares vs Labor Unrest

Notes: Each observation is at the state-year level. We use 'fraction of workers involved in strikes' and 'fraction of man-days lost due to strikes' as our measures of labor unrest. The above figures plot the OLS relationship between size-adjusted entry shares and size-adjusted measures of labor unrest after controlling for: (1) year fixed-effects that account for aggregate shocks, (2) share of regular workers since only regular workers have the right to strike, and (3) share of man-days contributed by regular workers. The figures show that a 1 standard deviation (s.d.) higher fraction of workers participating in strikes across states or a 1 s.d. higher fraction of man-days lost due to strikes is associated with 0.62 s.d. and 0.53 s.d. lower entry shares respectively. The figures also clearly show that good states as a group have lower labor unrest and higher entry and the opposite is true for low-performance states. Data on fraction of workers involved in strikes and man-days lost due to strikes is from the CMIE 'States of India' database.

B.5 Transition to Dormancy



(a) Regular (left panel), contract (middle panel), and managerial (right panel) employment



(b) Plant loans

Figure B.5: Plant employment and loans as they transition to dormancy

Notes: To plot these figures, we first residualize the y-variable and x-variable of plant fixed effects. Second, we re-scale the residuals by adding back the unconditional sample means of the respective variables. Third, we divide observations into 20 equally sized bins based on their x values and calculate the mean of y and x values within each bin. The solid lines above are a polynomial fit of the resulting mean values.

B.6 Labor Adjustment to Negative Shocks

As per fact 6, low-performance states fire fewer regular workers than high-performance states after a negative GVA shock. This could be because: (1) low-performance states have larger firing costs than high-performance states, or (2) negative shocks faced by firms in low-performance states were not as low-performance as those faced by firms in high-performance states. To rule out possibility (2), we do the following. As before, we compute residuals (r_{ijst}) after regressing the inverse sine transformation of GVA on plant FEs, industry-year FEs and state-year FEs. We then divide r_{ijst} into the following bins:

- $Bin_{ijst} = 1$ for $r_{ijst} <$ p10.
- $Bin_{ijst} = 2$ for $r_{ijst} \in$ [p10,p25).
- $Bin_{ijst} = 3$ for $r_{ijst} \in$ [p25,p50). Note $r_{ijst} = 0$ falls in this bin.
- $Bin_{ijst} = 4$ for $r_{ijst} \in$ [p50,p90).
- $Bin_{ijst} = 5$ for $r_{ijst} \geq$ p90.

We then estimate the below specification with $Bin_{i_{jst-1}} = 3$ as the base category. Results are in table B.1.

$$Y_{ijst} = \alpha_i + \alpha_{jt} + \alpha_{st} + \gamma' \mathbf{X_{ijst}} + \beta_1 Bin_{i_{jst-1}} + \beta_2 Bin_{i_{jst-1}} \times \mathbb{1}\{LP_s\} + \epsilon_{ijst}$$

Table B.1: Labor adjustment to GVA Shocks with finer bins

	(1) log(1+regular)	(2) log(1+contract)	(3) log(1+managers)
$Bin_{i_{jst-1}} = 1$	-0.051***	0.000	-0.039**
	(0.014)	(0.033)	(0.013)
$Bin_{i_{jst-1}} = 2$	-0.059***	-0.102***	-0.053***
	(0.005)	(0.014)	(0.005)
$Bin_{i_{jst-1}} = 4$	0.026***	0.031**	0.037***
	(0.005)	(0.012)	(0.005)
$Bin_{i_{jst-1}} = 5$	0.076***	0.180***	0.046**
	(0.019)	(0.039)	(0.016)
$Bin_{i_{jst-1}} = 1 \times 1\{LP_s\}$	0.034	0.011	0.028
	(0.022)	(0.053)	(0.020)
$Bin_{i_{jst-1}} = 2 \times 1\{LP_s\}$	0.021*	-0.009	0.005
	(0.009)	(0.025)	(0.009)
$Bin_{i_{jst-1}} = 4 \times 1\{LP_s\}$	-0.002	0.011	-0.012
	(0.008)	(0.021)	(0.008)
$Bin_{i_{jst-1}} = 5 \times 1\{LP_s\}$	-0.051	-0.071	0.036
	(0.028)	(0.063)	(0.024)
N	180961	102874	180082

Robust standard errors clustered at the plant level in parentheses.

