Minimum Wage, Business Dynamism, and the Life Cycle of Firms

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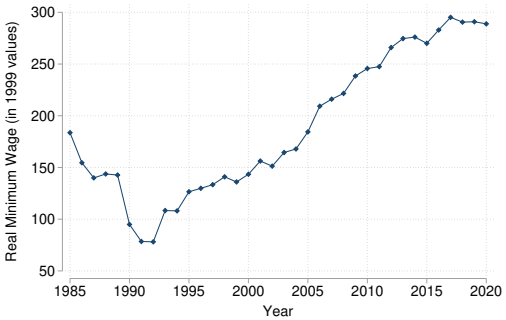
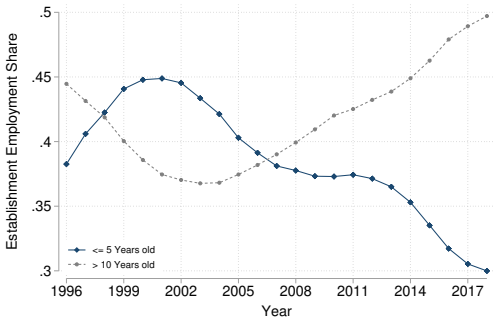
EEA-ES Summer Meetings 2024

The work was financed with the support of the Inter-American Development Bank. The views and findings expressed here are those of the authors' and do not necessarily reflect the views of the IDB, the Federal Reserve Bank of Cleveland, the Federal Reserve System, or the IMF.

Minimum Wage and Firms in Brazil





- Sharp rise of minimum wage (left) along with reallocation of labor from young to old plants (right)
- Emerging market: large share of population makes MW (35-40%), large informal sector

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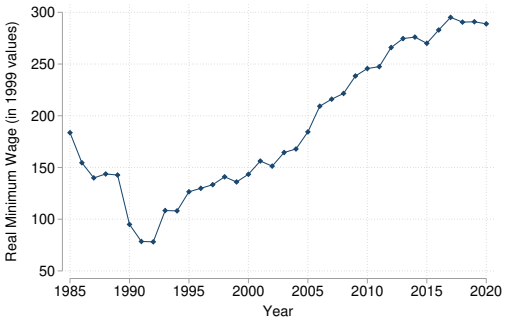
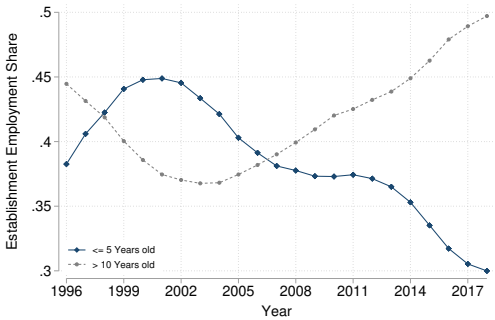




- Sharp rise of minimum wage (left) along with reallocation of labor from young to old plants (right)
- Emerging market: large share of population makes MW (35-40%), large informal sector
- **Question:** What is the impact of the minimum wage on the **life cycle of firms**?

Entry Rates | Informality Trends

Paper in One Slide

- **Theory**:
  - Monopsonistic model of heterogeneous firms w/ investment in innovation and sectoral choice
  - *Reallocation effect*: MW reallocates labor from young/small firms to old/large firms
  - *Life cycle effect*: MW slows down growth of young/small firms
- **Empirics**:
  - Estimate impact of MW exposure of firm outcomes in Brazil
  - Administrative and Census data, focus on long differences
- **Results**: A MW hike is associated with
  - $\downarrow$ growth of rate of establishments: $\downarrow$ small/young, $\uparrow$ large/old
  - $\uparrow$ probability of exit and informality
  - $\uparrow$ earnings of formal *and* informal workers

Literature

Simple Model

Framework

- Household: provides labor to all firms j
  - CES preferences over firms $\Rightarrow$ labor market power (Berger, Herkenhoff and Mongey, 2023)
    HH problem
- Heterogeneous firms: hire labor (monopsony) to competitively produce a final good
- **Sector choice**:
  - **Formal Firms**: subject to minimum wage and taxes
  - **Informal Firms**: face a convex and increasing cost of labor (Ulyssea, 2018)
- **Dynamic decision**: pay a cost to improve their productivity next period

Simple Model: One market, Static, No Minimum Wage

- **Informal Firms**:

