

No Country for Dying Firms:

Evidence from India

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Motivation: India's under-performance in Manufacturing

- India's under-performance in Manufacturing is well-known
- Especially: Low-skill, labor intensive sectors
- **This paper studies a new channel: Barriers to firm exit**
 - Exit barriers drag down entry and output
 - Selection in entry stricter
 - Unproductive firms “stuck” \implies resource misallocation
 - Result: Low average productivity
- **How?**
 - Use ASI (detailed plant-level panel data) from 1999-2018
 - Provide evidence on exit barriers and their importance
 - Quantify the magnitude of exit costs in India
 - Role in the under-development of Indian manufacturing
- **Why India?**
 - Institutional factors that create exit barriers
 - Spatial & temporal variation: Institutions vary by state and over time
 - Very low firm exit rates relative to other countries

Cross-country annual firm exit rates

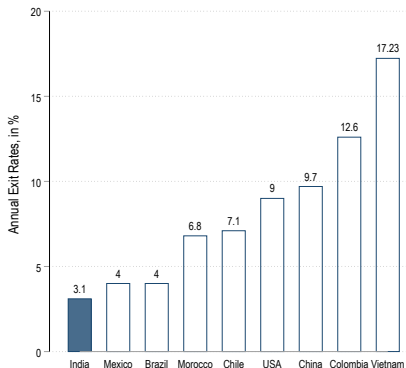


Figure 1: Cross-country annual firm exit rates

Outline of the Talk

1. Institutional Background: Labor laws, Bankruptcy

2. Data patterns and reduced-form Evidence [▶ Details](#)

3. Quantitative Model

- Framework [▶ Details](#)
- Estimation Procedure
- Counterfactual Exercises

Institutional Background

Increases in Exit costs

- Firms in India take a long time to exit.
 - Voluntary closure of a firm: ~ 4.3 years (official estimate)
- Factors that make exit difficult:
 - Govt authorization needed by large plants to fire workers [▶ Details](#)
 - Red-tape, paperwork, clearance from several govt. depts.
 - Delays in resolution of legal disputes (labor, bankruptcy, tax)
[▶ Nokia Case Study](#)
 - Harder for distressed firms: cannot “buy off” workers
 - Uncertainties due to inconsistencies in court judgements: [▶ Details](#)
 - Inconsistencies occur: across states & over-time
 - Prima facie similar cases reach very different outcomes
 - Lack of clarity in the law:
 - Which workers and sectors are protected?
 - Which court should deal with what type of case?
 - Until recently, lack of a clear pathway to bankruptcy [▶ Details](#)
 - After reforms: many disagreements b/w high-courts & the supreme court

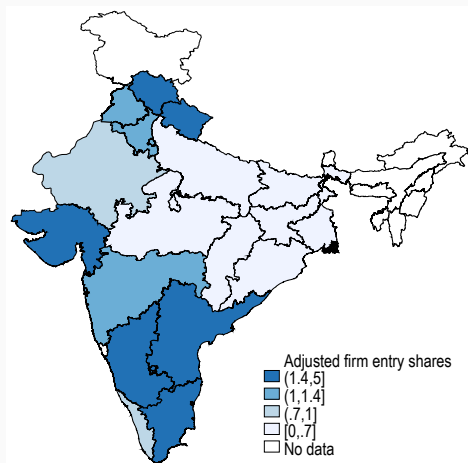
Data

Sources

- Annual Survey of Industries data (1999-2018).
 - Unit of observation: plant.
 - Sampling frame: all registered manufacturing plants in India. [▶ Details](#)
 - Information: plant identifiers, location, industry, employment, capital, sales, status of operation. [▶ Variables](#)
 - Sampling strategy: [▶ Details](#)
 - Plants with 100+ total employees surveyed every year.
 - 20% of remaining units from each (state, industry) surveyed every year.
 - Sampling weights: information on sampling probability of each unit.

Data Patterns

Size-adjusted entry shares, 1999-2018

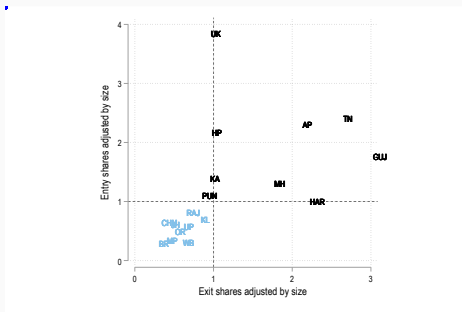


- Size-adjusted entry share of state s , time t : $\frac{\text{Entry share of state } s, \text{ time } t}{\text{Population share of state } s, \text{ time } t}$.
- **Good states:** size-adjusted entry share > 1 ; **Bad states:** adjusted entry share ≤ 1 .
- Entry shares highly persistent over time. [▶ Figure](#)

Data Patterns

Size-adjusted entry v/s exit shares

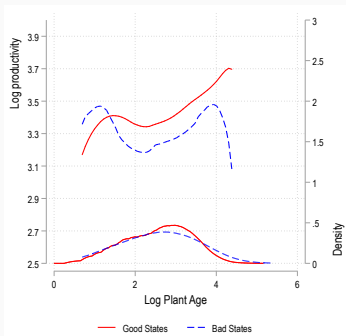
- Cannot observe plant exit directly in the data
- Estimate exit by following a cohort of plants over time (Hsieh & Klenow 2014)
- A reduction in the mass of a particular cohort b/w t and $t + \Delta \implies$ Exit
- Size-adjusted exit share of state s : $\frac{\text{Exit share of state } s}{\text{Population share of state } s}$
- Exit share of state $s = \sum_c w_c(\text{Exit}_{cs})$
- w_c : share of plants belonging to cohort c in state s .



Correlation b/w (un-adjusted) entry and exit shares: 0.93. [▶ Figure](#)

Data Patterns

Productivity of young & old plants in good v/s bad states



Density is plotted at the bottom and productivity at the top.

