

Labor-Material Complementarity and the Propagation of Competition Shocks

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October 10, 2026

Industrial Policy and Jobs

- Industrial policy → Particular focus on job creation + distorted economies (Grunau, Hoffmann, Lemieux & Mirko Titze, 2025; Martin, Netaraj & Harrison, 2017)
- Effects propagate through IO linkages across sectors (Liu, 2019)

This paper: Pro-competition employment effect and downstream technology

- Cheaper materials ↑ labor demand where **complements**, but ↓ labor where **substitutes**
1. IO linkages → Where the shock travels
 2. **Het. labor-materials substitution → Employment effects when the shock arrives**
 3. Variable markups → Direct competition effects

Labor-materials complementarity shapes the employment response

For policy, sector choice matters beyond the I/O structure: employment effects depend on the technology of the sectors reached.

Affected sector

- Lower markups and distortions
- Expansion in output and employment
- Higher labor demand through the **scale effect + lower distortions**

Downstream sectors (Indirect effect)

- Lower prices of intermediate inputs
- Labor demand depends on labor-material substitution

Substitutes: ↓ Demand

Complements: ↑ Demand

Reservation and Dereservation Policy in India

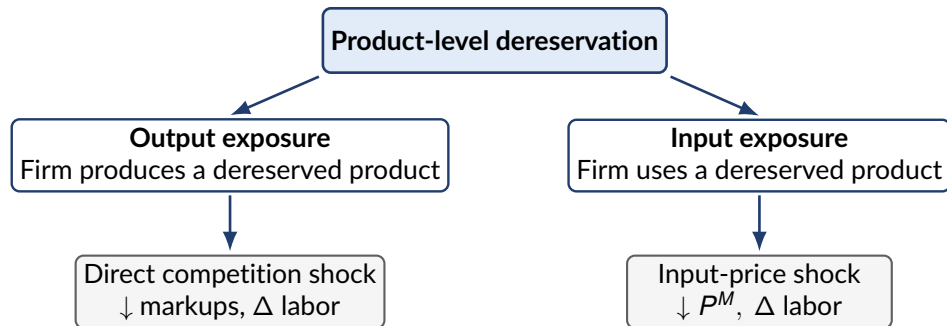
- **The Small Scale Reservation Policy (1967-1997):**

- “Protect” small firms by granting them exclusivity in the production of certain products.
- **Small-Firm Def:** Plan & Capital value $\leq$ ₹10'000,000 (\$200,000 in 2002)
- **Large firms** with export obligations $\geq$ 75% were allowed to produce reserved goods.

- **The Small Scale Dereservation Policy (1997-2015):**

- Removed production exclusivity restrictions $\longrightarrow$ No capital cap.
- Lift institutional entry barriers to large firms.
- Targets around 6% of manuf. sector sales and 10% of employment,

Dereservation generates two distinct shocks



What I do

- **Estimate** labor-materials substitutability sector by sector
- **Measure** the two shocks in the data
 - Staggered product dereservation. ASI plant-product panel 2001–2008
 - Output-exposure and input-exposure samples, held separate
 - Employment effects + Interaction with substitutability.
- **Quantitative** I/O model of Indian manufacturing
 - Variable markups, and a binding **capital cap** on reserved products
- Pro-Competition policy: **Remove** the cap → decompose employment response
 - **Scale** + **Markup** + **Complementarity**

Preview of Results

- Complementarity mechanism delivers aprox. **one third** of the employment gain.
83% of the complementarity effects operates through never affected sectors.
- Employment increases 4% in directly affected sectors
- Sectors the policy *never* touches lose 0.24% of employment through reallocation
Complementarity returns a **sixth of it**.
Heterogeneous across sectors: **p10 = -11.4%** / **p90 = 79.7%** → elasticity-dependent
- Ignoring complementarities leads to 27% understimation of total aggregate effects.
Driven by never regulated sectors.

The **complementarity** channel is stronger than classic pro-competition channel
(30% vs 26% operating through markups)

Contribution

Industrial policy effects through networks + Labor-Materials complementarities

(Liu, 2019 ; Bonilla, Muñoz-Morales & Zarate, 2026 Atalay, 2017; Castro-Vicenzi & Kleinmann, 2026; Peter & Ruane, 2026; Martin, Netaraj & Harrison, 2017; Garcia-Santana & Pijoan-Mas, 2012)

- Granular sector-level heterogeneity in labor-material elasticity of substitution +
 - Endogenous markups and network effects.
 - Using directly in a structural model replicating the heterogeneity
- Empirical isolation of input and output mechanisms.
- Counterfactual isolation of markups vs complementarity mechanism
 - Distortion vs Technology

Data and Empirical Findings

Annual Survey of Industries (2001-2008)

- Indian Panel of Manufacturing Establishments.
 - Around 114,000 unique firms
- Data on output **and** input prices and quantities
 - Around 5000 different products observed (500 dereserved)
 - Ex. Products: Cotton Bleached Yarn, Black Tea Leaf, Polished Diamonds, Rough Diamonds
- The granularity of the data allows to:
 - Identify firms affected only **directly** through products manufactured
 - Identify firms affected only **indirectly** through inputs consumed