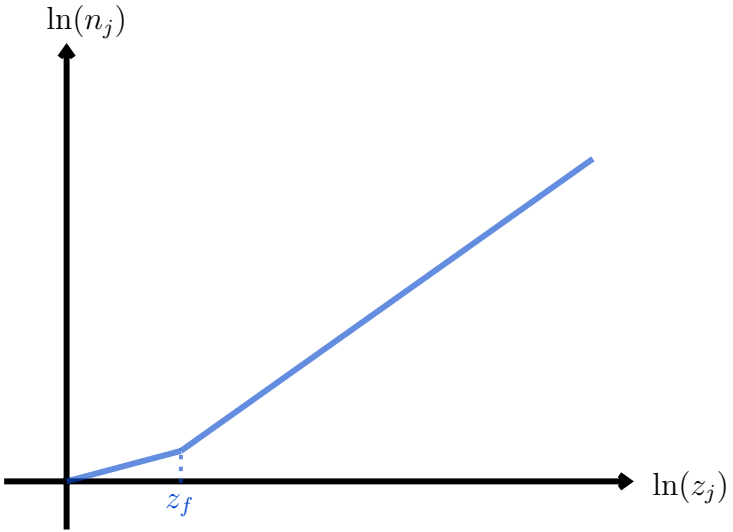
$$\pi_I(z_j) = \max_{n_j} \quad \left\{ z_j n_j^{\alpha} - w_j n_j^{1+\phi} - \kappa \right\} \quad \text{s.t.} \quad w_j = \left(\frac{n_j}{N} \right)^{1/\theta} W$$

- **Formal Firms**:

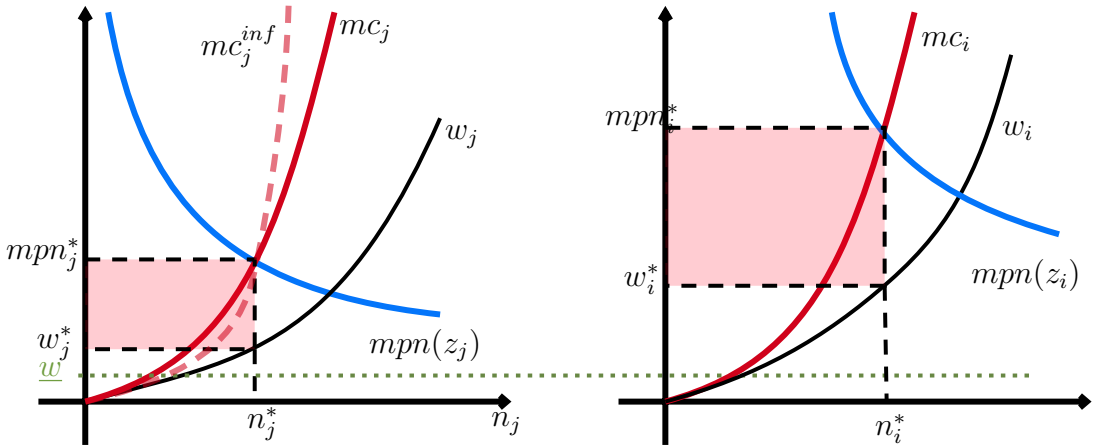
$$\pi_F(z_j) = \max_{n_j} \quad \left\{ z_j n_j^{\alpha} - (1+\tau_w) w_j n_j - \kappa \right\} \quad \text{s.t.} \quad w_j = \left(\frac{n_j}{N} \right)^{1/\theta} W$$

- There exists z_f, such that a firm with $z_j \geq z_f$ chooses to formalize. Model with MW

