Trade, Labor Market Concentration, and Wages

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Motivation

- **Motivating evidence**: Trade ↓ wages in labor markets more exposed to import competition.
  - Contexts. India: Topalova (2010); Brazil: Kovak (2013); US: Autor, Dorn and Hanson (2013).
  - Magnitude. 5% to 25% depending on context and time frame.
  - Polarization. Brazil: Iacoella, Justino and Martorano (2020); US: Dorn et al. (2020).
- **Motivating question**: What accounts for these effects?
  - Hypothesis: Trade liberalization might increase firm labor market power.
- **Motivating theory**: Trade models with firm heterogeneity predict reallocation to larger, more productive, exporting firms (e.g., Melitz (2003)).
  - Increases labor market concentration
  - If labor markets are imperfectly competitive, two effects:
    - ↑ wages by reallocating precisely to higher-paying firms
    - ↓ wages by increasing firm labor market power
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2. **Empirics**: Identification strategy and estimation of sufficient statistics

3. **Implication** of effect of trade on labor market concentration to average wages

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   - Effect of trade on labor market concentration: β
   - Workers' cross-market inverse elasticity of substitution: $\frac{1}{\theta}$
   - Workers' within-market cross-firm inverse elasticity of substitution: $\frac{1}{\eta}$
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   - $\downarrow$ wages by increasing firm labor market power
   - $\uparrow$ wages by compositional reallocation to exporters

Preview of findings

Definition: A local labor market is a microregion $\times$ occupational group cell.

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2. Gap between workers' key elasticities of substitution

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3. Implication to average wages
   - Trade increases market power, further reducing wage take-home share
   - Effect large enough to offset all wage gains from reallocation to exporters...
   - ...but only accounts for 2% of overall 13.8% negative effect of trade on wages

Preview of findings: Key take-aways

1. **Firms do command substantial labor market power in Brazil...**
   - Contrast: 65 - 80 cents on the dollar for US manufacturing (Yeh, Macaluso and Hershbein, 2022; Lamadon, Mogstad and Setzler, 2022; Berger, Herkenhoff and Mongey, 2022).
   - Key: Brazilian workers substitute *7x less strongly across firms* within markets than US workers do, based on US estimates from Berger, Herkenhoff and Mongey (2022), henceforth "BHM"

2. **... and trade liberalization further increased that power.**
   - By enough to offset all wage gains from reallocation.

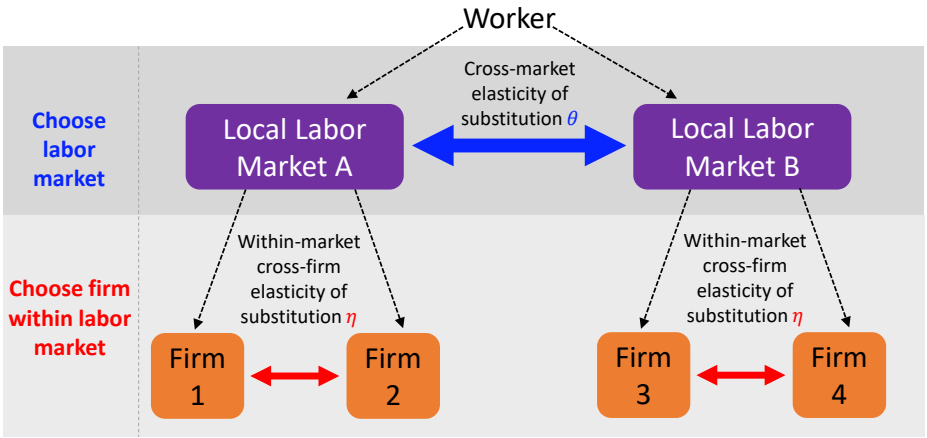
3. **But increased market power does not explain bulk of trade-induced wage declines.**
   - Effect driven instead by within-firm reductions in the marginal revenue product of labor.
   - E.g., reduction in prices firms can charge on goods markets.

Literature Contributions

Roadmap

1. Model
2. Context
3. Empirics
4. Implicatons for wages
5. Conclusion

Intuition: Workers' discrete choice labor supply (Nested CES)



Model summary

- **Supply**. NCES + idiosync. worker pref $\xi^j_{zm} \sim$ GEV gives firm z's **inverse labor supply** in market m:

$$w_{zm} = W \left(\frac{l_{zm}}{L_m} \right)^{\frac{1}{\eta}} \left(\frac{L_m}{L} \right)^{\frac{1}{\theta}} \xi_{zm}^{1+\frac{1}{\eta}} \xi_m^{1+\frac{1}{\theta}}$$

where L_m is market m's CES labor supply index (i.e., taste-adjusted employment). Details

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- **Demand**. Firm z equates marginal revenue to marginal cost taking others' emp as given (Cournot):

$$\frac{\partial R_z}{\partial l_{zm}} = w_{zm} \times \underbrace{\left(1 + \varepsilon_{zm}^{-1}\right)}_{\mu_{zm}\text{: markdown}}$$

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- **Equilibrium**. Standard result: Nested CES supply + Cournot demand gives

$$\varepsilon_{zm}^{-1} = \frac{1}{\theta} s_{zm} + \frac{1}{\eta}\left(1 - s_{zm}\right), \quad \text{where } s_{zm} \equiv \frac{w_{zm} l_{zm}}{\sum_j w_{jm} l_{jm}} = \frac{\partial \ln L_m}{\partial \ln l_{zm}}$$

  is firm z's payroll share in market m. **Intuition?**

Proposition 1: Average wage markdown in market m

When labor supply is nested CES and firms compete for workers à la Cournot, the average wage markdown at labor market m is given by:

$$\mu_m \equiv \frac{\bar{r}_m}{\bar{w}_m} = 1 + \frac{1}{\theta} HHI_m + \frac{1}{\eta}(1 - HHI_m)$$

where

- $\bar{r}_m$ and $\bar{w}_m$ are market m's (employment-weighted) average marginal revenue product of labor and average wage.
- $HHI_m = \sum_{z \in \Theta_m} s_{zm}^2$ is the market's payroll Herfindahl.

Proof: See Appendix

Corollary 1: Effect of an exogenous shock on average wage markdowns

In the labor market environment described in Proposition 1, the effect of an exogenous shock X on market m's average wage markdown μ_m at time t is given by

$$\gamma_t \equiv \frac{d\mu_{mt}}{dX} = \left(\frac{1}{\theta} - \frac{1}{\eta}\right)\beta_t$$

where

- $\beta_t \equiv \frac{dHHI_{mt}}{dX}$ is the effect of the exogenous shock on market m's payroll Herfindahl at time t
- $\frac{1}{\theta}$ is workers' cross-market inverse elasticity of substitution
- $\frac{1}{\eta}$ is workers' within-market cross-firm inverse elasticity of substitution

Model summary: Key take-aways

- **Level** of firm labor market power. A local labor market's average wage markdown μ_m is given by:

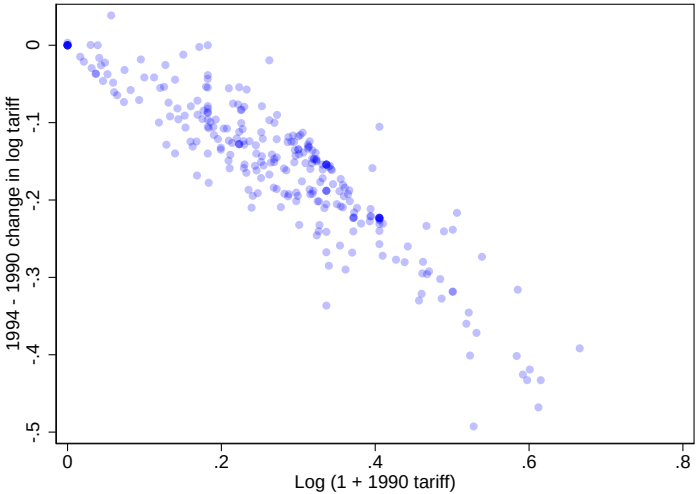
$$\mu_m = 1 + \frac{1}{\theta} HHI_m + \frac{1}{\eta}(1 - HHI_m)$$

- **Effect** of trade on firm labor market power. Quantified by its effect on μ_m, given by

$$\gamma \equiv \left(\frac{1}{\theta} - \frac{1}{\eta}\right)\beta$$

where β is th effect of trade on HHI_m.