- More old firms in bad states.
- Productivity rises with age in **good** states.
- Not so in **bad** states.
 - Productivity is high for young firms (selection)
 - Low for very old ones (exit barriers)

Plants are observed in three categories

- **Actively engaged in production.**
- **Dormant with workers:** has fixed assets & workers, but no production.
 - $\sim 5 - 6\%$ of all plants in the ASI data
- **Dormant w/o workers:** has fixed assets, but no workers & production.
 - $\sim 5 - 6\%$ of all plants in the ASI data
 - Dropped after 3 years from the sample
- In the national registry of companies, 20-30% are dormant.

Transition Probabilities

High exit costs \implies plants are dormant for a long time



Frictions to Labor Adjustment

How do plants respond to negative shocks?

$$\log Y_{ijst} = \underbrace{\alpha_i + \gamma_{jt} + \beta_{st}}_{\text{Fixed-effects}} + \gamma' X_{ijst} + \beta_1 \underbrace{\mathbb{1}\{\text{Negshock}_{it-1}\}}_{\text{Negative shock dummy}} + \beta_2 \mathbb{1}\{\text{Negshock}_{it-1}\} \underbrace{\mathbb{1}\{\text{Bad}_s\}}_{\text{Bad states}} + \epsilon_{ijst},$$

- Y_{ijst} : Employment of plant i in industry j located in state s at time t
- Residualize plant's GVA off plant, industry-year, state-year effects
- $\mathbb{1}\{\text{Negshock}_{it}\} = 1$ if the corresponding residual is negative.
 - following Guiso et al. (2005), Fagereng et al. (2018), Contractor (2023)
- β_1 : Effect of a negative shock on the plant's employment?
- β_2 : The differential effect in bad states

Labor Adjustment in Response to Shocks

Plants in Bad states are slow to adjust labor in response to negative shocks

Dependent variable:	log Employment					
	(1) Regular Workers	(2) Regular Workers	(3) Contract Workers	(4) Contract Workers	(5) Managers	(6) Managers
$\mathbb{1}\{Neg_shock_{it-1}\}$	-0.155*** (0.007)	-0.167*** (0.009)	-0.168*** (0.015)	-0.169*** (0.02)	-0.120*** (0.006)	-0.129*** (0.008)
$\mathbb{1}\{Neg_shock_{it-1}\} \times \mathbb{1}\{Bad_s\}$		0.029* (0.014)		0.002 (0.031)		0.021 (0.011)
<i>N</i>	165219	165219	61942	61942	157836	157836

All regressions contain plant, industry-year, state-year, and size-year fixed effects. Robust standard errors clustered at the plant level in parentheses.

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

Heterogeneous Impact by Plant Size

Large plants in Bad states are slow to adjust labor in response to negative shocks

- Interact previous regression with $\mathbb{1}\{Above100_{it}\}$
- $\mathbb{1}\{Above100_{it}\} = 1$, when employment > 100

Dependent Variable:	Log Employment			
	(1) Regular Workers	(2) Regular Workers	(3) Contract Workers	(4) Managers
$\mathbb{1}\{Neg_shock_{it-1}\}$	-0.185*** (0.01)	-0.185*** (0.01)	-0.169*** (0.02)	-0.135*** (0.009)
$\mathbb{1}\{Neg_shock_{it-1}\} \times \mathbb{1}\{Bad_s\}$	0.016 (0.016)	0.016 (0.016)	-0.018 (0.034)	0.018 (0.013)
$\mathbb{1}\{Above100_{it-1}\}$	0.514*** (0.011)			
$\mathbb{1}\{Neg_shock_{it-1}\} \times \mathbb{1}\{Above100_{it-1}\}$	0.05*** (0.019)	0.052** (0.019)	0.003 (0.041)	0.017 (0.016)
$\mathbb{1}\{Bad_s\} \times \mathbb{1}\{Above100_{it-1}\}$	0.076*** (0.021)	0.074*** (0.021)	-0.076 (0.040)	0.05** (0.016)
$\mathbb{1}\{Neg_shock_{it-1}\} \times \mathbb{1}\{Bad_s\} \times \mathbb{1}\{Above100_{it-1}\}$	0.076*** (0.029)	0.078** (0.029)	0.055 (0.066)	0.026 (0.027)
<i>N</i>	165219	165219	61942	157836
Size-Year FE	No	Yes	Yes	Yes

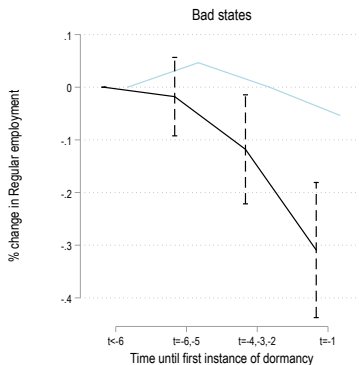
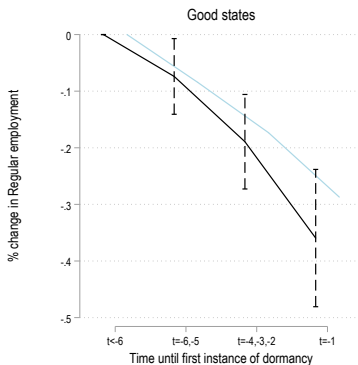
All regressions contain plant, industry-year, and state-year fixed effects. Robust standard errors clustered at the plant level in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Using inflation to shed unwanted workers

- Plants that approach dormancy, will try and shed workers.
- Regular workers are hard to fire
- **Hypothesis:** Plants can increase attrition
 - By keeping nominal wages fixed, making outside options more attractive for regular workers
 - This is effective during **high inflation (HI)** periods and should be more relevant in **bad** states
 - Should not be used against contract workers or managers as there are no frictions to laying them off

Using inflation to shed unwanted workers

Employment on the path to dormancy



— Low Inflation — High Inflation

Quantitative Model

Framework

- Plant output given by:

$$Y = \phi L^{\alpha_L} I^{\alpha_I} K^{\alpha_K}; \quad \alpha_L + \alpha_I + \alpha_K = 1$$

- ϕ : productivity, I: intermediate inputs, K: capital, L: labor
- Labor includes regular workers (L^r) and contract workers (L^c):

$$L = L_c^{\alpha_{Lc}} L_r^{\alpha_{Lr}}$$

- Plants take all input prices as given.
 - Static input: I, dynamic inputs: L & K.
- ϕ of plant i evolves according to an AR(1) process:

$$\ln \phi_{it} = \gamma_0 + \gamma_1 \ln \phi_{it-1} + \varepsilon_{it}$$

Quantitative Model

Framework: Frictions to Exit

1. Quadratic adj. costs for regular workers, contract workers & capital.
 - Costly labor adj \implies slow firing of workers by low productive plants.