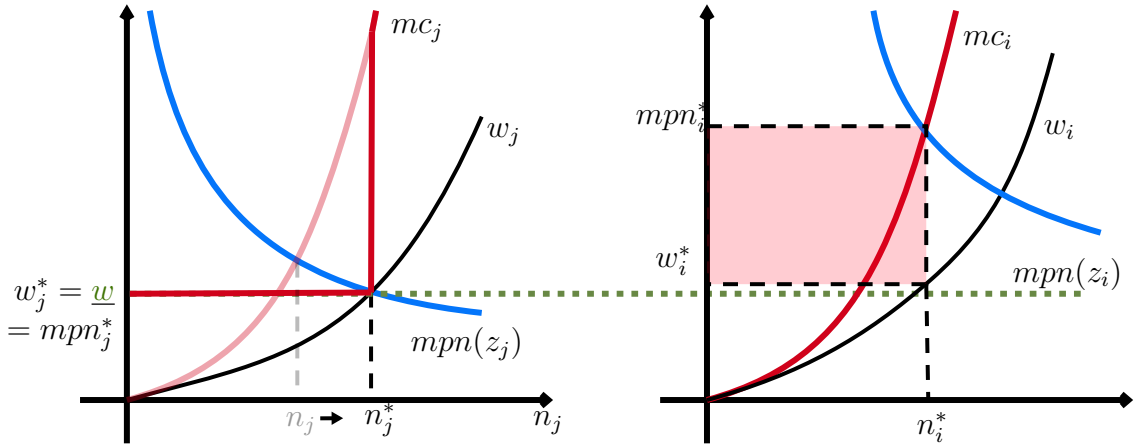
Equilibrium Without Minimum Wage



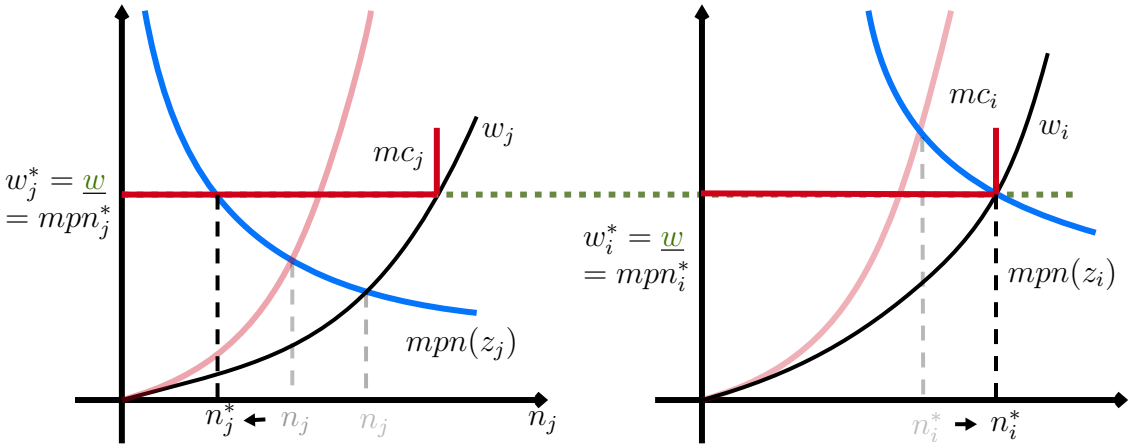
Minimum Wage does not Bite



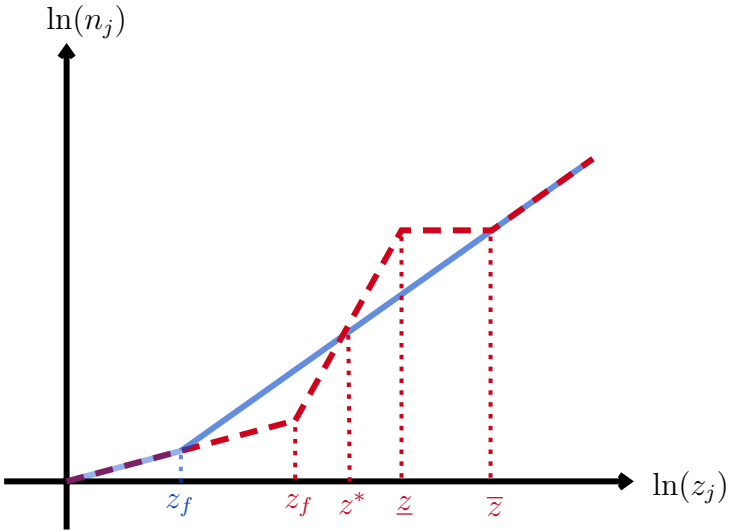
Minimum Wage Bites Firm j



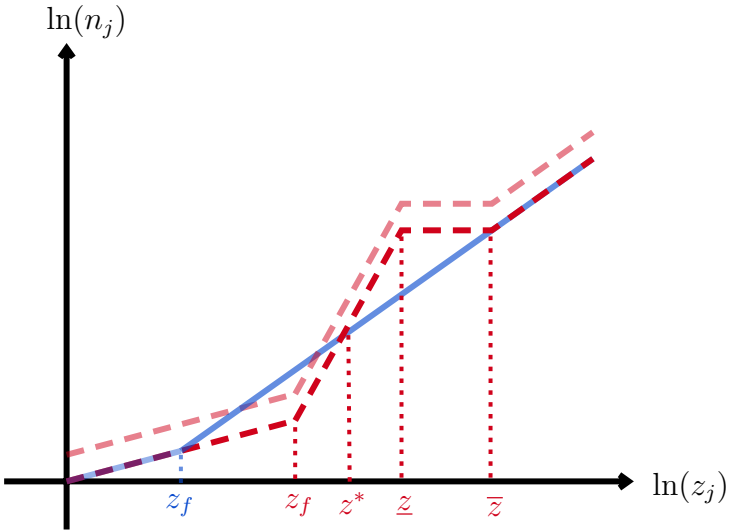
Minimum Wage Bites both Firms



Equilibrium *With* Minimum Wage



Equilibrium *With* Minimum Wage + GE ($\uparrow N^{\frac{1}{\theta}}/W$)



Introducing Dynamics: 2 Period Investment Decision

- Firms can pay a cost $z^{\psi}c(p)$ to increase z by a factor λ with probability p
- The value function of a firm operating in the formal sector:

$$V_F(z) = \max_{p \in [0,1]} \pi_F(z) - z^{\psi}c(p) + \beta \left[p\pi_F(\lambda z) + (1-p)\pi_F(z) \right]$$

- Optimal innovation decision with a minimum wage:

$$z^{\psi}c'(p^*) = \beta \left[\pi_F(\lambda z; \overline{w}) - \pi_F(z; \overline{w}) \right]$$

- Changes in $\overline{w}$: affect the incentives to grow by changing future profits (level *and* slope)