Brazil's 1990-1994 reform: Differential tariff reductions across sectors



Timing

Trade liberalization: Country-level Cross-sector employment effects

Trade liberalization: Country-level Cross-sector employment effects

Time series Wages

Data

1. **Employer-employee linked admin data** (1986-2000).
   - Universe of formal sector (~15 mil workers/year)
2. **Import tariff reductions**
   - HS product-level tariffs from TRAINS
   - HS-NCM and NCM-CNAE 1995 mappings from IBGE
3. **List of exporters**, from Ministry of Development, Industry, and Foreign Trade
4. Supplemental: 1991 and 2000 census for informality

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   - **Effect of trade on local labor market concentration:** β
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Effect of trade on local labor market concentration: Empirical strategy

From now onwards, I define a local labor market as a **microregion** $\times$ **occupational group** cell Matrices

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- My empirical strategy exploits cross-market variation in exposure to import competition induced by Brazil's trade 1990s liberalization, an approach similar to Dix-Carneiro and Kovak (2017).

- I define market m's liberalization-induced **change in Import Competition Exposure (ΔICE)** as

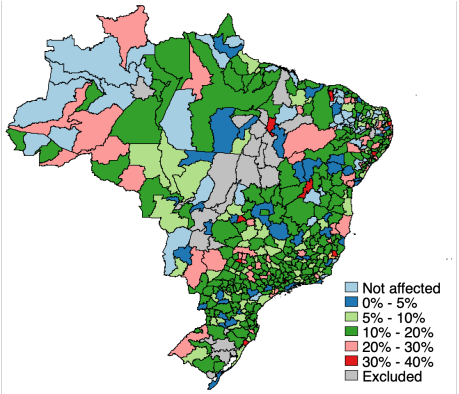
$$\Delta ICE_m \equiv - \sum_{z \in \Theta_m} \kappa_{zm} \ln \left(\frac{1 + \tau_{z,1994}}{1 + \tau_{z,1990}} \right)$$

$$\text{where} \quad \kappa_{zm} \equiv \frac{s^2_{zm,1991}}{\sum_j s^2_{jm,1991}}, \quad s_{zm,1991} \equiv \frac{w_{zm,1991} l_{zm,1991}}{\sum_j \left(w_{jm,1991} l_{jm,1991} \right)}$$

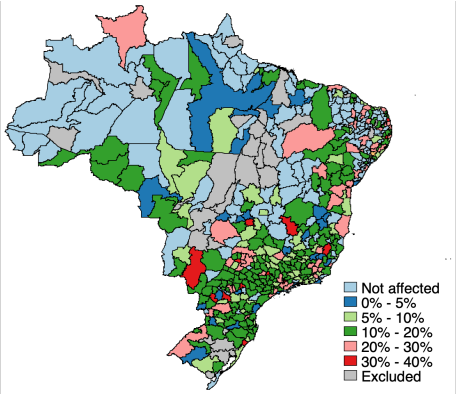
τ_z is the import tariff on firm z's output sector, and $s_{zm,1991}$ is firm z's payroll share in market m in the baseline year of 1991. **Intuition?**

Variation in ΔICE_m for two occupational groups

Office administration workers



Managers of industrial activities



Effect of trade on local labor market concentration: Regression equation

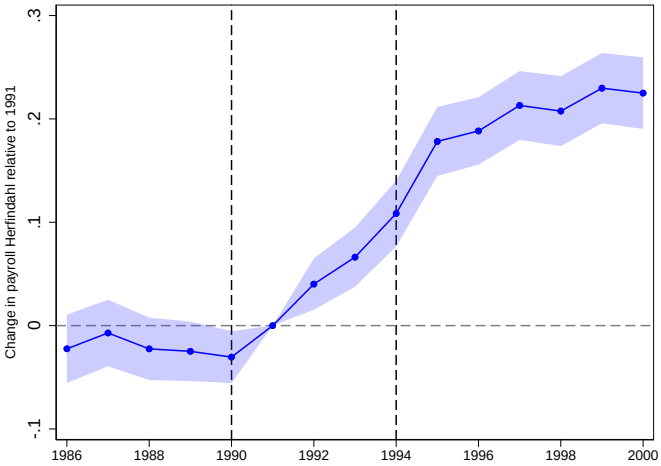
I then estimate the effect of ΔICE_m on the change in labor market m's outcome Y_m with the following **difference-in-differences regression**:

$$\Delta Y_{mt} = \sum_{k \neq 1991} \zeta_k \left(\Delta ICE_m \times 1_{t=k} \right) + \delta_m + \delta_t + \epsilon_{mt}$$

where

- ζ_k is the cumulative effect of ΔICE_m at year k
- δ_m and δ_t are market and year fixed effects

Effect of trade on local labor market concentration: Findings



Mayara Felix Retweeted

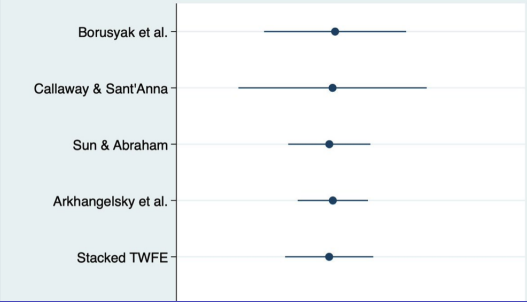
Kirill Borusyak @borusyak · Jul 20

A plea to referees: don't push the authors of diff-in-diff papers to mindlessly implement all estimators.

Push them to be explicit and precise about their estimand and the underlying assumptions, and choose estimator(s) based on those primitives.

Emma Rackstraw @emmarackstraw · Jul 20

I've been in a coding hole making this one figure. Will we all have to do this for every diff-in-diff/TWFE paper from now on? This was exhausting.

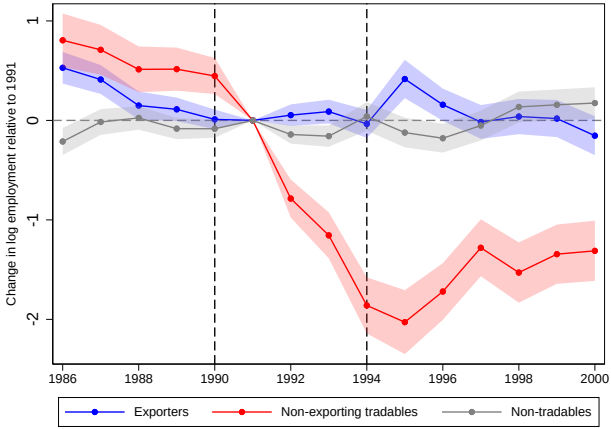


10% ↑ in ICE ↑ Payroll HHI by 0.02 points (7% of baseline 0.28 avg)

	Δ Import Competition Exposure (1)	Effect per 10% increase in ICE (2)
Panel A: Labor market concentration		
Δ Payroll Herfindahl (based on wage premium)	0.213	0.021
	(0.017)	(0.002)
Δ Payroll Herfindahl	0.213	0.021
	(0.017)	(0.002)
Δ Employment Herfindahl	0.247	0.025
	(0.016)	(0.002)

Robustness summary Placebo Weights ICE Clustering Boundary Tariffs Descriptives

Source of increased concentration: exit + exporters survive, less affected



Firm size dist. Firm-level regs

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   - Cross-market inverse elasticity of substitution: $\frac{1}{\theta}$
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Estimation of $\frac{1}{\eta}$: Regression equation

1. Start from inverse labor supply curve of firm z in market m at time t:

$$w_{zmt} = W_t \left(\frac{l_{zmt}}{L_{mt}} \right)^{\frac{1}{\eta}} \left(\frac{L_{mt}}{L} \right)^{\frac{1}{\theta}} \xi_{zmt}^{1+\frac{1}{\eta}} \xi_{mt}^{1+\frac{1}{\theta}}$$

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2. Take logs

$$\ln w_{zmt} = \frac{1}{\eta} \ln l_{zmt} + \underbrace{\left(\frac{1}{\theta} - \frac{1}{\eta} \right) \ln L_{mt} - \frac{1}{\theta} \ln L_t + \ln W_t + \ln \xi_{mt}^{1+\theta}}_{\text{Market x Year FE}} + \underbrace{\ln \xi_{zmt}^{1+\eta}}_{\text{Residual}}$$

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3. Simplifies to

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4. Anticipating exogenous source of variation, take long-differences:

$$\Delta \ln w_{zm} = \frac{1}{\eta} \Delta \ln l_{zm} + \Delta \delta_m + \Delta \epsilon_{zm}$$

Estimation of $\frac{1}{\eta}$: IV empirical strategy

1. **Regression** equation is:

$$\Delta \ln w_{zm} = \frac{1}{\eta} \Delta \ln l_{zm} + \Delta \delta_m + \Delta \epsilon_{zm}$$

where $\Delta \delta_m$ absorbs market-level *changes* that enter firm z's wage in market m.