Labor-material complementarity

Firm-level input prices

- Use input-level price and quantity data
- CD input price index, P_{it}^M
- Firm-level wages, w_{it}

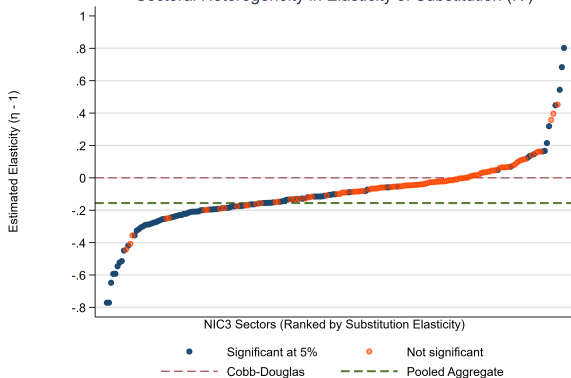
Elasticity IV estimation

IV

$$\log \left(\frac{P_{it}^M M_{it}}{w_{it} L_{it}} \right) = \alpha + (\eta_s - 1) \log \left(\frac{w_{it}}{P_{it}^M} \right) + \mathbf{X}_{it}' \gamma + \delta_t + \varepsilon_{it}.$$

- Sectoral (3-Digit) η estimate
- $\hat{\eta} < 1 \rightarrow$ **Complements**

Sectoral Heterogeneity in Elasticity of Substitution (IV)



- High heterogeneity across sectors
- Elasticities $\hat{\eta}$ range from 0.2 to 1.9
- Pooled estimate $\hat{\eta} = 0.84$

Complementarity shapes labor response to industrial policy

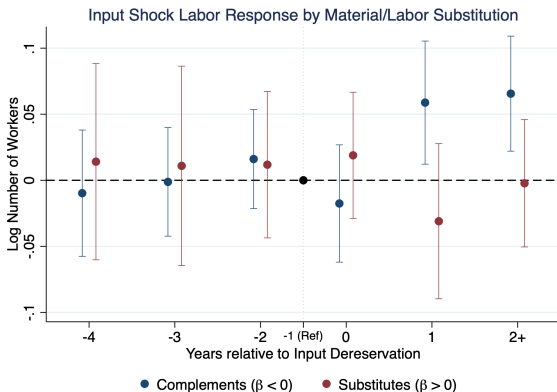
Event-study specification

$$\log L_{it} = \sum_{\tau \neq -1} \beta_{\tau} D_{it}^{\tau} + \sum_{\tau \neq -1} \gamma_{\tau} (D_{it}^{\tau} \times C_s) + \alpha_i + \delta_t + \varepsilon_{it},$$

$$C_s = \begin{cases} 1 & \text{if } \hat{\eta}_s - 1 < 0, \\ 0 & \text{if } \hat{\eta}_s - 1 > 0. \end{cases}$$

- D_{it}^{τ} : years relative to input dereservation

- Treatment $\rightarrow$ Firms affected through **inputs**, excluding those affected through **outputs**.
- Input margin of the policy creates jobs in industries where Labor and Mat. are complements



Industrial Policy Affects Directly Competition and Labor

- Proxy firm-level competition effects using product-level markups.
(Estimates using De Loecker, Goldberg, Khandelwal and Pavcnik, 2016)
- Treatment $\longrightarrow$ Firms affected through **outputs**, excluding affected through **inputs**.
- Output affected firms $\longrightarrow$ $\downarrow$ Markups and $\uparrow$ Labor Demand
- Labor effects consistent with reduced market distortions.

Markup and Labor

Model

Model

1. Cournot oligopoly: variable markups depend on endogenous market shares.
2. Restriction in capital stock: Reservation threshold
3. Production network: 3-digit input-output structure.
Examples of groups: Bakery Products, Leather Apparel
4. CES production: labour and materials with sector-specific η_s .
 - Cobb-Douglas between Labor-Materials CES, and Capital.
5. Entry margin: a predetermined pool of potential entrants.

Analysis Unit in the Model

- Calibrate the model $\rightarrow$ 3-digit product-groups.
- Within each product group: **Policy Affected (R)** and **Never affected (U)** subsectors.
- In **R** sectors we have a pool of **Incumbents (I)** and **Entrants (E)**.
- **R** sectors $\rightarrow$ Capital cap that introduces distortions:
 - A set of **potential entrants** $\rightarrow$ Lower profits than in undistorted market.
 - Binding **Incumbents** $\rightarrow$ Less than optimal K and Q
- Industrial policy $\rightarrow$ Cap removal $\rightarrow$ $\uparrow$ Entry and $\uparrow$ Expansion

Model Details: Competition

Final-good aggregator

$$Y = \left(\sum_{s=1}^S \Gamma_s^{(1/\theta)} C_s^{\frac{\theta-1}{\theta}} \right)^{\frac{\theta}{\theta-1}}$$

Sectoral aggregator

$$Y_s = \left(\sum_{i \in \mathcal{N}_s} (Y_i^s)^{\frac{\gamma-1}{\gamma}} \right)^{\frac{\gamma}{\gamma-1}}$$