2. Each period, plants can choose to produce, stay dormant, or exit.
 - Costly labor adj + exit costs \implies plants stay dormant for long w/o exiting.

Quantitative Model

Framework: Factor Adjustment Costs

- Suppose a plant has L_{rt-1} regular workers in t-1.
- \bar{L}_{rt} : plant's targeted employment level for year t.
- Actual realized employment: log-normally distributed with mean $\log(\bar{L}_{rt})$ and variance $\sigma_{Lr}^{\varepsilon}$.
- Adjustment costs:

$$C_r(\bar{L}_{rt}, L_{rt-1}) = \begin{cases} C_r^h(\bar{L}_{rt}, L_{rt-1}) & \text{if } \bar{L}_{rt} > L_{rt-1} \\ C_r^f(\bar{L}_{rt}, L_{rt-1}) & \text{if } \bar{L}_{rt} < L_{rt-1} \end{cases}$$

Quantitative Model

Framework: Factor Adjustment Costs

- Hiring cost:

$$C_r^h(\bar{L}_{rt}, L_{rt-1}) = (\bar{H}_r + c_{Hr} \cdot L_{rt-1}) \cdot \left(\frac{\bar{L}_{rt} - L_{rt-1}}{L_{rt-1}} \right)^2$$

- More hiring cost for the same % change in employment by large firms.
- Firing cost:

$$C_r^f(\bar{L}_{rt}, L_{rt-1}) = \begin{cases} (\bar{F}_r^L + c_{Fr}^L \cdot L_{rt-1}) \cdot \left(\frac{\bar{L}_{rt} - L_{rt-1}}{L_{rt-1}} \right)^2 & \text{if } L_{r,t-1} \geq 100 \\ (\bar{F}_r^S + c_{Fr}^S \cdot L_{rt-1}) \cdot \left(\frac{\bar{L}_{rt} - L_{rt-1}}{L_{rt-1}} \right)^2 & \text{if } L_{r,t-1} < 100 \end{cases}$$

- Similar adj costs for contract workers & capital, but no difference in firing cost by the 100 threshold.
- Reference: Cooper and Haltiwanger (2006).

Quantitative Model

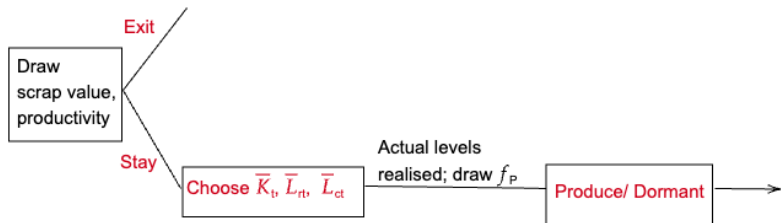
Framework: Dormancy as a Pathway to Exit

- Each period, plants can choose to produce, stay dormant, or exit.
 - Production: plants pay fixed cost of production, $f^P \sim \log\mathcal{N}(\mu_f^P, \sigma_P^2)$.
 - Dormancy: can avoid f^P but must pay factors & adj. costs.
 - Exit: plants get scrap value, $f^E \sim \log\mathcal{N}(\mu_f^E, \sigma_E^2)$.
 - Eg: high realization of f^E if court rules in favor of a plant in a year.
 - Plant draws f^P, f^E each period to capture idiosyncratic shocks.

Quantitative Model

Framework: Incumbent Plant's Problem

- State variables: $s_t = (\phi_t, L_{t-1}^r, L_{t-1}^c, K_{t-1})$



Quantitative Model

Framework: Potential Entrants

- Potential entrants must pay sunk entry cost.
- Plant draws its productivity after paying sunk entry cost and decides whether to exit immediately or not. If plant decides to stay, then they acquire labor, capital and are incumbents.
- In equilibrium, a positive mass of plants enter such that:

Ex-ante expected value of entry = Sunk entry cost

- Price of capital p_K endogenously determined.
- Total stock of capital in the market exogenously given: conservative assumption, does not affect estimates.
- More entrants \implies larger demand for capital \implies higher p_K .

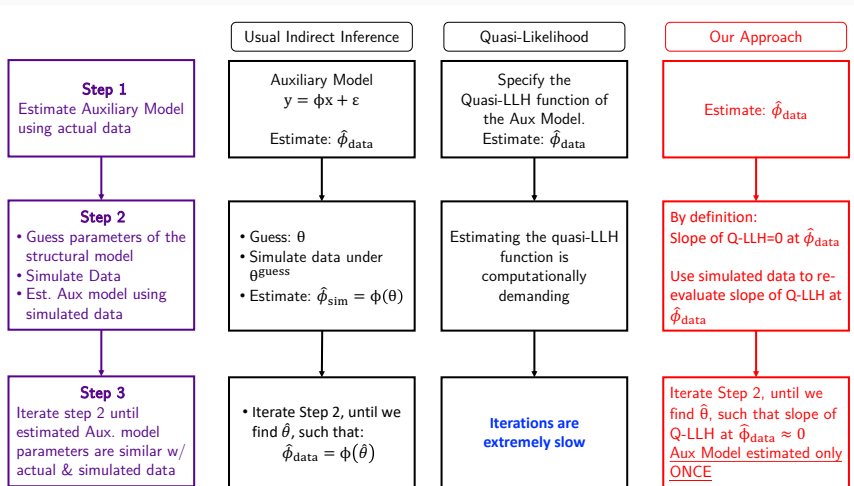
Quantitative Model

Estimation Strategy: Identification

- Mean and variance of fixed cost of production (μ_f^P, σ_P^2).
 - Plant decides produce/dormant after drawing f_P .
 - Ceteris paribus, higher $\mu_f^P \implies$ lower prob. of production given a state.
 - Higher $\sigma_P^2 \implies$ prob. of production less dependent on the state.
- Mean and variance of scrap value (μ_f^E, σ_E^2).
 - Plant decides exit/stay after drawing f_E .
 - Lower $\mu_f^E \implies$ lower probability of exit given state.
- Factor adjustment costs.
 - Larger hiring cost: smaller increase with positive prod shock.
 - Larger firing cost: smaller decrease with negative prod shock.
 - Larger shocks: lower ability to target actual factor levels given state.