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3. **Solution**: Instrument $\Delta \ln l_{zm}$ with a labor demand shock, the tariff change faced by firm z:

$$\text{[First Stage]} \quad \Delta \ln l_{zm} = \lambda \Delta \ln (1 + \tau_z) + \Delta d_m + \Delta \nu_{zm}$$

$$\text{[Second Stage]} \quad \Delta \ln w_{zm} = \frac{1}{\eta} \Delta \ln l_{zm} + \Delta \delta_m + \Delta \epsilon_{zm}$$

   where Δd_m absorbs all market-level changes that feed into firm z's hiring decisions in market m.

4. **Key assumptions**: first stage (i.e., $\lambda \neq 0$) and exclusion; **Clustering**: firm-level.

Estimation of $\frac{1}{\eta}$: Measurement

Implementing the IV empirical strategy requires measuring 3 model objects:

1. The wage w_{zmt} paid by firm z in market m at year t.
   - **Measure**: firm z's wage *premium* in market m for the month of December of year t. That is, wages for December *conditional on worker characteristics*.
2. The total units of labor l_{zmt} supplied to that firm-market pair.
   - **Measure**: Total number of workers employed at firm z in market m during the entire month of December of year t.
3. The tariff shock to the firm.
   - **Measure**: policy-induced change in import tariffs on firm z's output sector

$$\Delta \ln\left(1+\tau_z\right) \equiv -\ln\left(\frac{1+\tau_{z,1994}}{1+\tau_{z,1990}}\right)$$

Estimation of $\frac{1}{\eta}$: Findings

	Δ in Log Import Tariff faced by firm (1)
Panel A: First stage	
Δ Firm log employment in LLM	-0.554
	(0.044)
First stage F	158.497
Panel B: Reduced form	
Δ Firm wage premium in LLM	-0.545
	(0.024)
Panel C: 2SLS	
Labor supply within-market cross-firm inverse elasticity of substitution	0.985
	(0.089)
Implied upper bound on wage take-home share	50%
Observations	854,068
Firms	344,066
Local labor markets	15,717

Year-by-year DD

Estimation of $\frac{1}{\eta}$: Robustness

- Point estimate $\frac{1}{\eta} = 0.985$ is very similar across most relevant alternative specs
  - ... restricting to the sub-sample of unique producers, where shocks are firm-specific Alternative samples
  - ... defining labor markets more broadly as microregions only Alternative samples
  - ... using effective rates of protection as opposed to import tariffs as shocks Alternative shock and wage
  - ... alternative wage or tariff measures Alternative wage and tariff
- Strongly identified (i.e., FS F-stat 158) and precise. First stage strength sensitivity to clustering and sub-sampling discussed in Appendix.

New and Preliminary: Heterogeneity of $\frac{1}{\eta}$ by worker demos

- Spec: Interact RHS ($\Delta \ln l_{zm}$) with firm-market pair base composition (sex, educ, age). Instrument with tariff declines and its interactions with base comp.

	(1) IV	(2) Interacted IV
Outcome:	Δlog wage	Δlog wage
Δlog emp	0.985***	1.248***
	(0.0885)	(0.124)
Δlog emp X (base share female)		-0.434***
		(0.0608)
Δlog emp X (base share no HS)		-0.142*
		(0.0591)
Δlog emp X (base share College)		-0.479***
		(0.0861)
Δlog emp X (base share Older)		0.192***
		(0.0419)
Market FE	Yes	Yes
Observations	854068	854068

Standard errors clustered by firm in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

- Overall: **Most elastic**: highly educ young women; **Least elastic**: not highly educ older men.

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Estimation of $\frac{1}{\theta}$: Regression equation

1. Start from long-differenced inverse labor supply curve for firm z in market m:

$$\Delta \ln w_{zm} = \frac{1}{\eta} \Delta \ln l_{zm} + \underbrace{\left(\frac{1}{\theta} - \frac{1}{\eta}\right) \Delta \ln L_m - \frac{1}{\theta} \Delta \ln L + \Delta \ln W + \Delta \ln \xi_m^{1+\theta}}_{\Delta \delta_m} + \Delta \epsilon_{zm}$$

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2. The expression in brackets implies

$$\Delta\delta_m = \left(\frac{1}{\theta} - \frac{1}{\eta}\right)\Delta \ln L_m \underbrace{- \frac{1}{\theta}\Delta \ln L + \Delta \ln W}_{\text{Constant}} + \underbrace{\Delta \ln \xi_m^{1+\theta}}_{\text{Residual}}$$

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3. Simplifies to

$$\Delta\delta_m = \alpha + \left(\frac{1}{\theta} - \frac{1}{\eta}\right)\Delta \ln L_m + \Delta\epsilon_m$$

Estimation of $\frac{1}{\theta}$: IV empirical strategy

1. **Regression** equation is:

$$\Delta\delta_m = \alpha + \left(\frac{1}{\theta} - \frac{1}{\eta}\right) \Delta \ln L_m + \Delta\epsilon_m$$

where α absorbs country-level *changes* that enter the market-level component $\Delta\delta_m$ of firm wages.

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3. **Solution**: Instrument $\Delta \ln L_m$ with a labor demand shock, the change in Import Competition Exposure (ICE) faced by market m:

$$\text{[First Stage]} \quad \Delta \ln L_m = \tilde{\alpha} + \lambda \Delta ICE_m + \Delta\nu_m$$

$$\text{[Second Stage]} \quad \Delta\delta_m = \alpha + \left(\frac{1}{\theta} - \frac{1}{\eta}\right)\Delta \ln L_m + \Delta\epsilon_m$$

where $\tilde{\alpha}$ absorbs all country-level changes that feed into firms' hiring decisions in market m.

4. **Key assumptions**: first stage (i.e., $\lambda \neq 0$) and exclusion; **Clustering**: market-level.

Estimation of $\frac{1}{\theta}$: Measurement

Implementing the IV empirical strategy requires measuring 3 model objects:

1. $\Delta\delta_m$, the market-level component of the firm-level wage change
   - **Measure**: The market fixed effect $\Delta\delta_m$ from the Second Stage regression equation for estimating $\frac{1}{\eta}$.
2. $\Delta \ln L_m$, the market-level change in the CES labor supply index
   - **Measure**: Given the point estimate for η, compute as

$$\Delta \ln L_m = \Delta \ln \left\{ \left[\sum_{z \in \Theta_m} \left(\xi_{zm} l_{zm} \right)^{\frac{1+\eta}{\eta}} \right]^{\frac{\eta}{1+\eta}} \right\}$$

   where ξ_{zm} can similarly be retrieved for each year using firm z's inverse labor supply equation in market m and an estimate for η.
3. ΔICE_m, whose measurement I introduced earlier.

Estimation of $\frac{1}{\theta}$: Findings

	Δ Import Competition Exposure (1)
Panel A: First stage	
Δ LLM employment index	-0.396
	(0.032)
First stage F	150.752
Panel B: Reduced form	
Δ LLM wage premium index	-0.108
	(0.051)
Panel C: 2SLS	
$\frac{1}{\theta} - \frac{1}{\eta}$	0.272
	(0.131)
Panel D: Cross-market inverse elasticity of substitution	
$\frac{1}{\theta}$	1.257
	(0.096)
Implied lower bound on wage take-home share	44%
Observations (Local labor markets)	15,717

Year-by-year DD

Estimation of $\frac{1}{\theta}$: Robustness

- $\frac{1}{\theta} = 1.257$ point estimate is nearly identical across alternative relevant specifications, including...
  - ... defining labor markets more broadly as microregions only Alternative samples
  - ... using $\frac{1}{\eta}$ estimate based on sub-sample of unique producers Alternative samples
  - ... measuring firm wages using wage averages as opposed to wage premia Alternative wage
- Strongly identified (i.e., FS F-stat 151) and precise. First stage strength sensitivity to clustering, sub-sampling, and market boundaries discussed in Appendix.