Production Function

$$Y_i^s = z_i^s \left[\alpha_t^s L_i^{\frac{\eta_s-1}{\eta_s}} + (1 - \alpha_t^s) M_i^{\frac{\eta_s-1}{\eta_s}} \right]^{\beta \frac{\eta_s}{\eta_s-1}} K_i^{1-\beta}$$

Network: Materials bundle

$$M_i^s = \left[\sum_{s'} \underbrace{\omega^{s,s'}}_{\text{I/O weights}} M_i^{s'} \frac{\kappa-1}{\kappa} \right]^{\frac{\kappa}{\kappa-1}}, \quad P^{M,s} = \left[\sum_{s'} \omega^{s,s'} \kappa P^{s'} \frac{1}{1-\kappa} \right]^{\frac{1}{1-\kappa}},$$

- κ is the elasticity of substitution across upstream sectors.
- For production, firms in sector s combine inputs from other sectors s'
- Assumption: Within sectors, firms use the same input recipe.

Operational and Sunk Costs

- Policy affected markets and never affected markets incumbents $\rightarrow$
Pay f^R and f^U to operate (In wage terms).
- Incumbent profits:

$$\Pi_i^I = p_i^s y_i^s \left(1 - \frac{1}{\mu_i}\right) - f^R$$

- Policy affected markets entrants $\rightarrow$ Pay f^R and a sunk cost $\mathcal{F}^R$
- Entrant profits:

$$\Pi_i^E = p_i^s y_i^s \left(1 - \frac{1}{\mu_i}\right) - f^R - \mathcal{F}^R$$

The capital restriction distorts both scale and entry

- Firms in **reserved markets** solve their problem subject to

$$K_i \leq \bar{K}.$$

Incumbent scale

$K_i^*(z_i) \rightarrow$ opt. capital without restriction.

$$K_i^R(z_i) = \min \left\{ K_i^*(z_i), \bar{K} \right\}.$$

For firms for which the cap binds,

$$K_i^*(z_i) > \bar{K}$$

and

$$K_i^R < K_i^*.$$

Entry

Potential entrant i enters when

$$\Pi_i^E(z_i; \bar{K}) \geq 0,$$

where

$$\Pi_i^E = \pi_i^{var}(z_i; \bar{K}) - f^R - \mathcal{F}^R.$$

Define the entry cutoff by

$$\Pi^E(z^E; \bar{K}) = 0.$$

Removing the cap increases maximized variable profits for firms constrained by $\bar{K}$

Complementarity and Employment

- Decompose the labor variation upon market structure changes as follows
 - Labor responses to increases in number of competitors
Peters, (2022) ; Edmond, Midrigan and Xu, (2015)
 - Labor responses to Δ in competitors in upstream sectors.
The direction depend on the elasticity of substitution η_s

Illustration with Homogeneous Firms:

$$\hat{L}_i^s = \underbrace{\widehat{\text{Rev}}_s}_{\text{Scale}} - \underbrace{(\eta_s - 1) s_s^m \left[\Omega \Psi \left(\frac{1}{\gamma - 1} I + \Gamma \right) \hat{\mathbf{N}} \right]_s}_{\text{Network substitution}} + \underbrace{\Gamma_s \hat{N}_s}_{\text{Competition}} .$$

Calibration

Calibration Is Sector Specific: Many products in a sector

Parameters

- Each 3-digit affected sector s contains:

Reserved branch R and Never-Reserved branch U .

- Sector-specific objects:

η_s , $Input - Output$, market size, firm distribution.

- The Never-Reserved branch disciplines the undistorted equilibrium within sector s .
- The Reserved branch is subject to

$$K_i \leq \bar{K}.$$

- Remaining parameters reproduce pre-policy differences between the two branches.

Calibration: reproduces the pre-dereservation equilibrium.

Costs

Directly from data

- Input-output shares

$$\omega(s, s')$$

- Capital restriction

$$\bar{K}$$

- Sector size and expenditure shares

Estimated externally

- Labor-material elasticity

$$\eta_s$$

- Demand elasticity

$$\gamma = 6 \quad ; \quad \theta = 1.25$$

- Input Substitution

$$\kappa = 2.5$$

Internally calibrated

- Demand / competition parameters

- Operating costs

$$f^R, f^U$$

- Entry cost

$$\mathcal{F}^R$$

- Productivity parameters

Assumptions

Sector level pareto productivity distribution + Perfectly elastic labor supply elasticity

Disciplining the Model: Entry and Expansion

- **Expansion:** Disciplined by distortion size in affected sectors (Cap severity)
 - Follow **Hsieh and Klenow (2009) logic:**
 - Baseline MRPK uncapped/capped ratio in same 3-digit sector to calculate distortion size.
 - Model targets a 1.20 ratio in data. Attains 1.19 [Details](#)
- **Entry:** Entrants share productivity distribution of incumbents. [Details](#)
- **Productivity:** Disciplined by market share distribution within sectors and HHI.
- **Demand and Capital shifters:** Reserved sectors relative size and capital units.
- **Sunk and Operational Costs:** Operating costs are disciplined by incumbents; sunk costs by potential entrants' non-entry under the cap. [Details](#)