All regressions contain plant, industry-year, state-year, and size-year fixed effects.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

B.7 Using inflation to incentivize attrition

Table B.2: Nominal wage per worker of regular workers: high-inflation versus low-inflation years

	(1) log(wage per regular worker)	(2) log(wage per regular worker)	(3) log(wage per regular worker)
Linear time trend	-0.0111*	-0.0181***	-0.0238***
	(0.00500)	(0.00511)	(0.00506)
Quadratic time trend	0.00427***	0.00495***	0.00530***
	(0.000274)	(0.000273)	(0.000274)
1{High_inflation} = 1	-0.00693	0.00989	0.0212
	(0.0112)	(0.0113)	(0.0147)
t=-1		-0.108***	-0.134***
		(0.0256)	(0.0302)
t=-2,-3		0.00677	0.0192
		(0.0189)	(0.0220)
t=-4,-5,-6		0.00759	0.0200
		(0.0133)	(0.0165)
High_inflation*t=-1			0.0727
			(0.0439)
High_inflation*t=-2,-3			-0.0370
			(0.0259)
High_inflation*t=-4,-5,-6			-0.0294
			(0.0189)
Constant	10.03***	10.07***	10.09***
	(0.0650)	(0.0633)	(0.0629)
N	17682	17682	17682
Plant FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table B.3: Nominal wage per worker of contract workers: high-inflation versus low-inflation years

	(1)	(2)	(3)
	log(wage per contract worker)	log(wage per contract worker)	log(wage per contract worker)
Linear time trend	0.00120	-0.00389	-0.00213
	(0.0129)	(0.0153)	(0.0152)
Quadratic time trend	0.00390***	0.00483***	0.00494***
	(0.000604)	(0.000637)	(0.000649)
1{High_inflation} = 1	-0.0527*	-0.0412	-0.0713*
	(0.0253)	(0.0267)	(0.0313)
t=-1		-0.244**	-0.296***
		(0.0756)	(0.0885)
t=-2,-3		-0.0454	-0.0915
		(0.0542)	(0.0601)
t=-4,-5,-6		-0.00685	-0.00731
		(0.0344)	(0.0420)
$\text{High}_i nflation * t = -1$			0.0692
			(0.129)
$\text{High}_i nflation * t = -2, -3$			0.0936
			(0.0633)
$\text{High}_i nflation * t = -4, -5, -6$			-0.0290
			(0.0422)
Constant	9.954***	10.01***	10.01***
	(0.171)	(0.171)	(0.174)
N	5453	5453	5453
Plant FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