Implication for *levels* of firm labor market power given $\frac{1}{\eta} = 0.985$ and $\frac{1}{\theta} = 1.257$

Pre-liberalization average wage markdown

Pre-liberalization take-home share was **50 cents on the marginal dollar**. Ingredients:

- **Market-level** average wage markdown from Proposition 1:

$$\mu_m \equiv \frac{\bar{r}_m}{\bar{w}_m} = 1 + \frac{1}{\theta} HHI_m + \frac{1}{\eta}(1 - HHI_m)$$

- **Country-level** average wage markdown aggregates using markets' payroll share:

$$\mu \equiv \frac{\bar{r}}{\bar{w}} = 1 + \frac{1}{\theta} \tilde{HHI} + \frac{1}{\eta}\left(1 - \tilde{HHI}\right)$$

- In the baseline year of 1991, $\tilde{HHI} = 0.08$.
  - As if only $12.5 = 1/0.08$ equally-sized firms were active.
  - Implication for country-level *labor share*: Brazil vs US based on BHM

Implication for *effect* of trade on market power and wages given

$$\beta = 0.02 \textbf{ and } \left(\frac{1}{\theta} - \frac{1}{\eta}\right) = 0.272$$

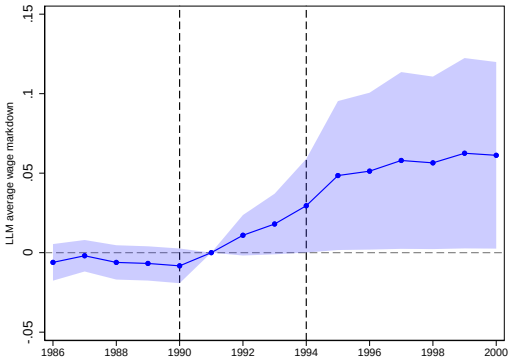
Effect of trade on firm labor market power

- The effect of trade on local labor markets' average wage markdown at time t can be quantified as

$$\gamma_t \equiv \frac{d\mu_{mt}}{dX} = \left(\frac{1}{\theta} - \frac{1}{\eta}\right)\beta_t$$

- Given the post-liberalization mid-point estimate of $\beta_{1997} = 0.02$ and given $\left(\frac{1}{\theta} - \frac{1}{\eta}\right) = 0.272$, the effect of trade on firm labor market power was small albeit statistically significant.
- A 10% increase in ICE:
  - Increased local labor markets' average wage markdown by $\gamma_{1997} = 0.006$ points.
  - Equivalent to reducing workers wage take-home share by 0.14 cents.

Effect of trade on firm labor market power: year by year



SE details

But HHI ↑ due to comp. realloc. to exporters. Positive wage effects?

- Recall:

$$\text{Wage} = \underbrace{(\text{Take-home share})}_{\mu^{-1}[\text{mkt power}]} \times \underbrace{(\text{Marginal Revenue Product of Labor})}_{r\ [\text{output prices, technology, etc.}]}$$

- So, effect on average wage can be decomposed:

$$\frac{d\bar{w}_{mt}}{dICE_m} = \underbrace{\frac{d\mu_{mt}^{-1}}{dICE_m}\bar{r}_{mt}}_{\text{Effect via market power}} + \underbrace{\frac{d\bar{r}_{mt}}{dICE_m}\mu_{mt}^{-1}}_{\text{Effect via MRPL}}$$

- Decomposing the effect via the Marginal Revenue Product of Labor (MRPL) further:

$$\frac{d\bar{r}_{mt}}{dICE_m} = \underbrace{\frac{d\left(\bar{r}_{mt}|_{s^e_{jm0}}\right)}{dICE_m}}_{\text{Within-firm effect}} + \underbrace{\frac{d\left(\bar{s}^e_{mt}|_{r_{jm0}}\right)}{dICE_m}}_{\text{Cross-firm reallocation}}$$

Decomposition of effect of trade on wages (multiples of min wage)

	Δ Import Competition Exposure (1)	Effect per 10% increase in ICE (2)
Δ Average wage premium	-3.340	-0.334
	(0.454)	(0.045)
Δ Average wage premium take-home share	-0.014	-0.0014
Trade reduced wages by increasing firm labor market power	(0.007)	(0.001)
Δ Average marginal revenue product of labor	-6.735	-0.673
	(1.334)	(0.133)
Δ Within-firm	-6.821	-0.682
	(1.876)	(0.188)
Δ Cross-firm	0.132	0.013
Trade increased wages by reallocating to exporters	(0.023)	(0.002)
Observations	243,750	243,750
Local labor markets	16,250	16,250

Bulk: Within-firm ↓ in marginal revenue product of labor

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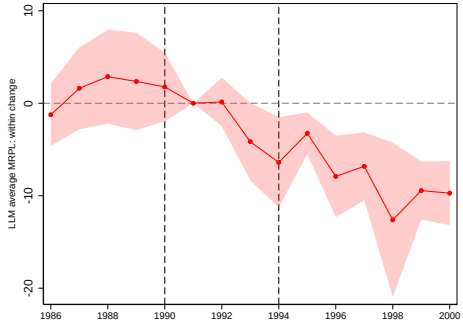

Decomp. of effect of trade on wages (mult. of min wage)

	Pre-reform level (1)	Directly affected by increased concentration? (2)	Impact of 10% increase in ICE on average wage premium (3)	Percent change from baseline average wage premium (4)	Effect as percent of total effect on average wage premium (5)
Average wage premium	2.48	--	-0.343	- 13.80%	100%
Average wage take-home share	0.50	Yes	-0.007	- 0.29%	2%
Average marginal revenue product of labor	4.99	--	-0.336	- 13.51%	98%
Δ Within-firm	--	No	-0.340	- 13.68%	--
Δ Cross-firm	--	Yes	0.007	+ 0.27%	--

Taking stock: Key take-aways

- I studied one potential mechanism for the negative effect of trade on local wages:
  - Trade-induced increases **firm labor market power**.
- Combining Brazilian employer-employee linked data and quasi-exogenous tariff shocks, I found:
  1. Firms do command substantial labor market power in Brazil...
  2. ... and trade liberalization further increased that power.
  3. But increased market power does not explain bulk of trade-induced wage declines.
- Hopefully:
  - Helps us better understand the relationship between trade, labor market concentration, and wages;
  - Offers more transparent and easier to implement methods to estimate markdowns and their response to trade in models of oligopsony under nested CES structures.

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A Local Labor Market (LLM) is a Microregion x Occupational Group pair

Total workers transitioning to different firm in 1990-1991	1,055,205
Percent staying in…	
Microregion (486 groups of municipalities)	79%
Occupational group (CBO94 / 2-digit / 65 groups)	50%
Local labor market: Microregion x Occupational group cell	40%
Economic sector group (CNAE95 / 2-digit / 59 groups)	33%
Microregion x Economic sector group cell	26%
Occupation (CBO94 / 5-digit / 2,357 occupations)	29%
Sub-sector (CNAE95 / 5-digit / 614 sub-sectors)	18%

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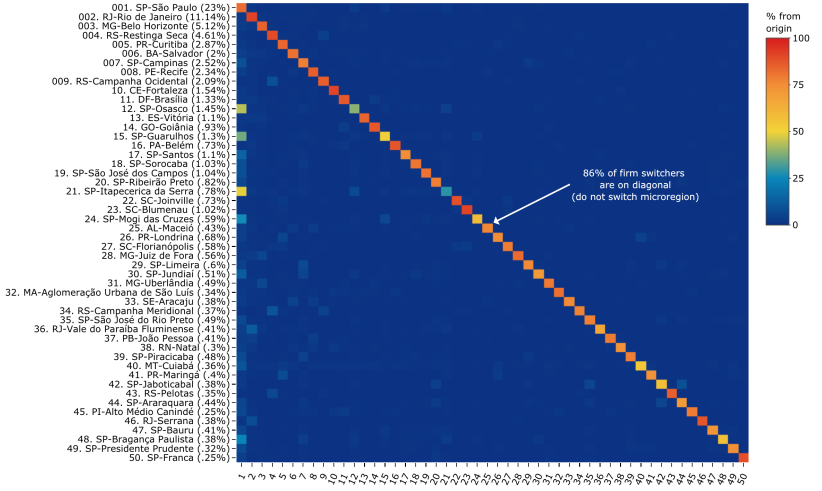
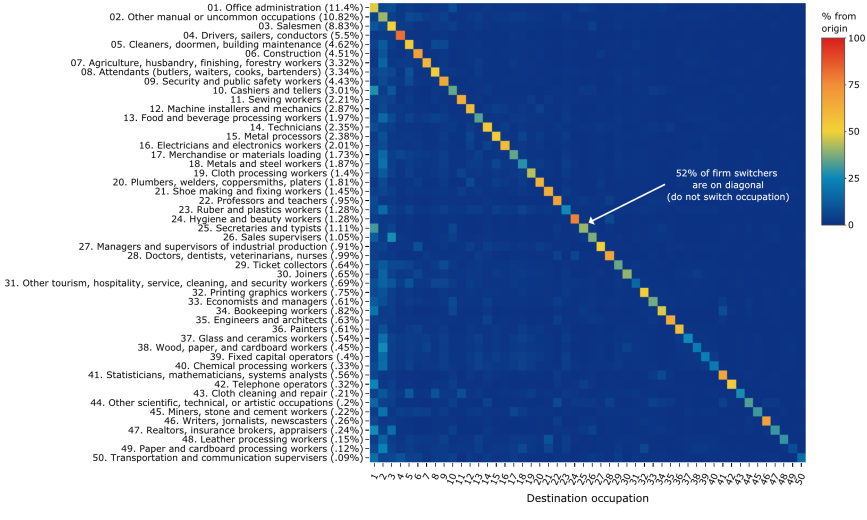
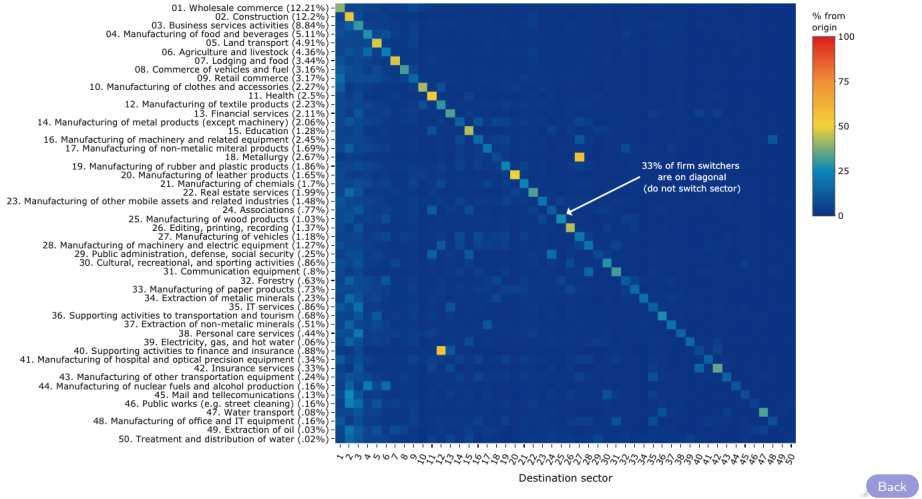
1990-1991 Transitions at Top 50 Microregions