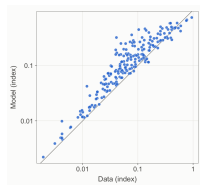
Calibration Results

Calibration Fit – Concentration Moments

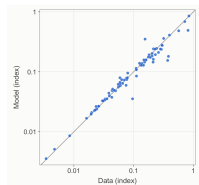
Calibration Fit

HHI

Never Reserved



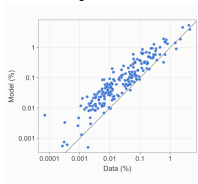
Reserved



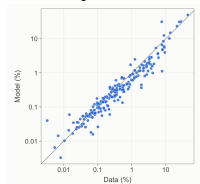
Market Shares

Never Reserved

p25

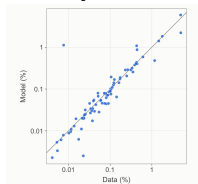


p75

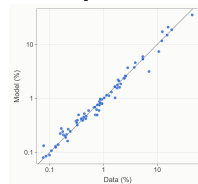


Reserved

p25



p75



Targeted Moments

Moment	Sectors	Data	Model
Eligible-to-unrestricted capital, K_R/K_U	106	0.17	0.17
Eligible bunching share, $K_i^{\text{total}} \in [\text{Rs } 8\text{m}, \text{Rs } 10\text{m}]$	108	0.03	0.06
Desired-to-observed capital, binding R firms	61	1.19	1.20

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Untargeted Moments

	Data	Model
<i>1. Incumbent expansion at the cap</i>		
$\Delta \log K$, capped firms	0.178	0.132
<i>2. Entrant capital, multiple of the cap $\bar{K}$</i>		
Median, entrants above $\bar{K}$	3.33	3.20
p25 / p75	1.94 / 8.63	1.77 / 6.46

Counterfactuals

Dereservation Policy: Removal of $\bar{K}$

Two expected effects:

1. Expansion by capped firms close to $\bar{K} \rightarrow$ Higher output, lower prices.

Expansion Validation

2. Re-optimization by entrants that can use now efficiently

- Lower output and materials prices due to increased competition
- Entrants range from 1-36 across all reserved sectors
- Capped vs Uncapped profits

Effects on Prices

Entry Validation

Entrants Profits

Decomposition of the Industrial Policy Effects on Employment:

Within group effect per 100 jobs created in deregulated lines

Within %

	Scale	Markup	Complementarity	Total
<i>Deregulated</i>				
$\eta < 1$	+67.1	+8.8	+2.5	+78.4
$\eta > 1$	+18.8	+3.1	-0.2	+21.6
All	+85.9	+11.9	+2.3	+100.0
<i>Never-reserved</i>				
$\eta < 1$	-54.9	0.0	+13.5	-41.4
$\eta > 1$	-11.3	0.0	-2.1	-13.4
All	-66.2	0.0	+11.4	-54.8
Net	+19.6	+11.9	+13.7	+45.2

- Per 100 jobs created in deregulated lines, **45** survive economy-wide

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- In directly affected sectors, employment gains are **dominated by scale effects**
- The **markup channel** is relevant, but smaller than the **scale effect**

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- Complementarity gives back **11** out of **54.8** → **30%** of the net effect

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- **Complementarity** > **Markup** channel

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- Never-reserved lines shed **66** → complementarity gives back **11**
- Complementarity → **30%** of the net effect
- Driven by the technology distribution in the economy
- Complementarity > Markup channel
- **83%** of the complementarity contribution arises outside the deregulated sectors

Experiments: Complementarity Component per 100 jobs created in deregulated lines

By Group

Baseline

- For every 100 jobs created in deregulated lines, **45** survive economy-wide
- **Complementarity** adds **14** jobs

	Net	Complementarity
Baseline (estimated η)	+45.2	+13.7
$\eta = 0.70$	+65.5	+37.1
$\eta = 0.85$	+49.8	+19.0
$\eta \rightarrow 1$	+33.2	0.0

Experiments: Complementarity Component per 100 jobs created in deregulated lines

By Group

Net effect

- Baseline: 45 jobs survive economy-wide
- Homogeneous $\eta = 0.7 \rightarrow$ **45% too large**

	Net	Complementarity
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Experiments: Complementarity Component per 100 jobs created in deregulated lines

By Group

Net effect

- Homogeneous $\eta = 0.7 \rightarrow 45\%$ too large
- Pooled $\hat{\eta} = 0.85 \rightarrow 10\%$ too large

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Experiments: Complementarity Component per 100 jobs created in deregulated lines

By Group

Net effect

- Pooled $\hat{\eta} = 0.85 \rightarrow$ **10% too large**
- Homogeneous $\eta = 1 \rightarrow$ **27% too small**
- The rest of manufacturing loses **67** jobs