Proposition: Expected Growth Rates

- Define expected growth rate of employment:

$$g_n(z;\overline{w}) = \mathbb{E}_t\left[\frac{n_{t+1}-n_t}{n_t}\right] = p^*(z;\overline{w})\frac{n(\lambda z;\overline{w})-n(z;\overline{w})}{n(z;\overline{w})}$$

- Suppose there is minimum wage $\overline{w} > 0$ and solution is interior for fixed aggregates W, N
- Young, low productivity firms **grow slower**: $\frac{\partial g_n(z;\overline{w})}{\partial \overline{w}} \begin{cases} = 0 & \text{if } z \geq \overline{z}, \\ = 0 & \text{if } z, \lambda z \in (\underline{z}, \overline{z}), \\ < 0 & \text{if } z, \lambda z \in (z_f, \underline{z}). \end{cases}$
- **Intuition**: small firms are the most affected by MW (lose all mkt power)
  - Profits: lower in level *and* grow more slowly with productivity
  - Lower future profits = lower benefit from innovation

Empirical Evidence

Empirical Strategy

- **Data**:
  - RAIS (1995-2018): panel of formal private plants (matched employer-employee), including plant features (wage, location, size, age, ...)
  - Census (2000, 2010): worker characteristics, employment & wages in informal sector
- **Strategy**: Long-run exposure to a decade of increase of the MW (1999-2010)
  - MW in Brazil is decided year-by-year $\Rightarrow$ predictable in the context of high inflation
  - The 11-year increase in the *real* MW is unlikely to be predicted by a firm in 1999
- Two approaches: plant level and municipality level

Plant-level Approach

- Plant j's exposure to the minimum wage between 1999 and 2010

$$\text{GAP}_j = \frac{\sum_{i \in j} \max\{0, \text{MW}_{2010} - w_{i,1999}\}}{\sum_{i \in j} w_{i,1999}}$$

- **Intuition**: increase in wage bill required to bring all workers up to the minimum wage
  - Note: between 1999 and 2010
  - Long gap $\Rightarrow$ no stickyness, harder to predict
  - Interpret as average long-run gap
- **Two margins**: many workers below MW; some workers *significantly* below MW

Summary Stats

Plant-level Approach

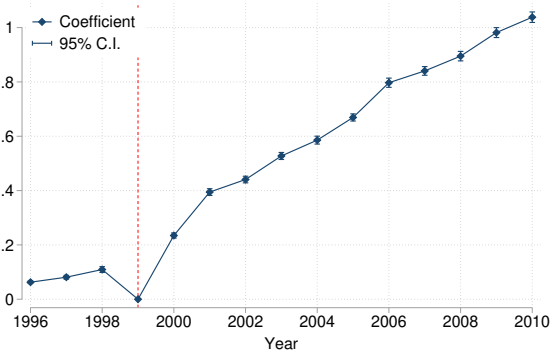
- Restrict to plants that had at least one employee in 1999; track their outcomes in the following years

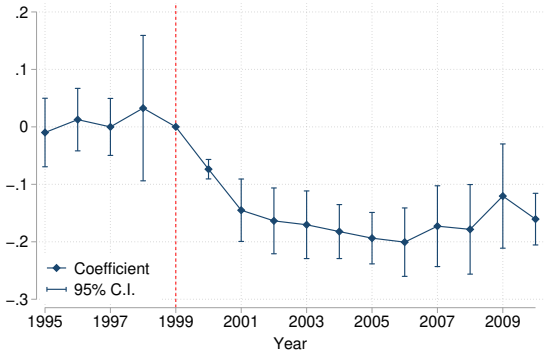
$$\frac{y_{jt} - y_{j1999}}{y_{j1999}} = \alpha_t + \beta_t \text{GAP}_j + \gamma_t X_{j1999} + \varepsilon_{jt} \tag{1}$$

- X_{j1999}: plant-level characteristics:
  - Interaction of industry-region-size-age fixed effects
  - Average wage (cubic polynomial)
  - Pre-1999 wage growth

Wage Growth and Employment Decline in Exposed Plants

Figure: Coefficients β_t: Wage (left) and Employment Growth (right)