1990-1991 Transitions at Top 50 Occupational Groups



1990-1991 Transitions at Top 50 Sectoral Groups



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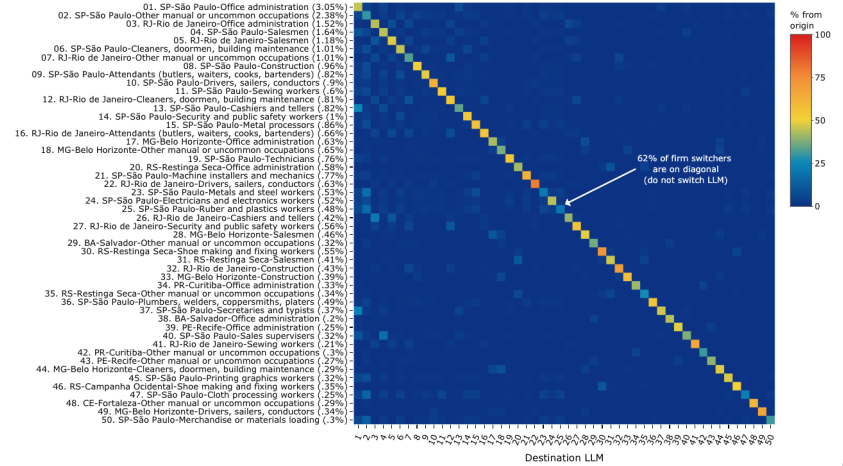
An LLM is a **Microregion** × **Occupational Group** cell (∼ 20K markets)
Plotted: 1990-1991 transitions for Top 50



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Labor supplied to firm z in local labor market m

- Follow Berger, Herkenhoff and Mongey (2021)'s microfoundation of nested CES labor supply.
  - Extend to incorporate taste shifters $\{\xi_{zm}, \xi_m\}$. Details
  - Workers consider: wages offered by firms $\{w_{zm}\}$. Take into account taste shifters $\{\xi_m, \xi_{zm}\}$ and idiosyncratic taste $\xi^j_{zm} \sim$ GEV with shape parameters θ and η.

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- Since $\xi^j_{zm} \sim$ GEV, by McFadden (1978) total **labor supplied to firm z in market m** is given by:

$$l_{zm} = L \left(\frac{w_{zm}}{W_m} \right)^{\eta} \left(\frac{W_m}{W} \right)^{\theta} \left(\xi_{zm}^{1+\eta} \xi_m^{1+\theta} \right)^{-1}$$

where L, W, W_m are CES labor supply and wage indices (see Aggretation and Indices). **Intuition?**

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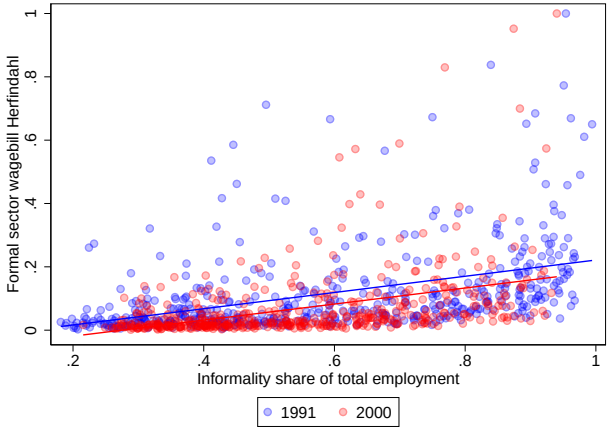
- The wage firm z must pay to attract l_{zm} workers is its **inverse labor supply curve**: Details

$$w_{zm} = W \left(\frac{l_{zm}}{L_m}\right)^{\frac{1}{\eta}} \left(\frac{L_m}{L}\right)^{\frac{1}{\theta}} \xi_{zm}^{1+\frac{1}{\eta}} \xi_m^{1+\frac{1}{\theta}}$$

where L_m is market m's CES labor supply index (i.e., taste-adjusted employment). **Intuition?** Back

Local labor market concentration vs. Informality



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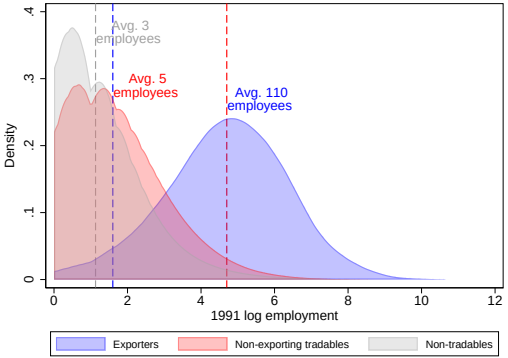
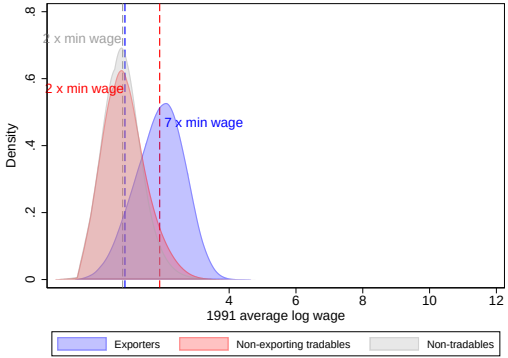
Exporter vs. Others: size and wages

Log employment



December monthly wage



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Wage premia regressions

- **Firm wage premia in LLM**. For each year, regress worker log December earnings on firm-LLM pair dummies and:
  1. Gender
  2. Education group dummies
  3. Age group dummies
- **LLM wage premia**. For each year, regress worker log December earnings on LLM dummies and:
  1. Gender
  2. Education group dummies
  3. Age group dummies
  4. Broad economic sector dummies
- **Microregion wage premia**. For each year, regress worker log December earnings on Microregion dummies and:
  1. Gender
  2. Education group dummies
  3. Age group dummies
  4. Broad economic sector dummies
  5. Occupation group dummies

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Labor supply: Discrete choice

- **Each worker j chooses in which firm z and market m to work**, providing l^j_{zm} units of labor to that firm subject making y^j reservation earnings, by minimizing their disutility of work:

$$\min_{zm} V^j_{zm} = \ln l^j_{zm} + \ln \xi_m + \ln \xi_{zm} - \xi^j_{zm}$$
$$\text{s.t. } l^j_{zm} w_{zm} \geq y^j$$

w_{zm} is the wage paid by firm z in market m; $\xi_{zm} > 0$ and $\xi_m > 0$ are firm-market and market taste shifters; ξ^j_{zm} is an idiosyncratic worker taste shifter with Generalized Extreme Value (GEV) form

$$G\left(\left\{\xi^j_{zm}\right\}\right) = \exp\left[-\sum_m \left(\sum_{z \in \Theta_m} e^{-(1+\eta)\xi^j_{zm}}\right)^{\frac{1+\theta}{1+\eta}}\right]$$

- Due to equivalance to representative agent setup with **nested CES labor supply preferences**:
  - η is workers' within-market cross-firm elasticity of substitution
  - θ is workers' cross-market elasticity of substitution