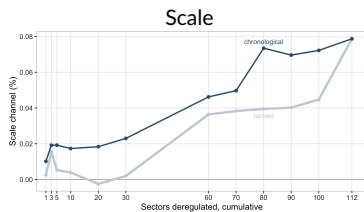
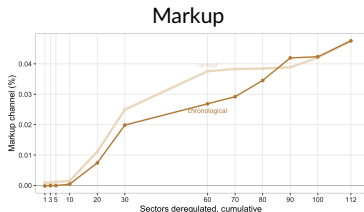
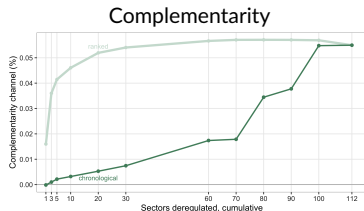
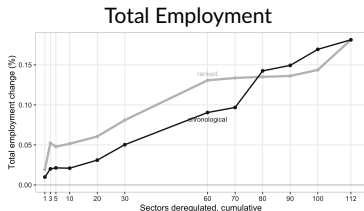
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- I build a rank variable $Compl_s$ Revenue-weighted, network-propagated sum of $(1 - \eta)$ across every sector s' reached by sector s
- The rank accounts for
 - the sectors reached Size ϑ + Network position $\mathcal{L}$ + the sectors reached Technology $(1 - \eta)$
- Higher $Compl_s \rightarrow$ First deregulated in the counterfactual

$$Compl_s = \left[\mathcal{L} (\vartheta \odot (1 - \eta)) \right]_s, \quad \mathcal{L} = (I - W'M)^{-1}$$

$$W_{ss'} = \frac{\omega_{ss'}}{\sum_{s''} \omega_{ss''}}, \quad \vartheta_s = \frac{Rev_s}{\sum_{s'} Rev_{s'}}, \quad M_s = \frac{Mat_s}{Rev_s}$$

Sequential Deregulation - Effects on all sectors



- Complementarity mechanism explains between 30-85% of the total effect.
- 10 well-chosen sectors deliver what 30 historically-ordered sectors delivered.
 - The gap is mostly in the complementarity channel.

Compl. Share

Conclusions

- Pro-competition policy affects employment beyond the markets it directly deregulates.
- **Technology determines what happens to employment when shocks arrive.**
 - Cheaper materials raise labor demand in complementary sectors; reduce it in substitute.
- Complementarity accounts for about **one third** of the aggregate employment effect.
 - **83%** of its aggregate contribution arises outside directly deregulated sectors.
- Complementarity mechanism is more important than reduction in markups.
- Policy makers should consider not only I/O position but also technology of the **sectors reached.**

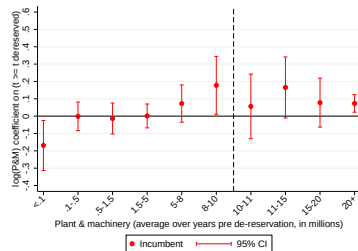
Appendix

Appendix: Calibration and Model Diagnostics

Incumbent Expansion

Back

- Pooled effect on capital of pre-policy binding firms.
(Same specification as in Martin Netarajaj and Harrison, 2017)
- Average post-policy expansion of 17.4%
(Firms in the [8M-10M] bin)
- Disciplines incumbents' expansion.
- In the model, we assume that firms in the [8M-10M] plant and machinery capital bin, are constrained by the cap.



Appendix: Parameter estimates

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Parameter	Source / target	Value	Dispersion
<i>Panel A. Fixed or externally estimated</i>			
γ within-sector elasticity	set	6	—
θ across-sector elasticity	set	1.25	—
κ input-substitution elasticity	Peter & Ruane	2.5	—
α_K capital share	MRPK = r on U firms	0.10	sector IQR [0.04, 0.17]
r rental rate	set	0.10	—
$\bar{K}$ statutory cap	policy	₹10m	—
η_s labor–materials elasticity	sector IV	med. 0.94	range [0.39, 1.33]
$\omega(s, s')$ IO shares	input expenditure	—	3-digit
<i>Panel B. Internally calibrated, per sector ($n = 113$ reserved-branch sectors)</i>			
ξ_s Pareto shape	U quantiles + HHI_U	med. 4.58	IQR [3.47, 5.56]
σ_s R-type advantage	HHI_R , R quantiles, τ	med. 0.336	IQR [0.26, 0.41]
β_s labor share in bundle	factor shares	med. 0.088	IQR [0.06, 0.12]
A_s, δ_s demand shifters	sector sales, R/U share	exactly identified	—
f_s^R, f_s^U operating costs	incumbent survival	interval	—
$\mathcal{F}_s^R$ entry cost	revealed preference, position 0.10	interval	—
$(K^*/\bar{K})_s$ cap severity	implied; target $\tau = 1.20$	med. 1.04	IQR [1.01, 1.19]

	What it equals	Median	IQR
<i>Identified as bounds, not fitted</i>			
f_s^R	gross profit of the marginal R incumbent	1.1×10^{-6}	$[2.5 \times 10^{-7}, 1.5 \times 10^{-5}]$
f_s^U	gross profit of the marginal U incumbent	4.0×10^{-5}	$[1.8 \times 10^{-5}, 1.2 \times 10^{-4}]$
$\mathcal{F}_s^R$	$\underline{\mathcal{F}} + 0.10 (\overline{\mathcal{F}} - \underline{\mathcal{F}})$	1.3×10^{-3}	$[3.8 \times 10^{-4}, 3.3 \times 10^{-3}]$
<i>Unit-free ratios</i>			
$\mathcal{F}^R / f^R$	sunk cost vs marginal operating cost	952	[96, 6,210]
f^R / f^U	reserved vs never-reserved operating cost	0.028	[0.006, 0.19]
$\overline{\mathcal{F}} / \underline{\mathcal{F}}$	width of the entry-cost interval	1.12	[1.00, 1.62]