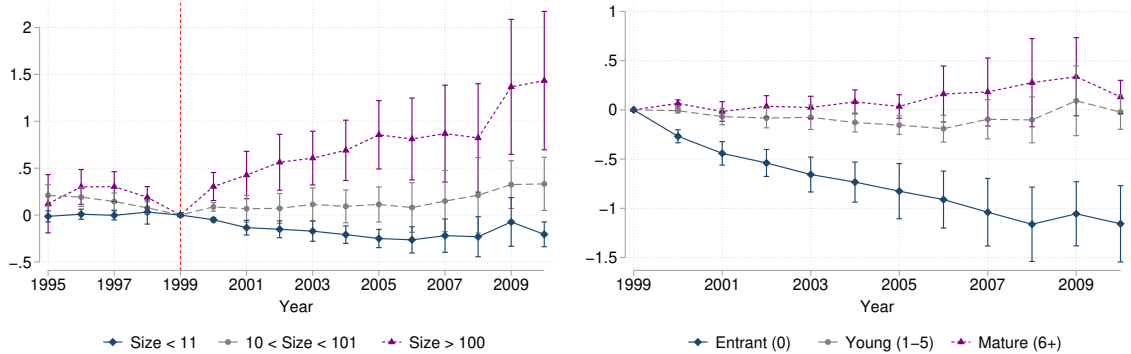




Intensive vs. Extensive

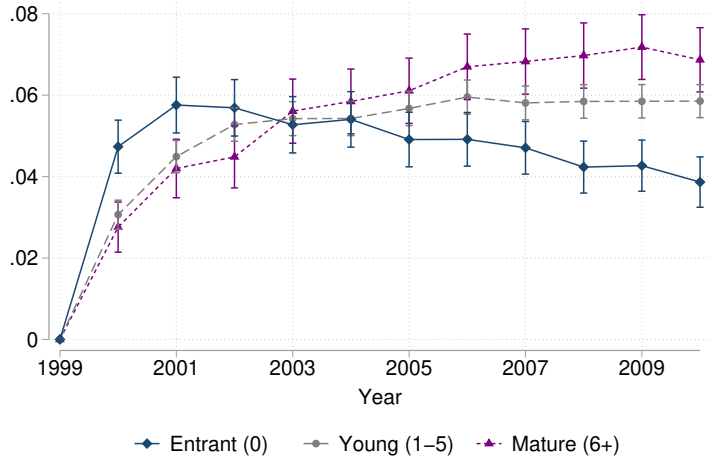
Labor is Reallocated to Large/Old Plants

Figure: Incumbents' Employment Growth by Size and Age



Young Plants More Likely to Exit in the Short Run

Figure: Exit Probability by Age



Region-level Approach

- **Plant-level approach**: formal & incumbent firms: misses entry, informality, and GE
- **Region-level approach**: local labor market (municipality) exposure

$$\text{GAP}_m = \frac{\sum_{i \in m} \max\{0, \text{MW}_{2010} - w^f_{i,1999}\}}{\sum_{i \in m} w^f_{i,1999} + \sum_{i \in m} w^i_{i,1999}}$$

  - Aggregate effects on wages and employment (local general equilibrium effects)
  - Reallocation to informality
  - Other effects driven by workers not employed in the formal labor market

Map

Region-level Approach

- Diff-in-diff specification, pre/post 2000 and 2010:

$$y_{jmt} = \alpha_m + \alpha_t + \beta \text{GAP}_m \times \text{Post}_t + \text{controls} + \varepsilon_{jmt} \tag{2}$$

  where y_{jmt} is the outcome of a firm/worker j, in municipality m, and time t

- Controls include:
  - Time-varying firm/worker-level characteristics (industry and demographic)
  - Municipality Income per capita in 2000 interacted with year FE

Region-level Approach: Firms

	(1) Share Entrants	(2) $\mathbb{P}$(Exit)	(3) $\mathbb{P}$(Age > 5)	(4) log(size)
GAP$_m \times 2010$	-0.0188	0.155***	0.325***	-0.335***
	(0.0290)	(0.0198)	(0.0614)	(0.0918)
Observations	4,707,558	4,707,558	4,707,558	4,707,558
Municipality FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes

SE Clustered at municipality
*** p<0.01, ** p<0.05, * p<0.1

Region-level Approach: Workers

	(1) $\mathbb{P}$(Informal)	(2) $\mathbb{P}$(Employer)	(3) $\mathbb{P}$(Unemployed)	(4) $\mathbb{P}$(Out of Lab Force)	(5) $\log(earn)$ Formal	(6) $\log(earn)$ Informal	(7) $\log(earn)$ Employer
GAP$_m \times 2010$	0.159***	-0.00884***	0.0481***	0.0268	0.892***	0.503***	0.119
	(0.0236)	(0.00241)	(0.00825)	(0.0174)	(0.0713)	(0.0505)	(0.210)
Observations	7,981,170	7,981,170	13,030,226	13,030,226	3,357,422	2,003,671	175,035
Municipality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SE Clustered at municipality
*** p<0.01, ** p<0.05, * p<0.1

Conclusion

- Using Brazil as a case study, **the minimum wage**:
  - Reallocates labor across plants
  - Disproportionally affects young/small firms
  - Slow down young firms' growth
  - Reallocates labor towards informality

    $\Rightarrow$ Allocative efficiency gains from MW in developing countries could be lower

- **Next Steps (suggestions?):**
  - Full model: go quantitative
  - Aggregate impacts of MW; what policies can undo negative effects?

Thank you!