Quantitative Model

Estimation Strategy: Road map of Indirect Inference



- Reference: Golombek and Raknerud (2018).

Estimation Strategy: Quasi Maximum Likelihood Approach

- Why? Nature of Problem and Efficiency.
- Plants face a discrete-continuous choice problem in our model.
 - Decision to produce, stay dormant, exit: discrete choice.
 - How much labor and capital to employ: continuous choice.
 - Small changes in f^P, f^E implies simulated data would jump discretely ($P \rightarrow D, D \rightarrow E$).
 - Distance between estimates of the auxiliary model on actual & simulated data would jump discretely. Creates problems as one cannot use gradient-based methods of optimization.
 - So cast in terms of probability of becoming dormant, ... which makes it all continuous. Do not evaluate entire LF, only derivative at parameters estimated for data.

Quasi-Likelihood Function

Summary

- Parameters of the auxiliary model: $\theta^a = \theta_1^a \cup \theta_2^a \cup \theta_3^a$
- θ_1^a : prod function, productivity evolution parameters.
- θ_2^a : fixed cost of production parameters.
- θ_3^a : factor adjustment costs, scrap value parameters.
- Quasi-likelihood function: sum of three parts.
 - Part 1: function of θ_1^a . Easy as it is static.
 - Part 2: function of θ_2^a given θ_1^a . Easy as it is static.
 - Part 3: function of θ_3^a given θ_2^a, θ_1^a . Computationally intensive as it is dynamic.

Calibrated Parameters

Parameters	Description	
δ^V	Discounting Factor	0.9
δ^K	Capital Depreciation Rate	0.9
σ	Demand Elasticity	3.94
α_I	Share of Intermediate Input	0.57
w_r (1,000 rupees)	Wage of Regular Workers	50
w_c (1,000 rupees)	Wage of non-Regular Workers	117

- The median markup is 1.34 (De Loecker et al., 2016), so $\sigma = 3.94$.

Preliminary Estimates

Parameters	Description	
Productivity Process and Production function		
$\tilde{\gamma}_0$	Intercept of AR(1) Process	0.19
$\tilde{\gamma}_1$	Slope of AR(1) Process	0.86
σ_ϕ	Std dev of AR(1) Process	0.94
α_K	Share of Capital	0.23
α_{Lr}	Share of regular workers	0.67
Production Cost		
μ_f^P	Mean of fixed cost dist.	-10.55
σ_P	Variance of fixed cost dist.	9.8

- Slope of productivity evolution process .86: persistence.

Preliminary Estimates

	Description	Good States
\bar{H}_K	Hiring cost of capital: intercept	28.62
c_{HK}	Slope	9.21
\bar{F}_K	Firing cost of capital: intercept	331.89
c_{FK}	Slope	4.2
\bar{H}_r	HC of RW: Intercept	15.48
c_{Hr}	Slope	22.36
\bar{F}_r^L	FC of RW for large firms: intercept	68.73
c_{Fr}^L	Slope	10.73
\bar{F}_r^S	FC of RW for small firms: intercept	45.36
c_{Fr}^S	Slope	3.76
\bar{H}_c	Hiring cost of non-regular workers: intercept	-3.41
c_{Hc}	Slope	6.82
\bar{F}_c	Firing cost of non-regular workers: intercept	30.33
c_{Fc}	Slope	16.00
σ_K	Var. of actual realized capital	0.56
σ_{Lr}	Var. of actual realized emp. of regular workers	0.86
σ_{Lc}	Var. of actual realized emp. of contract workers	0.95
μ_f^E	Mean of scrap value distribution	-718.68
σ_E^2	Var. of scrap value distribution	785.72

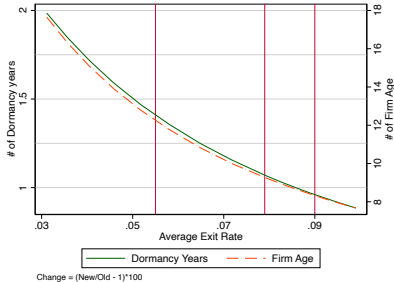
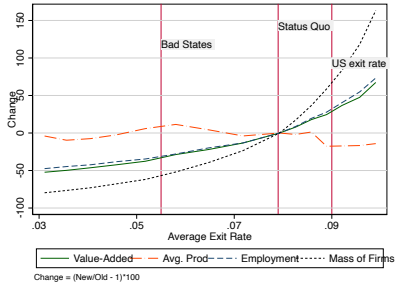
Preliminary Estimates

- Slope and intercept for firing costs for regular workers more than for non-regular ones. Regular workers less flexible.
- Slope and intercept of hiring costs are higher for regular workers.
- Slope and intercept for firing costs for regular workers are larger for large firms than small ones. Large firms less flexible in firing regular workers.
- Scrap value is very low, in fact negative!

Counterfactual Exercise (Fixed Capital Stock)

Good States and Labor Intensive Sector: Raise Scrap Value.