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Labor supply aggregation

- By the results in McFadden (1978), P_{zm}^{j} is given by

$$P_{zm}^{j} = \frac{\left(\frac{w_{zm}}{\xi_{zm}}\right)^{1+\eta}}{\sum_{k\in B_n}\left(\frac{w_{km}}{\xi_{km}}\right)^{1+\eta}} \times \frac{\left[\left(\frac{1}{\xi_m}\right)^{1+\eta}\sum_{z\in B_m}\left(\frac{w_{zm}}{\xi_{zm}}\right)^{1+\eta}\right]^{\frac{1+\theta}{1+\eta}}}{\sum_{l}\left[\left(\frac{1}{\xi_l}\right)^{1+\eta}\sum_{k\in B_l}\left(\frac{w_{kl}}{\xi_{kl}}\right)^{1+\eta}\right]^{\frac{1+\theta}{1+\eta}}} \quad \forall j$$

- Integrating P_{zm}^{j} (times $l_{zm}^{j} = y^{j}/w_{zm}$ supplied by each worker) over the continuum of workers gives:

$$l_{zm} = \int_0^1 P_{zm}^{j}\left(\frac{y^{j}}{w_{zm}}\right) dF(y) = w_{zm}^{-1} P_{zm} Y \tag{1}$$

where $\int_0^1 y^{j} dF(y) \equiv Y$ is national labor income. Next, define:

$$W_m \equiv \left[\sum_z \left(\frac{w_{zm}}{\xi_{zm}}\right)^{1+\eta}\right]^{\frac{1}{1+\eta}}, \quad W \equiv \left[\sum_m \left(\frac{W_m}{\xi_m}\right)^{1+\theta}\right]^{\frac{1}{1+\theta}}, \quad L_m \equiv \left[\sum_z \left(\xi_{zm} l_{km}\right)^{\frac{1+\eta}{\eta}}\right]^{\frac{\eta}{1+\eta}}, \quad L \equiv \left[\sum_m \left(\xi_m L_m\right)^{\frac{1+\theta}{\theta}}\right]$$

which imply $Y = WL$ and $P_{zm}^{j} = \left(\frac{w_{zm}/\xi_{zm}}{W_m}\right)^{1+\eta} \times \left(\frac{W_m/\xi_m}{W}\right)^{1+\theta}$. Plugging into 1 gives

$$l_{zm} = L\left(\frac{w_{zm}}{W_m}\right)^{\eta}\left(\frac{W_m}{W}\right)^{\theta}\left(\xi_{zm}^{1+\eta}\xi_m^{1+\theta}\right)^{-1} \tag{2}$$

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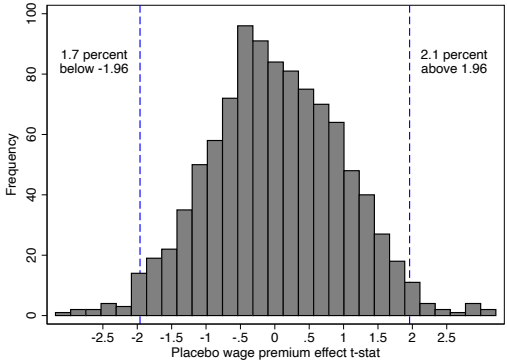
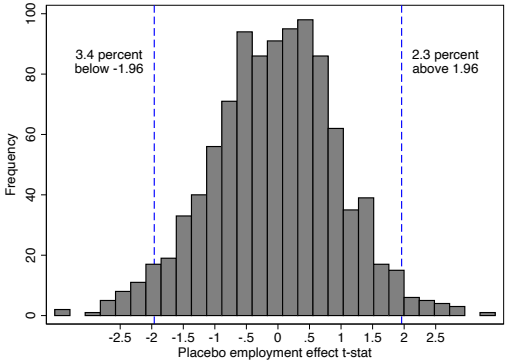
1,000 regressions using placebo shift-share instruments: placebo shock + actual shares

LLM wage premia



De-trended DD



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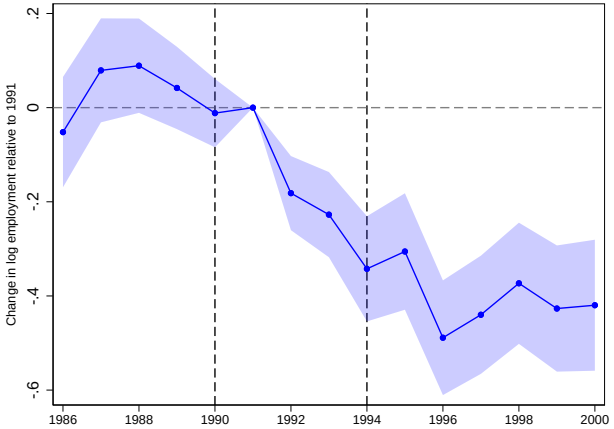
ICE effect on LLM employment



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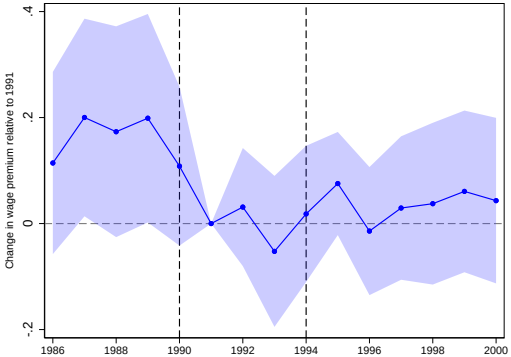
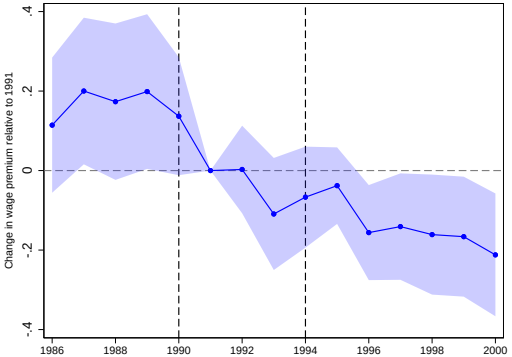
ICE effect on LLM wage premia

LLM wage premia (DD)



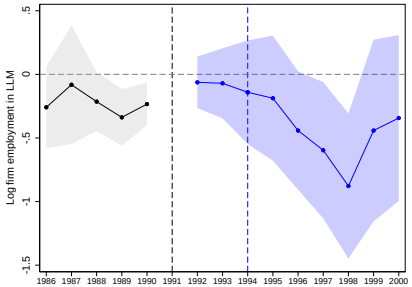
Effect relative to trend



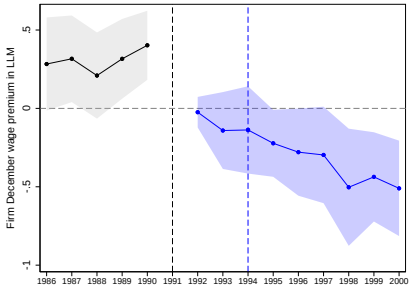
Back Relative to trend details

Firm level Diff-in-Diff underlying $\frac{1}{\eta}$ estimates

Log employment



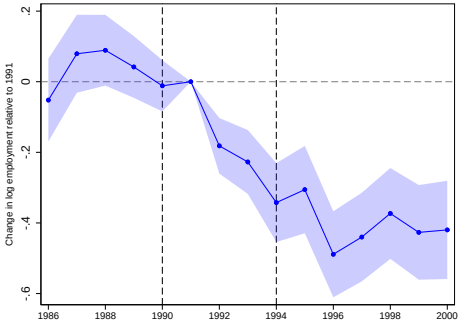
Firm wage premium



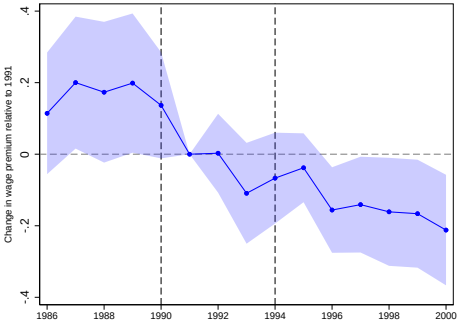
Back

LLM level De-trended DD underlying $\frac{1}{\theta}$ estimates

Employment DD



Wage premium DD relative to trend



Back to Theta | Relative to trend details

Effects relative to trend: estimation details

- These effects are estimated as the $\tilde{\beta}$ coefficients from the following regression:

$$\Delta \tilde{Y}_{mt} = \tilde{\alpha} + \sum_{k \neq 1991} \tilde{\beta}_k \left(\Delta ICE_m \times 1_{t=k} \right) + \tilde{\delta}_m + \tilde{\delta}_t + \tilde{\epsilon}_{mt}$$

where $\Delta \tilde{Y}_{mt} = \Delta Y_{mt} - \hat{\zeta} \left(\Delta ICE_m \times t \right)$ is the predicted outcome from the following regression, which I estimate using the pre-treatment years 1986-1990 only:

$$\Delta Y_{mt} = \omega + \zeta \left(\Delta ICE_m \times t \right) + \nu_m + \nu_t + \nu_{mt}$$

in which ν_m and ν_t are local labor market and year fixed effects, respectively.