Appendix

Literature

- **Monopsony Models of the Labor Market:**
  - Berger, Herkenhoff and Mongey (2023); Berger, Herkenhoff and Mongey (2022); Card et al (2018); Lamadon et al (2022); Engbom and Moser (2022); Haanwinckel (2020); Jarosch et al (2019); Manning (2011).
  - + informality/development: Amodio et al (2023); Meghir et al (2015); Parente (2023)

- **Empirical Minimum Wage Literature:**
  - Dustmann et al (2022); Harasztosi and Lidner (2019); Draca et al (2011); Card and Krueger (1994); Cengiz et al (2019); Aaronson et al (2012); MaCurdy et al (2015) Dube et al (2016);

- **Business Dynamism:**
  - Decker et al., (2016); Haltiwanger (2015); Calvino et al (2020); Criscuolo et al (2014); Akcigit and Ates (2021); De Loecker et al (2021)

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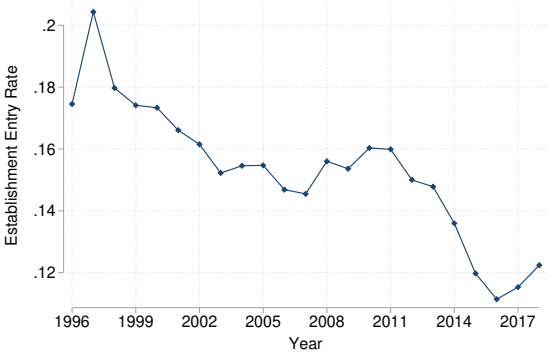
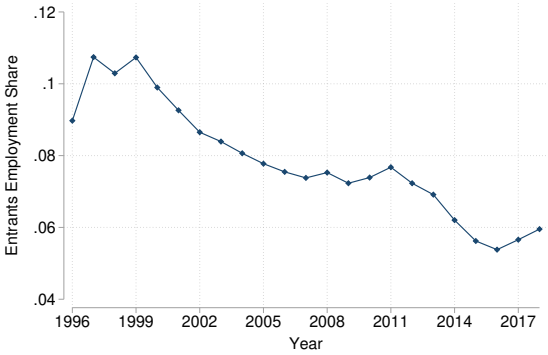
Decline in Entry in Brazil

Figure: Entry Rate (left) and Entrants Employment Share (right)





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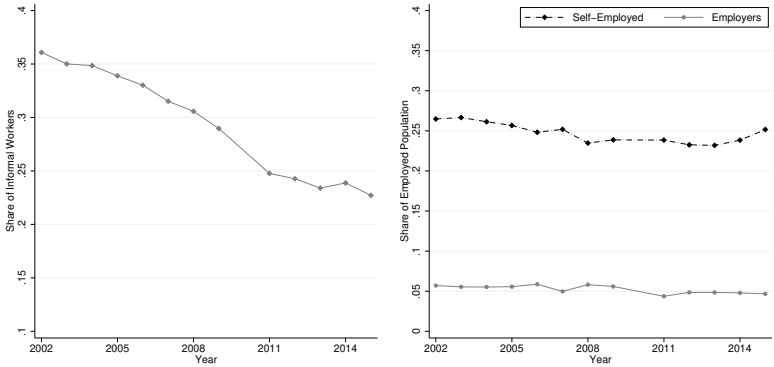
Informality Trends

Figure: Informality in Brazil: 2002-2015



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Labor Supply

- Representative worker maximizes consumption and has CES disutility for labor:

$$\max_{C,\{n_j\}_{j=1}^J} U(C,N) \quad \text{s.t.} \quad N = \left[\sum_{j=1}^{J} n_j^{\frac{1+\theta}{\theta}}\right]^{\frac{\theta}{1+\theta}} \quad \text{and} \quad C = \sum_{j=1}^{J} n_j w_j + \Pi + T,$$

- Labor supply of the representative worker to firm j:

$$n_j = \left(\frac{w_j}{W}\right)^{\theta} N,$$

where $\theta > 0$ is the elasticity of substitution between firms.

- As $\theta \to \infty$, the labor market tends to perfect competition.

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Sectoral Choice and Entry

- Informal firm's profit: $\pi_I(z_j) = z_j^{\frac{1/\theta+\phi+1}{1/\theta+\phi+1-\alpha}} \Pi_I(W,N) - \kappa$
- Formal firm's profit:

$$\pi_F(z) = \begin{cases} \pi_U(z) = z^{\frac{1/\theta+1}{1/\theta+1-\alpha}} \Pi_U(W,N) - \kappa & \text{if } z \geq \overline{z}, \\ \pi_{C,LS}(z) = z \left(\frac{\overline{w}}{W}\right)^{\alpha\theta} N^{\alpha} - (1+\tau)\overline{w}^{1+\theta} \frac{N}{W^{\theta}} - \kappa & \text{if } z \in [\underline{z}, \overline{z}), \\ \pi_{C,LD}(z) = z^{\frac{1}{1-\alpha}} \Pi_C(\overline{w}) - \kappa & \text{if } z \in (z_f, \underline{z}), \end{cases}$$

Hence:

- $\pi_F(z)$ grows faster than $\pi_I(z)$ when z increases. Thus, $\exists\, z^f$ such that all firms $z_j \geq z^f$ choose to formalize.
- $V(z) = \max\{V_I(z), V_F(z)\}$ is monotonically increasing in the firm's productivity, there will be a threshold, z_e, such that firms $z \geq z_e$ decide to operate.