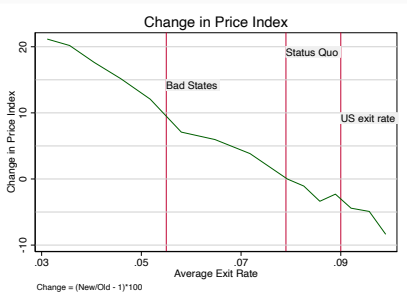
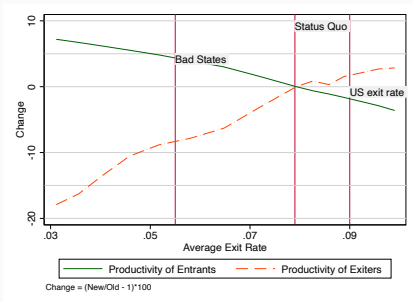
- Adjust mean of the scrap value distribution to get exit rate.
- **Average productivity**, **Value added**, **Employment**.
- With US exit rate, increase in VA 37%, employment 39%, Firm Mass 79%; years in dormancy & average age fall by (0.12 & 1.1 years).



Counterfactual Exercise (Fixed Capital Stock)

Good States and Labor Intensive Sectors: Raise Scrap Value

- As exit rates rise to US level, productivity of exitters rises about 2.5%, entrants falls a bit less 2%.
- Price index falls by about 3.5 %.



Counterfactual Exercise

Good States and Labor Intensive Sector

- Sensitivity to capital supply elasticity? $K^S = Bp_K^{\varepsilon_K}$.
- US exit rate v/s status-quo.
- Greatly magnifies the responses of output, employment & price index.

Changes in	ε_K			
	0	0.1	0.2	0.5
Value-added	37.13%	46.1%	56.3%	91.2%
Employment of Workers	39%	61.8%	73.0%	111.6%
Mass of Firm	65.3%	96.1%	110%	156.5%
Price Index	-3.5%	-6.6%	-9.9%	-14.8%
Welfare ¹	7.21%	9.38%	11.68%	19.38%

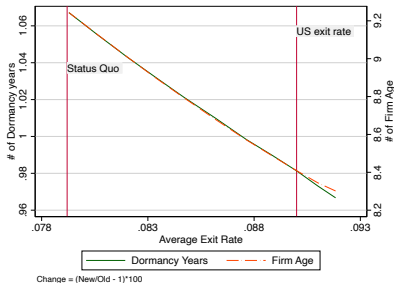
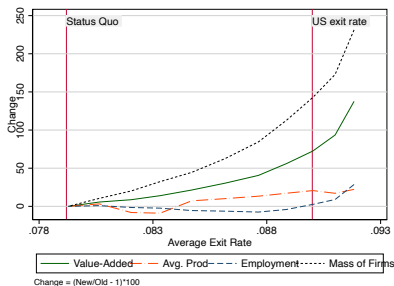
1

- Manufacture share in GDP is 16.5% in 2004 (The World Bank)
- Consumption share of manufacturing goods is 24.7% in 2004 (The WIOD)

Counterfactual Exercise

Good States and Labor Intensive Sector: Change in Firing Cost of Labor

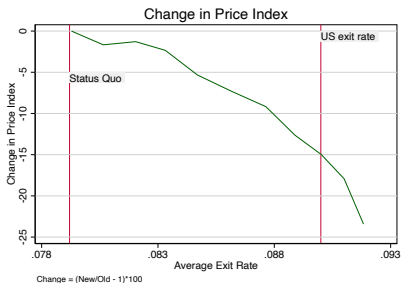
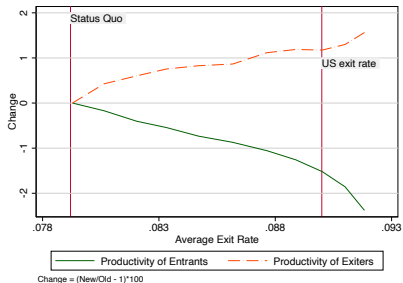
- Adjust the firing cost of labor to get exit rate. **Prod**, **VA**, **Emp**.
- With US exit rate, increase in VA 74% (37% for scrap value), employment 1% (39%), Firm Mass 148% (79%); years in dormancy & average age fall by 0.08 (.12) years and 0.8 (1.1) years).
- Scrap value better for employment, Firing costs better for VA?



Counterfactual Exercise (Fixed Capital Stock)

Good States and Labor Intensive Sectors: Change in Firing Cost of Labor

- As exit rates rise to US levels, productivity of exiters rises a lot, 110% (2.5%), entrants falls 150 % (2%).
- Price index falls by about 15 % (3.5%).



Counterfactual Exercise

Good States and Labor Intensive Sector

- Sensitivity to capital supply elasticity? $K^S = Bp_K^{\varepsilon_K}$.
- US exit rate v/s status-quo.
- Greatly magnifies the responses of output, employment & price index.

Changes in	ε_K			
	0	0.1	0.2	0.5
Value-added	72.4%	84.3%	97.8%	141.4%
Employment of Workers	0.8%	1.0%	8.1%	32.2%
Mass of Firm	142.7%	159.6%	177.5%	239.5%
Price Index	-15.3%	-17.9%	-20.4%	-24.6%
Welfare ²	16.20%	18.90%	22.0%	31.1%

2

- Manufacture share in GDP is 16.5% in 2004 (The World Bank)
- Consumption share of manufacturing goods is 24.7% in 2004 (The WIOD)

Next Steps and Conclusion

- More estimates and counterfactuals in progress.
- Labor adjustment costs also contribute to exit costs.
- Synergies between policies.
- 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."*
- Exit costs are entry costs!
- Thank You!

Appendix I

Indian Employment Protection Legislation

- As per IDA, if an establishment that employs more than 100 workers wishes to shut down or layoff a worker, then they have to first submit an application to the State Government concerned clearly stating the reasons for the intended layoff.
- The appropriate government authority would then grant or refuse permission to them after they conduct an inquiry and after giving a reasonable opportunity of being heard to the employer and the worker concerned.
- Once the establishment receives permission to shut down or layoff workers, then they have to pay them wages of 15 days as compensation.

Indian Employment Protection Legislation

- If an establishment is found to have shut down or laid off workers before receiving permission, then they can be imprisoned or charged a fine according to the provisions of this chapter.

- In case either the employer or the employee is not satisfied with the decision of the government authority, then they can contest their decision in a tribunal.