- Causal interpretation of the $\tilde{\beta}_k$ coefficients rely on the identification assumption that more affected markets would have continued to follow the same pre-liberalization growth trend relative to least affected markets.

Back to effect on HHI | Back to Theta

Proof that $s_{zm} \equiv \frac{w_{zm} l_{zm}}{\sum_k (w_{km} l_{km})} = \frac{\partial \ln L_m}{\partial \ln l_{zm}}$

To see why this holds, depart from the definition of the labor market index L_m to derive $\partial \ln L_m / \partial \ln l_{zm}$ as

$$\frac{\partial \ln L_m}{\partial \ln l_{zm}} = \frac{\left(\xi_{km} l_{km}\right)^{\frac{1+\eta}{\eta}}}{\sum_{j=1}^{N_m} \left(\xi_{jm} l_{jm}\right)^{\frac{1+\eta}{\eta}}}$$

Now set this aside. Plug in inverse labor supply to the definition $s_{zm} \equiv w_{zm} l_{zm} / \sum_k \left(w_{km} l_{km}\right)$ to obtain

$$s_{zm} = \frac{\left(\xi_{km} l_{km}\right)^{\frac{1+\eta}{\eta}}}{\sum_{j=1}^{N_m} \left(\xi_{jm} l_{jm}\right)^{\frac{1+\eta}{\eta}}}$$

Therefore, $s_{zm} = \partial \ln L_m / \partial \ln l_{zm}$.

Back

Proof of Proposition 1

Step 1: Show $1+\varepsilon_m^{-1} = \frac{1}{\theta} HHI_m + \frac{1}{\eta}(1 - HHI_m)$. Aggregate firm-level $1+\varepsilon_{zm}^{-1}$ with payroll shares to get:

$$\begin{aligned} 1+\varepsilon_m^{-1} \equiv \sum_{z\in\Theta_m} s_{zm}\left(1+\varepsilon_{zm}^{-1}\right) &= 1 + \sum_{z\in\Theta_m} s_{zm}\left[\frac{1}{\eta}(1-s_{zm}) + \frac{1}{\theta}s_{zm}\right] \\ &= 1 + \frac{1}{\theta} HHI_m + \frac{1}{\eta}(1 - HHI_m) \end{aligned}$$

Step 2: Show $1+\varepsilon_m^{-1} = \frac{\bar{r}_m}{\bar{w}_m}$. Aggregate firm-level wage-setting equation $\frac{r_{zm}}{w_{zm}} = 1+\varepsilon_{zm}^{-1}$ with payroll shares to get:

$$\begin{aligned} 1+\varepsilon_m^{-1} \equiv \sum_{z\in\Theta_m} s_{zm}\left(1+\varepsilon_{zm}^{-1}\right) = \sum_{z\in\Theta_m} s_{zm}\left(\frac{r_{zm}}{w_{zm}}\right) &= \sum_{z\in\Theta_m} \frac{w_{zm}l_{zm}}{\sum_j w_{jm}l_{jm}}\left(\frac{r_{zm}}{w_{zm}}\right) \\ &= \frac{\sum_{z\in\Theta_m} r_{zm}l_{zm}}{\sum_{j\in\Theta_m} w_{jm}l_{jm}} \\ &= \frac{\left(\sum_{z\in\Theta_m} r_{zm}l_{zm}\right) / \left(\sum_{z\in\Theta_m} l_{zm}\right)}{\left(\sum_{j\in\Theta_m} w_{jm}l_{jm}\right) / \left(\sum_{z\in\Theta_m} l_{zm}\right)} = \frac{\bar{r}_m}{\bar{w}_m} \equiv \mu_m \end{aligned}$$

Back

Standard errors for γ_t

Assume $\left(\frac{1}{\theta} - \frac{1}{\eta}\right)$ and β_t are independent. Then

$$\begin{aligned}
\text{Var}(\gamma_t) =& \text{Var}\left[\left(\frac{1}{\theta} - \frac{1}{\eta}\right) \cdot \beta_t\right] \\
=& E\left[\left(\frac{1}{\theta} - \frac{1}{\eta}\right)^2\right] E\left[\beta_t^2\right] - \left[E\left(\frac{1}{\theta} - \frac{1}{\eta}\right)\right]^2 \left[E(\beta_t)\right]^2 \\
=& \left[\text{Var}\left(\frac{1}{\theta} - \frac{1}{\eta}\right) + \left[E\left(\frac{1}{\theta} - \frac{1}{\eta}\right)\right]^2\right] \left[\text{Var}(\beta_t) + \left[E(\beta_t)\right]^2\right] - \left[E\left(\frac{1}{\theta} - \frac{1}{\eta}\right)\right]^2 \left[E(\beta_t)\right]^2
\end{aligned}$$

whose components can all be plugged-in using sample estimates.

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Estimates for labor share in Brazil based on BHM formula

Brazil

Estimated		Scale of production		
$\frac{1}{\theta}$=1.257 $\frac{1}{\eta}$=0.985 $\widehat{HHI}$ = 0.08		IRS	CRS	DRS
		1.1	1	0.90
Cobb-Douglas	1	55%	50%	45%
labor factor	0.83	46%	42%	37%
exponent	0.67	37%	33%	30%

US: Based on BHM estimates

Estimated		Scale of production		
$\frac{1}{\theta}$=2.2 $\frac{1}{\eta}$=0.14 $\widehat{HHI}$ = 0.11		IRS	CRS	DRS
		1.1	1	0.90
Cobb-Douglas	1	80%	73%	66%
labor factor	0.83	67%	61%	55%
exponent	0.67	53%	49%	44%

Note: BHM (2021) labor share estimate: 57%. Nearly CRS (alpha = 0.957) and labor exponent nearly 0.83 (0.812).

Back

Note #1: Robustness of first stage strength

- FS strength (and thus, precision) of $\left(\frac{1}{\theta} - \frac{1}{\eta}\right)$ is sensitive to clustering and samples. Which choice(s) are sensible?
  - Let **framework and setting guide main specification**.
- Sample: Framework is based on all firms operating in a local labor market.
  - So estimation sample should also **include all firms**, even non-tradables (face zero tariff change).
- Clustering: Framework's change in taste-shifters (the error terms in 2SLS regressions) is idiosyncratic to either firm and/or market. Plus, ample shock variation at both levels.
  - Main specification for $\frac{1}{\eta}$: specification at firm-market level, **cluster at firm level**.
  - Main specification for $\frac{1}{\theta}$: specification at market level, **cluster at market level**.

Note #2: External validity to incorporating informality

- Effect based on universe of formal sector firms and workers is important in its own right.
  - Those are the tax-paying firms and workers
- But are my findings externally valid to incorporating informality? Important consideration:
  - Nearly 50% of all employment in Brazil is informal (Ulyssea, 2018)
  - Trade liberalization increased informality in harder hit regions (Dix-Carneiro et al., 2021).
- Panel data on informal firms don't exit, but I discuss external validity in light of:
  - Statistics uncovered by Ulyssea (2018) using Brazil's 2003 ECINF dataset.
  - Correlation between concentration (from RAIS) and informality (from Census).

Note #2: External validity to incorporating informality: Key take-aways

1. Theoretically ***ambiguous*** impact on my estimates of the ***level*** of market power (i.e., 50 cents on the dollar). Omitting informality:
   - Overestimates concentration levels because informality is decreasing in firm size (Ulyssea, 2018).
     - Also: observe positive correlation between *HHI* from RAIS and informality from census. Scatter
   - Underestimates levels of $\frac{1}{\eta}$ and $\frac{1}{\theta}$ by:
     - Overestimating effect on employment (first stage): firms might instead take workers off books.
     - Underestimating effect on wages (reduced form): firms can pay below the min wage.

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     - Overestimating effect on employment (first stage): firms might instead take workers off books.
     - Underestimating effect on wages (reduced form): firms can pay below the min wage.
2. Most likely ***underestimates effect*** on market power. No prediction regarding elasticities gap, but omitting informality underestimates effect on concentration:
   - Informal firms more likely to exit due to ICE because much less productive (Ulyssea, 2018).
   - Wages in informal sector can fall by more than in formal sector: payroll shares of already small firms likely declines by more than payroll shares of larger, formal firms.

Note #2: External validity to incorporating informality: Additional considerations on the Brazilian context

- While effect on *level* of market power is theoretically ambiguous, evidence suggest **market power is likely greater under informality**:
  - Workers are paid 29% less (Ulyssea, 2018).
  - Not covered by labor laws: right to vacation, weekly rest, overtime pay, severance, etc.