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Simple Model with Minimum Wage $\overline{w}$

- Wage increases with firm productivity: very large firms ($z_j \geq \overline{z}$) are not directly affected by $\overline{w}$
- Affected formal firms solve

$$\begin{aligned} \max_{n_j} \quad & z_j n_j^{\alpha} - (1+\tau)\overline{w} n_j - \kappa \\ \text{s.t.} \quad & n_j = \min\left\{ \left(\frac{\overline{w}}{W}\right)^{\theta} N, \overline{n}_j \right\}, \end{aligned}$$

  where $\overline{n}_j = \left(\frac{\alpha}{\overline{w}} \frac{z_j}{1+\tau}\right)^{\frac{1}{1-\alpha}}$ is the competitive labor demand

- Firms now face a **rationing constraint**
  - Firms never hire more than $\overline{n}_j$ workers $\Rightarrow$ leads to negative profits
  - Households internalize this and ration their supply to each firm

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Cutoff for Unconstrained Firms

$$\overline{w} = w_U(\overline{z}) = \left[\left(\frac{\alpha\theta}{1+\theta} \frac{\overline{z}}{1+\tau} \right)^{\frac{1}{\theta}} \left(\frac{W}{N^{\frac{1}{\theta}}} \right)^{1-\alpha} \right]^{\frac{1}{1/\theta+1-\alpha}},$$

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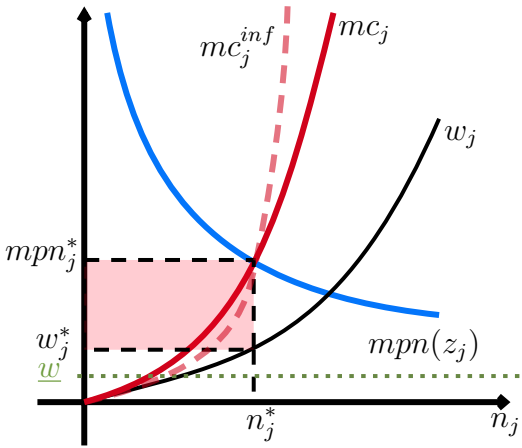
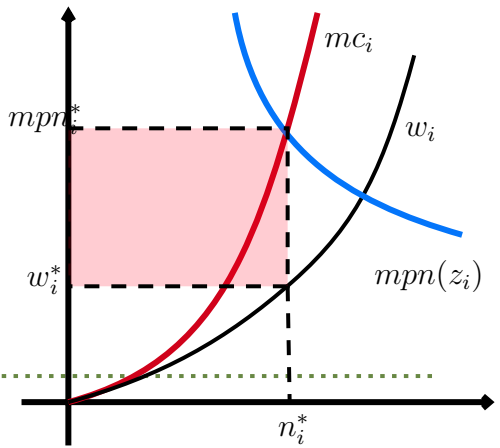
Minimum Wage does not Bite





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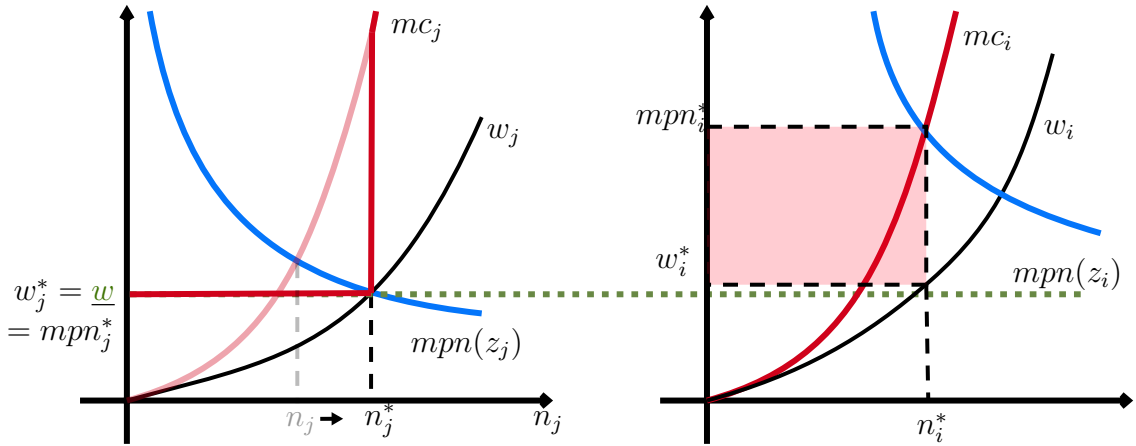
Minimum Wage Bites Firm j