Increase in Firing Cost

- Plant owners face delays in securing govt authorization \implies higher uncertainty during an adverse shock.
- Reasons for the delay:
 - Indian state capacity is weak - as of 1998, there existed only one labor court for 437,868 workers.
 - Absence of affected parties at the time of hearing.
 - Seeking of frequent adjournments by parties to file documents.
 - Parties approaching the higher courts challenging orders issued by labor courts on preliminary points ([Shyam Sundar\(2020\)](#), [Teamlease Services Report \(2006\)](#)).

Increase in Marginal Cost of Production

- Labor laws enforced through frequent inspections of factory premises by labor inspectors.
- These inspectors have the power to extract bribes, tighten/ease the administrative burden that plants face.
- Anecdotal evidence exists of inspectors exploiting the arbitrariness and antiquated nature of these laws to extract bribes.
- Amount of bribes plants pay typically scale up with the number of workers ([Teamlease Services Report \(2006\)](#), [Amirapu and Gechter \(2021\)](#)).

Indian Employment Protection Legislation

- Previous work on this legislation such as [Besley and Burgess \(2004\)](#), [Hasan et al \(2007\)](#), [Ahsan and Pages \(2009\)](#) analyzed the relationship between IDA and establishment outcomes by making use of the fact that the Constitution of India has vested different states in India with the power to amend this legislation.
- For instance, by aggregating all state level amendments from 1958 to 1992, [Besley and Burgess \(2004\)](#) classified states based on how many pro-worker/pro-establishment amendments were enacted and looked at how establishment outcomes like output and employment varied between states.
- However, several issues have been highlighted in [Bhattacharjea \(2006,2009\)](#) about the manner in which amendments were interpreted as pro-worker/pro-employer, weighted and aggregated to classify states.

Contract Workers

- Contract workers: hired by plants through staffing companies on a temporary contractual basis.
- They are not full-time employees of the plant.
- They are paid 20% less than full-time workers.
- They do not fall under the purview of EPL.
(Bertrand et al (2021))

Registered Plants

- Following plants have to be registered by law:
 - Those that use power and with 10+ total employees.
 - Those without power and with 20+ total employees.
- Total employees: formal workers + contract workers + managers.

Data Source

- Plants in the frame classified into two groups - the census sector and the sample sector.
- Census sector:
 - Units with 100+ total employees regardless of their location.
 - Those located in the 6 least industrially developed states regardless of their employment.
- Remaining plants belong to the sample sector.
- Grouping of units into census and sample sectors gets revised every 5 years.

Data Source

- Census sector plants surveyed every year until the next revision occurs.
- Sample sector plants in each state arranged into different groups based on their 4 digit industry classification.
- 1/5th of units drawn from each (state, 4 digit industry) combination based on stratified circular systematic sampling.

Variables in ASI

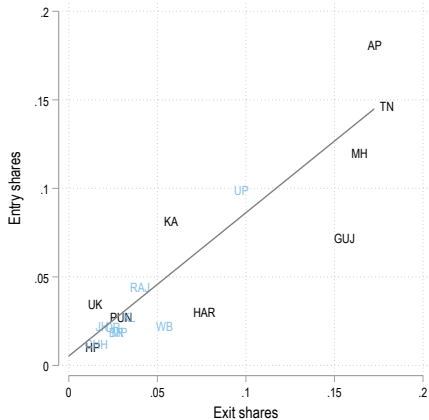
- State, industry that they belong to.
- No. of regular workers/contract workers/managerial staff employed.
- Sales.
- Book value of capital.
- Balance Sheet Details.

ASI versus Other Datasets

- ASI vs. Economic Census (EC).
 - EC: covers the universe of all manufacturing establishments in India.
 - Data published only once in 5 years.
 - Not possible to track individual establishments over time.
- ASI vs. Prowess.
 - Prowess: balance sheet information of large firms.
 - Only 10% of firms provide information on employment level.
 - Indian labor laws applicable at the establishment level and not at the firm level.

Entry Shares v/s Exit Shares

Figure 2: Correlation b/w (un-adjusted) entry shares and exit shares (correlation: 0.93)



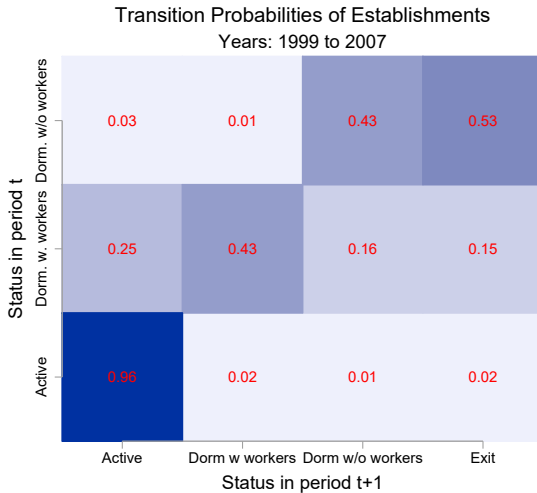
Dormancy With Workers

- Plant 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.
- It can take up production any moment once the problems are sorted out.

Dormancy W/o Workers

- Plant did not engage any employee during the reference period.
- Did not initiate production or produce anything during the reference period.

Transition Probability Matrix



Simulation Procedure

- Let z_{it} : status of plant i in year t .
- $z_{it} \in \{P, D, M, E\}$.
- $Pr(z_{it} = M | L_{c,it-1}, L_{r,it-1}, K_{r,t-1})$: conditional prob of missing data at t .
- Incorporates above prob. into simulation after estimating it with actual data.
- Simulated data now also has holes; follows the exact pattern as data.