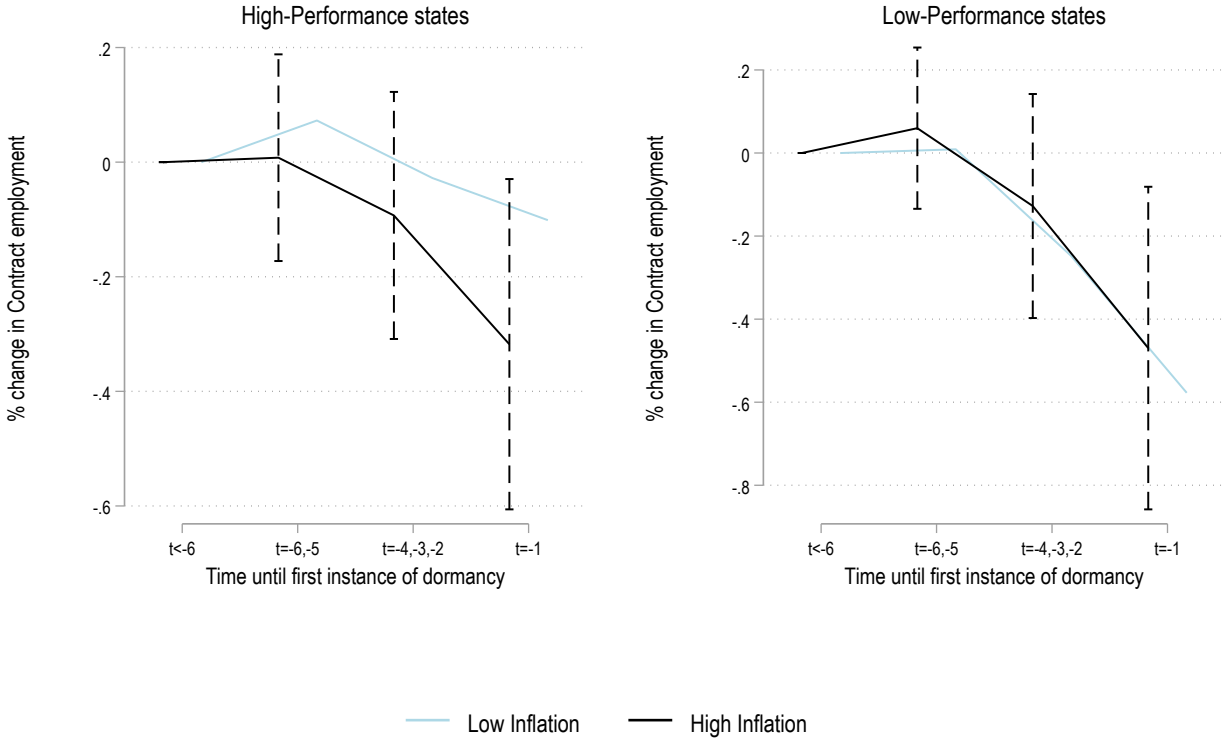


Figure B.6: Adjustment of Contract Workers and Inflation: High- vs Low-performance States