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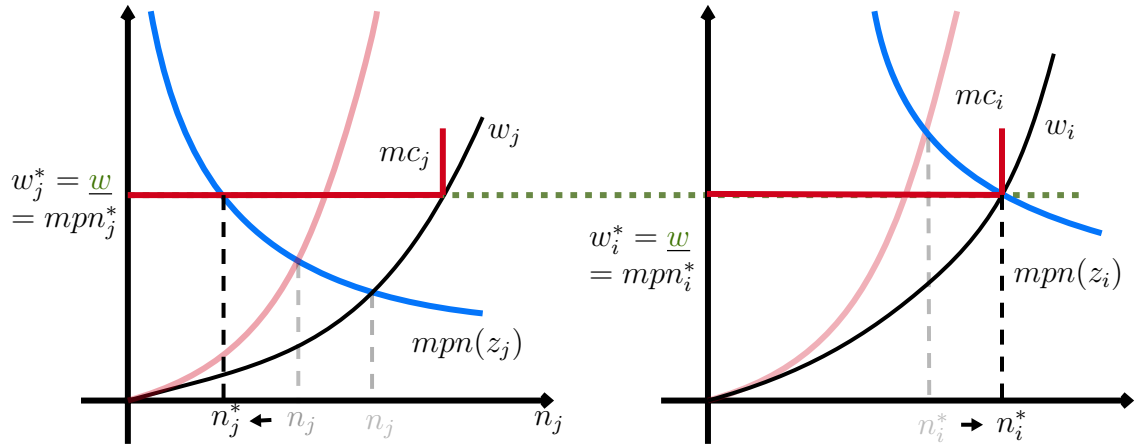
Minimum Wage Bites both Firms



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Entry Decision

- Infinite mass of potential entrants.
- Upon paying an entry cost they draw initial productivity from the distribution $G(z)$.
- After their draw, they decide whether to operate in the formal or informal sector.

$$c_e = \int \max\{V_F(z; \overline{w}), V_I(z)\} G(z) dz. \tag{3}$$

- Increase in the minimum wage, decline the value of being formal and decrease entry rates.

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Entry Decision

- Firms living in infinite periods.
- Can receive positive or negative productivity shocks $\lambda_H > 1$ and $\lambda_L < 1$.
- Value function of the formal firm:

$$V_F(z;\overline{w}) = \max_{p\in[0,1]} \pi_F(z;\overline{w}) - z^{\psi} b_1(\exp\{b_2 p\} - 1) + \beta \left[p\tilde{V}_F(z\lambda_H) + (1-p)\tilde{V}_F(z\lambda_L) \right],$$

$$\tilde{V}_F(z;\overline{w}) = \max\{V_F(z;\overline{w}), 0\}.$$

  where the max operator defines an exiting cutoff rule.

- Minimum wage hike decreases $\tilde{V}_F(z;\overline{w})$ and increases the exiting cutoff.

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Plant-level Approach

- Restrict to firms that had at least one employee in 1999 and follow the outcomes in the subsequent years.
  - On average, smaller and younger firms tend to be more exposed.

Table: Average GAP_j by selected characteristics.

	Avg. GAP	Observations
All Establishments	0.21	1,809,026
Age ≤ 5	0.24	1,070,155
Age > 5	0.16	738,871
Size ≤ 20	0.22	1,681,936
Size > 20	0.08	127,090

  - Pattern holds conditional on average wage.

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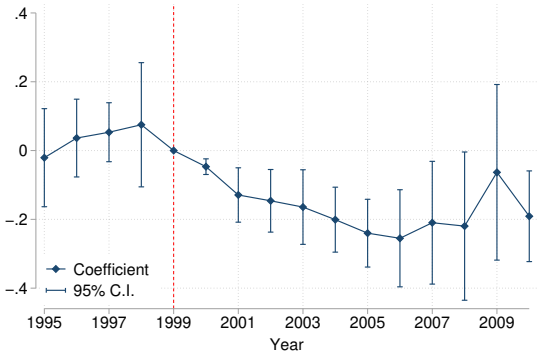
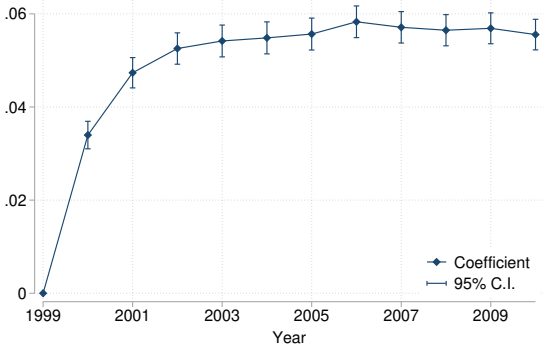
Both Margins are Important

Figure: Intensive vs Extensive Margin: Incumbents Growth (left) and Exit Probability (right)





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Gap: Large Cross-Section Variation

Closing gap increases average wage by 7.2%.

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