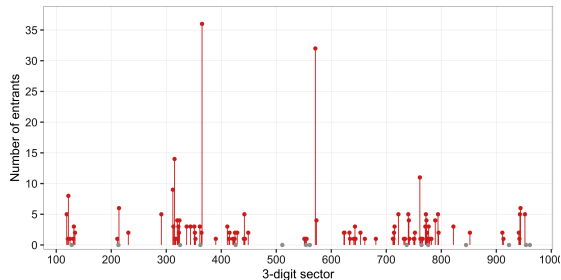
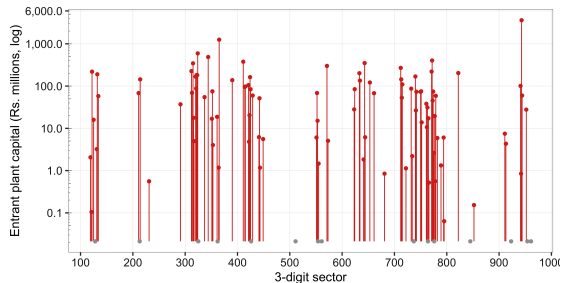
Moment	Data	Model	Corr.
<i>Targeted</i>			
HHI, reserved ($n = 113$)	0.230	0.222	0.98
HHI, never-reserved ($n = 236$)	0.171	0.213	0.94
Share quantiles, reserved p25 / p50 / p75	—		0.90 / 0.98 / 0.99
Share quantiles, never-reserved p25 / p50 / p75	—		0.92 / 0.96 / 0.96
Aggregate capital	matched exactly		$ \log \text{gap} < 10^{-15}$
Cap severity $K^*/\bar{K}$, binding firms ($n = 61$)	1.20	1.19	—
<i>Untargeted – out-of-sample</i>			
Entrant capital above $\bar{K}$, median multiple	3.33	3.20	—
p25 / p75	1.94 / 8.63	1.77 / 6.46	—
Incumbent expansion at the cap, $\Delta \log K$	0.178	0.106	—
Bunching share, $K \in [8m, 10m]$	0.031	0.061	—
Share of entrants above $\bar{K}$	30%	61%	—

Where entrant productivity comes from

Potential entrants are placed on the **incumbent** productivity distribution, preserving their within-pool ranking:

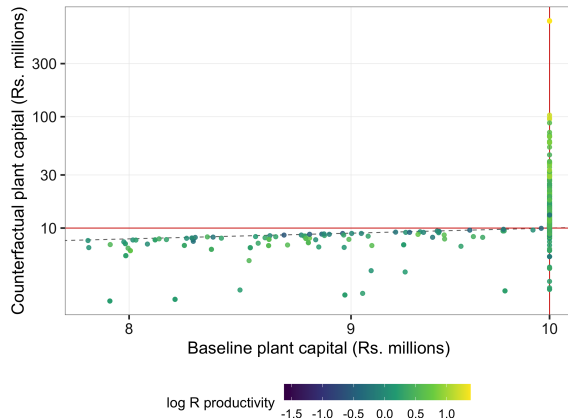
$$z_{(i)}^E = F_{z, \text{incumbent}}^{-1}\left(\frac{i - 0.5}{N^E}\right), \quad i = 1, \dots, N^E$$

Removing Cap $\bar{K}$ - Entry Diagnosis

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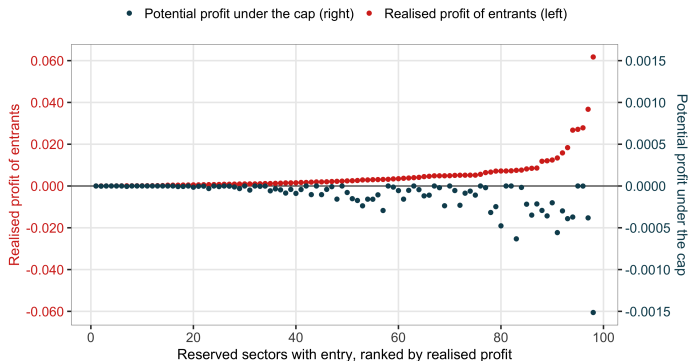
- Non negligible intensive and extensive entry margin.
- Entrants range from 1 to 36 across all reserved sectors.