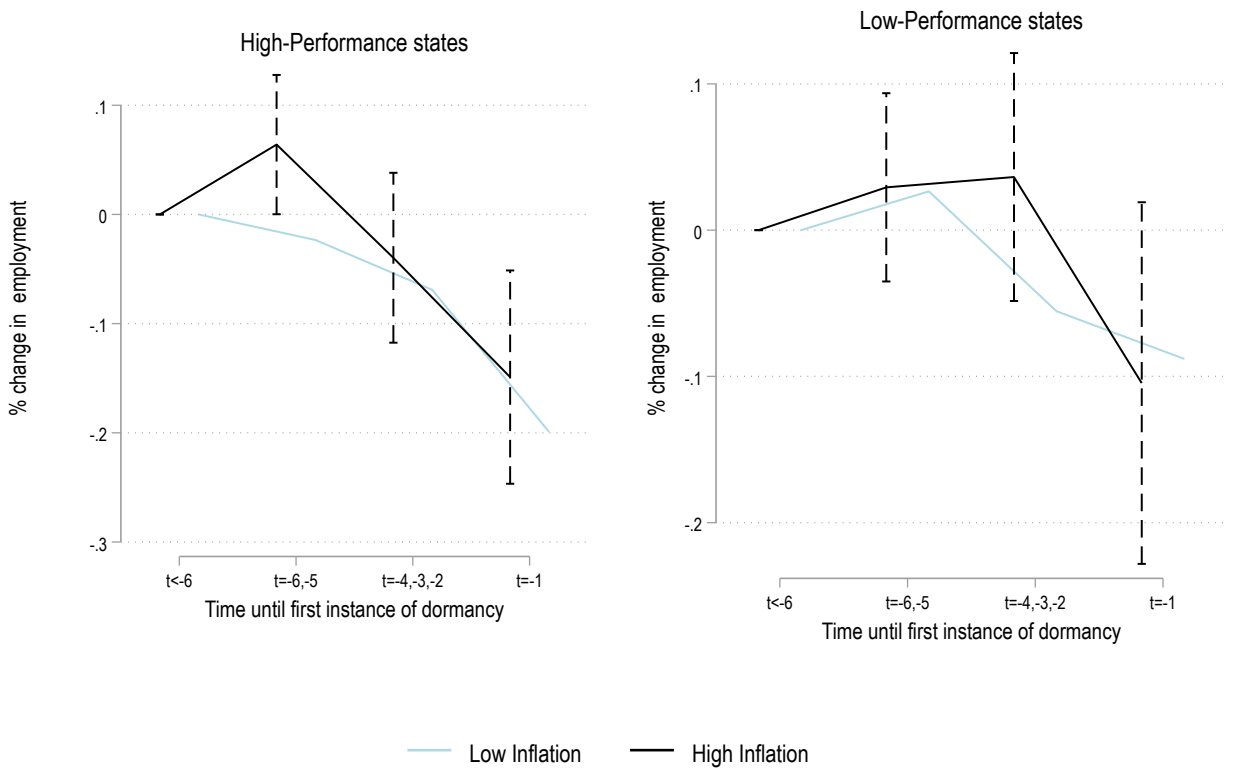


Figure B.7: Adjustment of Managers and Inflation: High- vs Low-Performance States

C Estimation

D Additional Figures

E More Counterfactual Results

E.1 Counterfactual Results of Four Cases Separately

Figure E.9 and Figure E.10 presents the counterfactual of policies changing exit and labor adjustment