Exit Rates in Manufacturing v/s Services

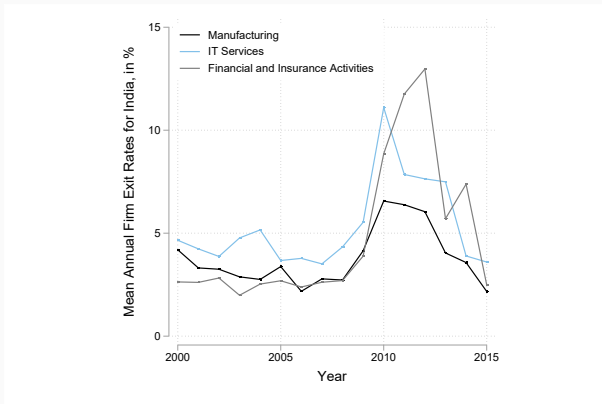


Figure 3: Exit rates of manufacturing v/s services

Bellman Equation

- State variables: $s_t = (\phi_t, L_{t-1}^r, L_{t-1}^c, K_{t-1})$.
- Value of an incumbent plant:

$$V(s_t) = \mathbb{E}_{\{f^E\}} \left\{ \max_{d=Exit, Stay} \{V^E(s_t), V^S(s_t)\} \right\} \quad (1)$$

- Value of exiting:

$$V^E(s_t) = \{f^E + p_K K_t - F_r - F_c - F_K\} \quad (2)$$

Bellman Equation

- Value of staying:

$$V^S(s_t) = \max_{\bar{L}_{ct}, \bar{L}_{rt}, \bar{K}} \left\{ \mathbb{E}_{\{L_{ct}, L_{rt}, K_t\}} \left[R(\tilde{\phi}_t, L_{ct}, L_{rt}, K_t) - w_c L_{ct} - w_r L_{rt} \right. \right. \\ \left. \left. + \delta^V \mathbb{E}_{\tilde{\phi}_{t+1} | \tilde{\phi}_t} V(s_{t+1}) \right] - C^{\text{contract}}(\bar{L}_{ct}, L_{ct-1}) \right. \\ \left. - C^{\text{regular}}(\bar{L}_{rt}, L_{rt-1}) - C^{\text{capital}}(\bar{K}_t, K_{t-1}) \right\}$$

- Factor payments, Expected continuation value, Factor adj costs.
- Expected value-added net of fixed production costs:

$$R(\tilde{\phi}_t, L_{ct}, L_{rt}, K_t) = \mathbb{E}_{\{f^P\}} \max_{P, D} \{ VA(\tilde{\phi}_t, L_{ct}, L_{rt}, K_t) - f^P, 0 \}$$

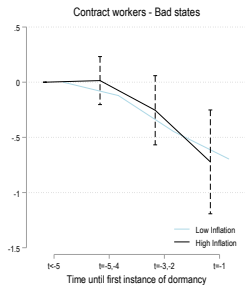
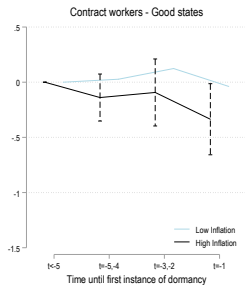
Estimation Procedure

1. Specify an auxiliary model that approximates structural model.
 - θ^a : parameters of the auxiliary model.
 - Derive likelihood function for auxiliary model.
 - Quasi-likelihood function (quasi-LLH).
 - Use actual data to estimate θ^a by maximising quasi-LLH.
 - $\hat{\theta}_{Data}^a$: estimator of θ^a .
 - By definition, evaluated at $\hat{\theta}_{Data}^a$, first derivative of quasi-LLH = 0.

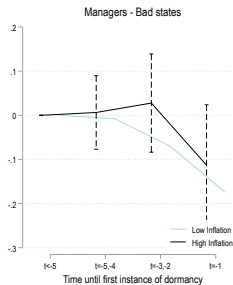
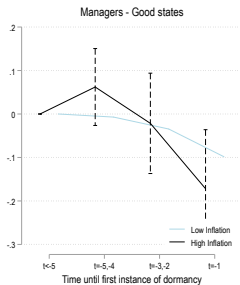
Estimation Procedure

2. Simulate data from structural model with arbitrary parameter values.
 - Find 1st derivative of quasi-LLH with simulated data, evaluated at $\hat{\theta}_{Data}^a$.
3. Find parameters so that 1st derivative at $\hat{\theta}_{Data}^a$ with simulated data is as close as possible to 0.
 - If parameter values are guessed correctly, then:
 - Simulated data mimics actual data.
 - 1st derivative of quasi-LLH using simulated data at $\hat{\theta}_{Data}^a = 0$.
 - Reference: Golombek and Raknerud (2018).

Adjustment of Contract Workers and Inflation



Adjustment of Managers and Inflation



- Indirect Inference. Basic Idea:
 - Fix arbitrary values of parameters to be estimated.
 - Simulate data from the structural model.
 - Choose a statistical model that describes covariation patterns in the data.
 - Estimate the auxiliary model on simulated & actual data.
 - Update parameters until estimates of auxiliary model on actual & simulated data are as close as possible.

1. Empirically:

- Classifies states as “good” or “bad” by variation in entry rates.
 - Documents that bad states have lower exit, higher productivity of young firms (more selective entry), a larger mass of old low unproductive firms (exit barriers), lower average productivity, and that firms use dormancy as a path to exit.
 - Provides causal evidence that states react to shocks in a way consistent with higher exit costs, especially for larger firms subject to IDA. Bad states are slower to fire workers with negative value-added shocks, and more so for large firms and bad states use inflation to rid themselves of unwanted workers they have constraints in firing, but not others.

2. **Models Exit Barriers:** Dynamic heterogeneous firm model with entry and exit.
 - Features adjustment costs for labor and capital.
 - Exit costs captured by scrap value of plants.
 - Costly labor adj \implies slow firing of workers by low productive plants.
 - Costly labor adj + exit costs \implies plants stay dormant for long without exiting.
3. **Estimates** the structural model on Indian data by state group (good/bad) and sector (labor intensive/not labor intensive).
 - Quantifies how exit barriers impact efficiency, output & entry in Indian manufacturing.
 - Explores policy synergies between rules that reduce labor firing & exit costs (in progress).

Institutional Background

- According to IDA, if an establishment that employs more than 100 workers (now 300 workers) wishes to shut down or layoff a worker, then they have to first submit an application to the State Government concerned clearly stating the reasons for the intended layoff.
- The appropriate government authority would then grant or refuse permission to them after they conduct an inquiry and after giving a reasonable opportunity of being heard to the employer and the worker concerned.
- Once the establishment receives permission to shut down or layoff workers, then they have to pay them wages of 15 days as compensation.