Removing Cap $\bar{K}$ - Expansion Diagnosis

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- Model generates expansion in a set of previously capped firms.
- Interaction with entry generates some firms in the cap to reduce the capital holdings

Removing Cap $\bar{K}$ - Net Profits Potential Entrants Diagnosis

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- Unfeasible entry in the baseline
- $\bar{K}$ removal $\longrightarrow$ set of potential entrants overcome sunk costs and enter

Appendix: Identification

Identification of Sunk Cost and operation costs

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- Entrants enter $\rightarrow$ Cournot Equilibrium $\rightarrow p, s$ and μ
- $\Pi^E = pq - f^R$ assuming capital restriction is on place.
- Entry sunk cost $>$ surplus of the most profitable potential entrant: $\bar{\Pi}^E$
- Sunk cost lower bound $= \bar{\Pi}^E + \varepsilon = \underline{\mathcal{F}}^E(s)$
- Upper bound ($\bar{\mathcal{F}}^E(s)$) $\rightarrow$ Similarly but assuming no capital restriction.
- The final $\mathcal{F}^E(s) = \underline{\mathcal{F}}^E(s) + 0.1 \left(\bar{\mathcal{F}}^E(s) - \underline{\mathcal{F}}^E(s) \right)$. Also sensitivity checks in the 0.1.

Identifying cap severity from MRPK

labelapp:HK_{logic}

Pair Reserved and Never Reserved branches of the same 3-digit sector

- Follow Hsieh and Klenow (2009) logic:
 - Uncapped case: firms optimize at $MRPK = r$. **Never-reserved firms.**
 - Capped case, we have $MRPK(\bar{K})$. **Reserved firms.**
 - Only consider firms with $K \in [8M \ 10M]$

$$r = MRPK(\bar{K}) \times \left(\frac{K^*}{\bar{K}}\right)^{\frac{-1}{1-\alpha}} \implies \frac{K^*}{\bar{K}} = \left(\frac{MRPK(\bar{K})}{r}\right)^{1-\alpha}$$

Measurement

$$\hat{\tau}_s = \left(\frac{\widehat{r}}{MRPK(\bar{K})}\right)_s = \frac{\text{med}\{MRPK_i : i \in \mathcal{R}_s, K_i \in B\}}{\text{med}\{MRPK_j : j \in \mathcal{U}_s, K_j \in B\}}, \quad \hat{\tau} = \text{med}_s \hat{\tau}_s$$

Model targets $\hat{\tau} = 1.205$, attains 1.187

Identification of sunk and operation costs

Sunk Costs

Operating Costs

- Only entrants pay sunk costs
- Entrants and Incumbents pay operation costs.
- Sunk cost is such that potential entrants would not enter in a capped economy.
- Operation costs are identified in the incumbent-only baseline.
- Minimum cost such that every observed incumbent in R and U stay in the market

- Largest cost consistent with every observed **R** incumbent continuing
- Largest cost consistent with every observed **U** incumbent continuing
- In the baseline, I assume that incumbents already paid the one-shot sunk cost

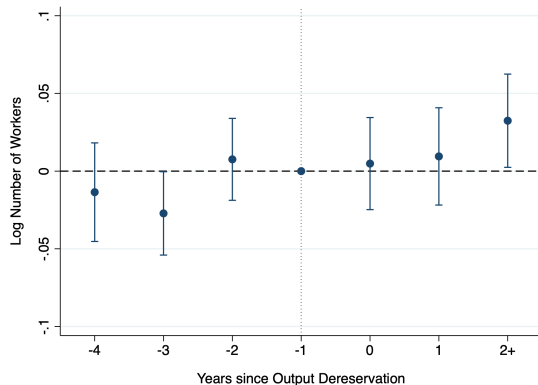
Appendix: Empirical Results

Output dereservation $\longrightarrow \downarrow$ Markup $+$ $\uparrow$ Labor

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Static Effects on Product-Level Markups

	Output Dereservation
	$\ln(\mu)$
Post Output Dereservation	-0.077** (0.034)
Observations	214,294
Pre-trends F-stat	1.84
Pre-trends p-value	0.117



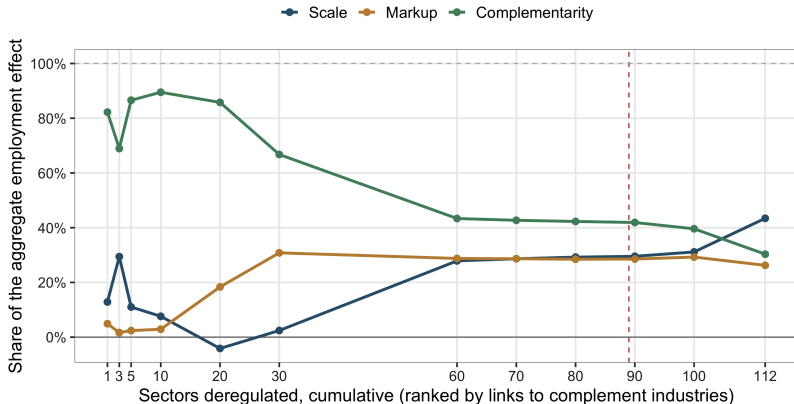
$$\log \mu_{ijt} = \beta Post_{jt}^O + \sum_{k=2}^{5+} \gamma_{-k} D_{jt}^{O,-k} + \mathbf{X}'_{ijt} \theta + \alpha_j + \delta_{s(j),t} + \varepsilon_{ijt}$$

$$\log L_{it} = \beta Post_{jt}^O + \sum_{k=2}^{5+} \gamma_{-k} D_{jt}^{O,-k} + \mathbf{X}'_{it} \theta + \alpha_i + \delta_{s(i),t} + \varepsilon_{it}$$

Appendix: Decomposition and Experiments

Sequential Deregulation - Relative importance of Complementarity Channel

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- Complementarity plays an important role when policy is not simultaneous.
- Explains between 30-85% of the total effect.