costs in four cases (Labor-intensive in High-performance states, Labor-intensive in Low-performance states, Capital-intensive in high-performance states and Capital-intensive in Low-performance states) separately.

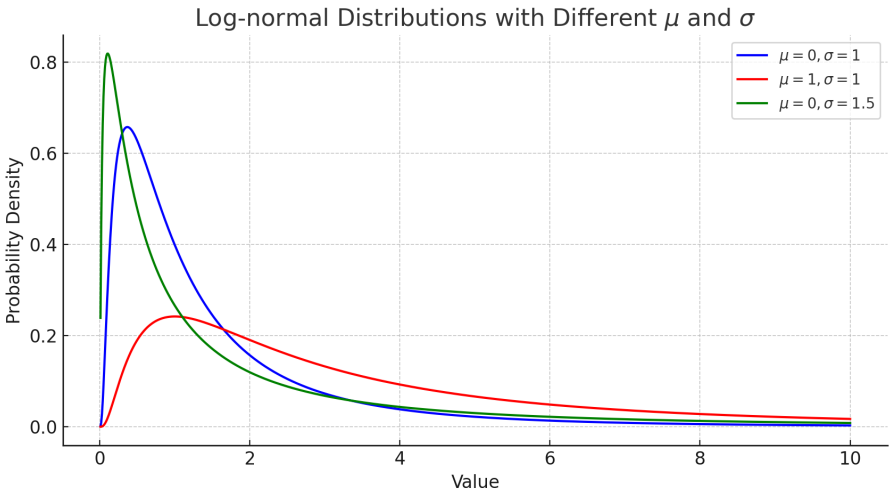
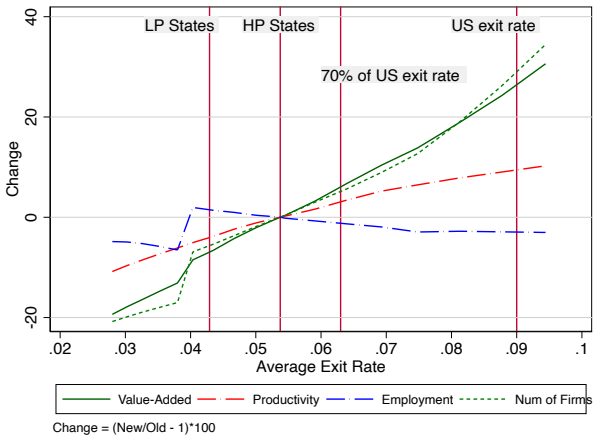
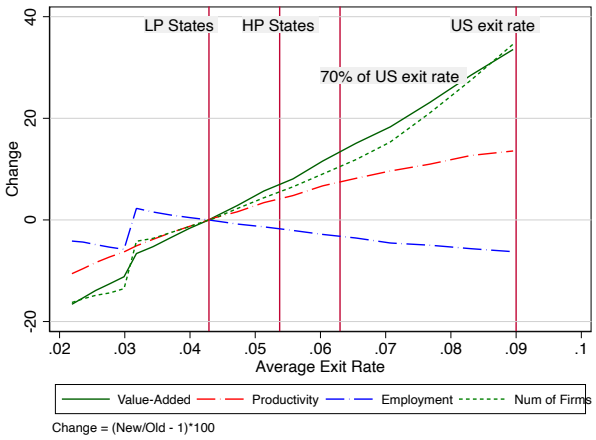