Institutional Background

- Anecdotal evidence suggests that firms typically have to wait for a long time until they hear about the final decision and firms mostly do not receive permission despite all the effort.
- If an establishment is found to have shut down or laid off workers before receiving permission, then they can be imprisoned or charged a fine according to the provisions of this chapter.
- In case either the employer or the employee is not satisfied with the decision of the government authority, then they can contest their decision in a tribunal. Adds to delays and uncertainty

Institutional Background

- Plant owners face delays and uncertainty in securing government authorization. Exit is costly in terms of legal expenses & the pall cast by uncertainty. Courts rule on things, then reverse judgments at higher levels or rule differently on similar cases. Indian state capacity is weak - as of 1998, there existed only one labor court for 437,868 workers.
- Examples:
 - In "Bharat Forge Co Ltd vs. 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..
 - Is a Hospital an industry? 1960 Supreme Court Hospital Mazdoor Sabha case, ruling was yes! Then in 1967 case Safdarjung Hospital, supreme court reversed itself!
 - Who is a worker? Janitor? What is covered? Shops? Airline pilots?
 - Murky. Nokia, GM, ..all have been burnt in India.

Institutional Background

- Reforms since 1990 helped to lay out a path to bankruptcy for distressed firms.
 - In 1993, Debt Recovery Tribunals (DRTs) were setup. But got clogged and there were legal loopholes exploited by debtors.
 - In 2002 came SARFAESI (Securitization and Reconstruction of Financial Assets and Enforcement of Security Interests Act). Allowed secured creditors to take possession of secured assets within 60 days of notice on a non-performing asset loan. Over time, courts diluted it by allowing appeals by borrowers.
 - In 2016 the Insolvency & Bankruptcy Code (IBC) was implemented. Gave for first time a path to bankruptcy. Later shelved due to Covid-19.
- Variation across states in court efficiency & implementation of laws.

Nokia Case Study

- Nokia **setup** its factory in India in **2006**
- Low entry costs: States offered various concessions to woo Nokia
- **2006–2012**: factory was the poster child of capitalism
 - Nokia's largest factory worldwide
 - 20000 employees; 15mn phones produced every month
 - 70% employees were women
 - Exports to over 80 countries
- **Troubles** started from **2013**
- Cellphone technology changed
- Vietnam offered better tax breaks
- Large factory: labor unrest, unions, death of an assembly operator
- Writing was on the wall that Nokia will exit

Nokia Case Study

- **Apr 2014:** Nokia sells devices business to Microsoft
- State apparatus gets after Nokia: two tax evasion cases
- Indian factory had to be excluded from the deal
- **Nov 2014:** Production stops
- **2018:** Tax dispute settled
 - Case #1: Struck down by high court
 - Case #2: 202mn Euro penalty
- +2 years of paper work & legal clearances
- **2020:** Factory bought by Salcomp
- **Time to exit:** 6 years
- In the interim:
 - Contract workers laid off
 - Some regular workers took severance pay
 - Others had to be paid even when there was no production
 - We can see this in the PROWESS data

Using inflation to shed unwanted workers

- Specification:

$$Y_{ijst} = \beta_0 + \sum_b \beta_1^b (D - t)_{ijst}^b + \beta_2 HI_t + \beta_3^b (D - t)_{ijst}^b \times HI_t \\ \beta_3^b (D - t)_{ijst}^b \times HI_t + \mathbf{X}'_{ijst} \delta + \lambda_i + \lambda_{st} + \lambda_{jt} + \epsilon_{ijst}$$

- Y_{ijst} : $\log(1 + \text{employment})$.
- HI_t : indicator equals 1 if year t inflation exceeded 5%.
- $(D - t)$: years until first instance of dormancy for plant i .
- b indexes the years before dormancy into four bins:
 $\{< -5; -5, -4; -3, -2; -1\}$.

Quasi-Likelihood Function

- Data for plant i : (VA_{it} , K_{it} , L_{it}^r , L_{it}^c , $Status_{it}$, VA_{it-1} , K_{it-1} , L_{it-1}^r , L_{it-1}^c , $Status_{it-1}$...).
- Assumption: K_{it} , L_{it}^r , L_{it}^c , $Status_{it}$, ... are strictly exogenous.
- What is the likelihood of observing VA_{it} given (K_{it} , L_{it}^r , L_{it}^c , $Status_{it}$, VA_{it-1} , K_{it-1} , L_{it-1}^r , L_{it-1}^c , $Status_{it-1}$...)?
- Above likelihood depends on prod function & productivity evolution parameters.

Quasi-Likelihood Function

- Data for plant i : (*Production* _{it} or *Dormancy* _{it} , VA_{it} , K_{it} , L_{it}^r , L_{it}^c , VA_{it-1} , K_{it-1} , L_{it-1}^r , L_{it-1}^c , ...).
- What is the likelihood of (*Production* _{it} or *Dormancy* _{it}) given (VA_{it} , K_{it} , L_{it}^r , L_{it}^c , VA_{it-1} , K_{it-1} , L_{it-1}^r , L_{it-1}^c , ...)?
- Above likelihood depends on the distribution of fixed cost of production f_p .

Quasi-Likelihood Function

- Data for plant i : ($K_{it}, L_{it}^r, L_{it}^c, \text{Exit}_{it} \text{ or } \text{Stay}_{it}, K_{it-1}, L_{it-1}^r, L_{it-1}^c, \text{Exit}_{it-1} \text{ or } \text{Stay}_{it-1} \dots$).
- What is the likelihood of observing ($K_{it}, L_{it}^r, L_{it}^c, \text{Exit}_{it} \text{ or } \text{Stay}_{it}$) given ($K_{it-1}, L_{it-1}^r, L_{it-1}^c, \text{Exit}_{it-1} \text{ or } \text{Stay}_{it-1} \dots$)?
- Above joint likelihood involves dynamics and depends on:
 - Factor adjustment cost parameters.
 - Parameters of the scrap value distribution.

Data Patterns