Entry and expansion: separate effects on prices and markups

		Expansion	Entry
Total	Output price	-0.03	-0.85
	Materials price	-0.02	-0.56
	Markup	0.00	-0.04
Reserved	Output price	-0.32	-6.96
	Materials price	-0.04	-1.20
	Markup	-0.01	-0.57
Never-reserved	Output price	-0.01	-0.43
	Materials price	-0.02	-0.51
	Markup	0.00	0.00

- Entry is the dominant mechanism
- Reserved sectors:
 - ↓ 7% Output price
 - ↓ 1.2% Materials price
- Never Reserved sectors – Network propagation:
 - ↓ 0.43% Materials price
 - ↓ 0.51% Materials price

Experiments: Complementarity Component by Group

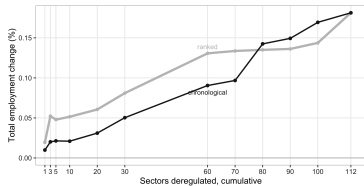
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Employment effect and its complementarity component, by branch (direct effect = 100)

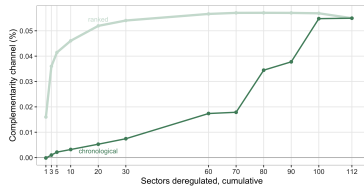
	Total	Complementarity
<i>Baseline (estimated η)</i>		
Deregulated	+100.0	+2.3
Never-reserved	−54.8	+11.4
Net	+45.2	+13.7
<i>direct</i>	0.401 pp; aggregate 0.181 pp	
$\eta = 0.70$		
Deregulated	+100.0	+5.8
Never-reserved	−34.5	+31.3
Net	+65.5	+37.1
<i>direct</i>	0.415 pp; aggregate 0.272 pp	
$\eta = 0.85$		
Deregulated	+100.0	+3.0
Never-reserved	−50.2	+16.1
Net	+49.8	+19.0
<i>direct</i>	0.404 pp; aggregate 0.201 pp	

- η changes the aggregate almost entirely through what happens outside the deregulated sectors.
- Consistent with the economy wide contribution discussed before
- Economy-wide effects are sensitive to what happens outside the deregulated sectors.
- Assumptions on η meaningfully change the results!

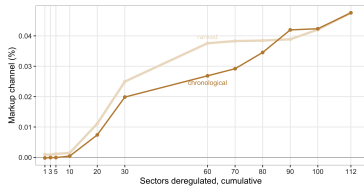
Chronological Deregulation - Effects on all sectors

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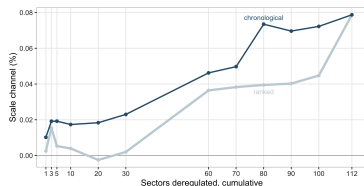
Total Employment



Complementarity



Markup



Scale

- 10 well-chosen sectors deliver what 30 historically-ordered sectors delivered.
- The gap is mostly in the complementarity channel.

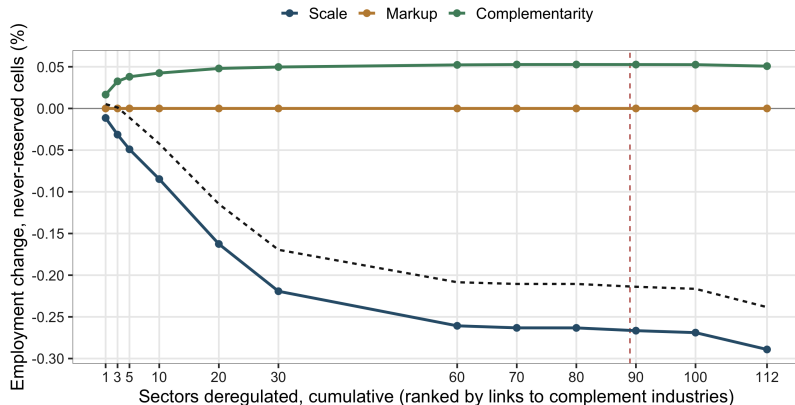
Decomposition of the Industrial Policy Effects on Employment:

Within group effect

	Scale	Markup	Complementarity	Total
<i>Reserved</i>				
All	+3.55	+0.50	+0.09	+4.15
<i>Never-reserved</i>				
All	-0.29	0.00	+0.05	-0.24
Total	+0.08	+0.05	+0.05	+0.18

- Dereserved sectors ↑ employment 4%
Represent 6% of manufacturing revenue
- Never-regulated sectors ↓ employment -0.24%
- Complementarity acts as a 'cushion' mechanism in **never affected sectors**.
Compensates 20% of total negative effect
- Total aggregate = +0.18% of agg. empl.
Large gain on a few sectors, small loss on a large base

Sequential Deregulation - Effects on never regulated sectors



- In never affected sectors → Cushion mechanism
- Loses through scale are compensated by the complementarity mechanism.