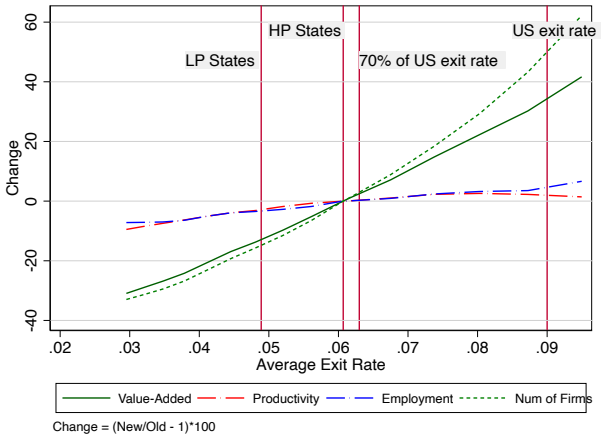
Figure D.8: Log-normal distributions with different values of μ and σ.



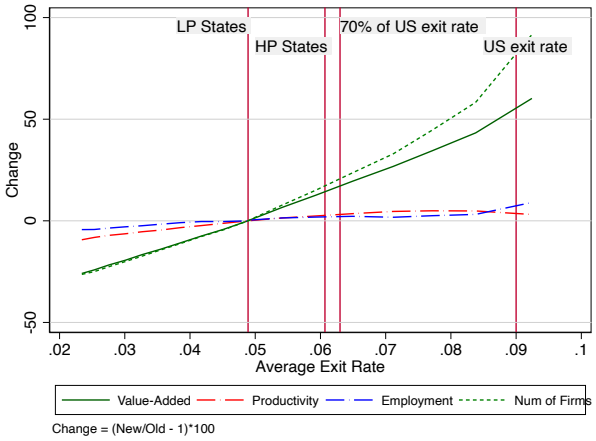
(a) LI sector in HP states



(b) LI sector in LP states



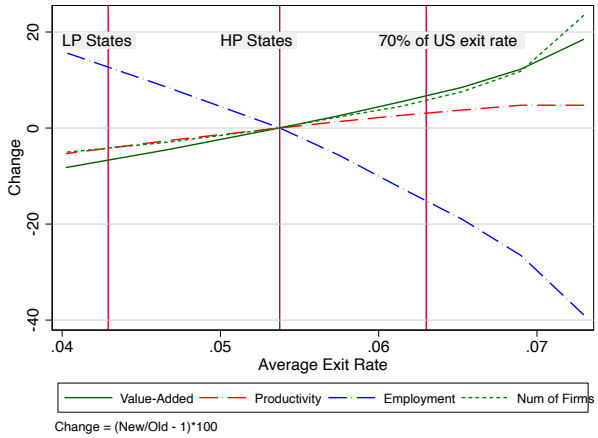
(c) CI sector in HP states



(d) CI sector in LP states

Figure E.9: Counterfactual of Changing Exit Costs in Four Cases Separately

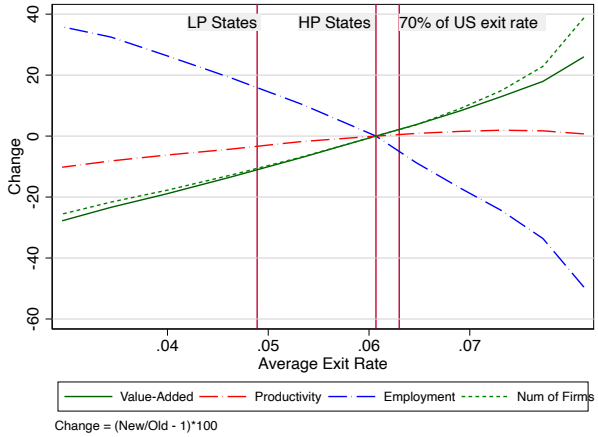
Notes: LP: Low-performance States, HP: High-performance states, LI: Labor-Intensive Industries, CI: Capital-Intensive Industries.



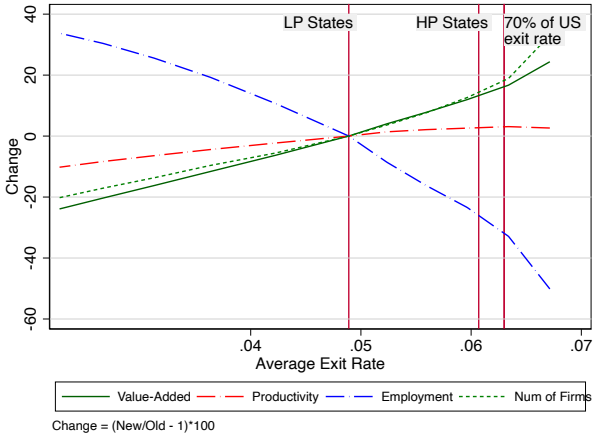
(a) LI sector in HP states



(b) LI sector in LP states



(c) CI sector in HP states



(d) CI sector in LP states

Figure E.10: Counterfactual of Changing Labor Adjustment Costs in Four Cases Separately

Notes: LP: Low-performance States, HP: High-performance states, LI: Labor-Intensive Industries, CI: Capital-Intensive Industries.

E.2 Synergies in Labor Adjustment and Exit Costs

In the paper, we presented the change in value added when the government lower the exit cost or labor adjustment cost, simultaneously or separately. In the following table, we present the policy impact on other variables, i.e., Employment of workers, mass of firms, price index and welfare.

Table E.4: Synergies in Labor Adjustment and Exit Costs

Scrap Value	Firing Cost	Only Scrap Value	Only Firing Cost	Both
(million ruppee)		Changes in Value-added (%)		
+200	−60%	16.6	6.9%	25.5
+300	−40%	27.9	10.7	50.5
+400	−20%	49.1	15.4	126.7
		Changes in Emp. of Workers (%)		
+200	−60%	3.9	-12.6	-7.6
+300	−40%	6.5	-18.7	-4.6
+400	−20%	17.1	-26.1	25.5
		Changes in Mass of Firm (%)		
+200	−60%	16.80	6.18	25.73
+300	−40%	28.81	10.26	57.01
+400	−20%	54.96	15.78	166.38
(million ruppee)		Changes in Price Index (%)		
+200	−60%	-5.2	-2.3	-7.5
+300	−40%	-8.2	-3.4	-13.1
+400	−20%	-12.8	-4.8	-23.5
		Changes in Welfare (%)		
+200	−60%	4.10	1.71%	6.24
+300	−40%	6.83	2.65%	12.14
+400	−20%	11.81	3.80%	29.16