Note #2: External validity to incorporating informality: Additional considerations on the Brazilian context

- While effect on *level* of market power is theoretically ambiguous, evidence suggest **market power is likely greater under informality**:
  - Workers are paid 29% less (Ulyssea, 2018).
  - Not covered by labor laws: right to vacation, weekly rest, overtime pay, severance, etc.
- More abhorrently, **near-slavery working conditions persist** to this day under informality.
  - Over 49K workers freed since 1995, when inspections began following anonymous tip-offs.
  - I investigate relationship to trade liberalization in on going work (Felix, 2021b).
- I leave to future work the harder task of *quantifying* labor market power inclusive of informality.

Effect of ICE on LLM outcomes: Robustness to clustering

	Main specification (1)	Two-way clustered by microregion and occupational group (2)
Panel A: Labor market concentration		
Δ Payroll Herfindahl (based on wage premium)	0.213	0.213
	(0.017)	(0.029)
Δ Payroll Herfindahl	0.213	0.213
	(0.017)	(0.028)
Δ Employment Herfindahl	0.247	0.247
	(0.016)	(0.028)
Panel B: Log number of firms and log employment		
Δ Log number of firms	-0.549	-0.549
	(0.045)	(0.131)
Δ Log total employment	-0.440	-0.440
	(0.064)	(0.153)
Panel C: Log wage premium		
Δ Log wage premium	0.029	0.029
	(0.031)	(0.068)
Δ De-trended log wage premium	-0.141	-0.141
	(0.031)	(0.068)
Observations	296,400	296,400
Local labor markets	19,760	19,760

Back

Effect of ICE on LLM outcomes: Robustness to boundary

	Main specification (1)	Local labor market is microregion (2)
Panel A: Labor market concentration		
Δ Payroll Herfindahl (based on wage premium)	0.213	0.102
	(0.017)	(0.046)
Δ Payroll Herfindahl	0.213	0.110
	(0.017)	(0.064)
Δ Employment Herfindahl	0.247	0.058
	(0.016)	(0.056)
Panel B: Log number of firms and log employment		
Δ Log number of firms	-0.549	-0.367
	(0.045)	(0.208)
Δ Log total employment	-0.440	-0.338
	(0.064)	(0.335)
Panel C: Log wage premium		
Δ Log wage premium	0.029	0.116
	(0.031)	(0.131)
Δ De-trended log wage premium	-0.141	0.106
	(0.031)	(0.131)
Observations	296,400	7,125
Local labor markets	19,760	475

Back

Effect of ICE on LLM outcomes: Robustness to shock

	Main specification (1)	ICE weights are firms' base year payroll shares (2)	ICE weights are firms' base year employment shares (3)	ICE tariff shocks are firms' effective tariff protection (4)
Panel A: Labor market concentration				
Δ Payroll Herfindahl (based on wage premium)	0.213	0.259	0.278	0.119
	(0.017)	(0.020)	(0.020)	(0.011)
Δ Payroll Herfindahl	0.213	0.259	0.277	0.121
	(0.017)	(0.020)	(0.020)	(0.012)
Δ Employment Herfindahl	0.247	0.303	0.329	0.141
	(0.016)	(0.019)	(0.020)	(0.011)
Panel B: Log number of firms and log employment				
Δ Log number of firms	-0.549	-0.673	-0.736	-0.309
	(0.045)	(0.050)	(0.052)	(0.030)
Δ Log total employment	-0.440	-0.527	-0.577	-0.225
	(0.064)	(0.073)	(0.076)	(0.044)
Panel C: Log wage premium				
Δ Log wage premium	0.029	0.037	0.046	0.059
	(0.031)	(0.035)	(0.037)	(0.021)
Δ De-trended log wage premium	-0.141	-0.156	-0.150	-0.090
	(0.031)	(0.035)	(0.037)	(0.021)
Observations	296,400	296,400	296,400	296,400
Local labor markets	19,760	19,760	19,760	19,760

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Effect of ICE on LLM outcomes: Robustness to weights

	Main specification (1)	Weighted by local labor market 1991 employment (2)
Panel A: Labor market concentration		
Δ Payroll Herfindahl (based on wage premium)	0.213	0.156
	(0.017)	(0.032)
Δ Payroll Herfindahl	0.213	0.162
	(0.017)	(0.034)
Δ Employment Herfindahl	0.247	0.098
	(0.016)	(0.018)
Panel B: Log number of firms and log employment		
Δ Log number of firms	-0.549	-0.657
	(0.045)	(0.159)
Δ Log total employment	-0.440	-0.187
	(0.064)	(0.142)
Panel C: Log wage premium		
Δ Log wage premium	0.029	-0.004
	(0.031)	(0.071)
Δ De-trended log wage premium	-0.141	-0.332
	(0.031)	(0.071)
Observations	296,400	296,400
Local labor markets	19,760	19,760

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Within-market cross-firm inverse elasticity of substitution $1/\eta$: Robustness to clustering

	Main specification (Clustered by firm) (1)	Clustered by local labor market (2)	Clustered by sector (3)
	Panel A: First stage		
Δ Firm log employment in LLM	-0.554	-0.554	-0.554
	(0.044)	(0.070)	(0.107)
First stage F	158.497	62.719	26.720
	Panel B: Reduced form		
Δ Firm wage premium in LLM	-0.545	-0.545	-0.545
	(0.024)	(0.104)	(0.103)
	Panel C: 2SLS		
Labor supply within-market cross-firm	0.985	0.985	0.985
inverse elasticity of substitution	(0.089)	(0.207)	(0.149)
Observations	854,068	854,068	854,068
Firms	344,066	344,066	344,066
Local labor markets	15,717	15,717	15,717

Back

Within-market cross-firm inverse elasticity of substitution $1/\eta$: Robustness to definition of wage and tariff shock

	Using December wage conditional on observables (1)	Using December wage conditional on worker FE and demo-by-year controls (2)	Using (2) and further conditioning on stayers in firm-market pair (3)	Using December average wage (4)	Using effective rate of protection (5)
Panel A: First stage					
Δ Firm log employment in LLM	-0.554	-0.609	-0.606	-0.554	-0.358
	(0.044)	(0.054)	(0.074)	(0.044)	(0.035)
First stage F	158.497	129.572	66.895	158.497	107.143
Panel B: Reduced form					
Δ Firm wage premium in LLM	-0.545	-0.497	-0.513	-0.527	-0.351
	(0.024)	(0.028)	(0.041)	(0.025)	(0.019)
Panel C: 2SLS					
Labor supply within-market cross-firm inverse elasticity of substitution	0.985	0.815	0.847	0.952	0.980
	(0.089)	(0.081)	(0.121)	(0.088)	(0.108)
Implied upper bound on wage take-home share	50%	55%	54%	51%	50%
Observations	854,068	433,760	182,610	854,068	851,662
Firms	344,066	195,486	89,130	344,066	343,558
Local labor markets	15,717	12,293	9,501	15,717	15,665

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Within-market cross-firm inverse elasticity of substitution $1/\eta$: Robustness to alternative samples

		Robustness to key alternative samples	
	Main specification	Unique producers	Local labor market defined as microregion
	(1)	(2)	(3)
Panel A: First stage			
Δ Firm log employment in LLM	-0.554	-0.289	-0.417
	(0.044)	(0.043)	(0.037)
First stage F	158.497	44.304	124.666
Panel B: Reduced form			
Δ Firm's wage premium in LLM	-0.545	-0.327	-0.404
	(0.024)	(0.044)	(0.017)
Panel C: 2SLS			
Labor supply within-market cross-firm inverse elasticity of substitution	0.985	1.134	0.969
	(0.089)	(0.224)	(0.092)
Implied upper bound on wage take-home share	50%	47%	51%
Observations	854,068	693,360	440,966
Firms	344,066	301,666	420,246
Local labor markets	15,717	13,131	474

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Cross-market inverse elasticity of substitution $1/\theta$: Robustness to clustering

	Main specification (1)	Two-way clustered by microregion and occupational group (2)
Panel A: First stage		
Δ LLM employment index	-0.396	-0.396
	(0.032)	(0.076)
First stage F	150.752	27.008
Panel B: Reduced form		
Δ LLM wage premium index	-0.108	-0.108
	(0.051)	(0.075)
Panel C: 2SLS		
$\frac{1}{\theta} - \frac{1}{\eta}$	0.272	0.272
	(0.131)	(0.190)
Panel D: Cross-market inverse elasticity of substitution		
$\frac{1}{\theta}$	1.257	1.257
	(0.096)	(0.169)
Implied lower bound on wage take-home share	44%	44%
Observations (Local labor markets)	15,717	15,717

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Cross-market inverse elasticity of substitution $1/\theta$: Robustness to wage measure

	Main specification (1)	Using average December wage (2)
Panel A: First stage		
Δ LLM employment index	-0.396	-0.403
	(0.032)	(0.034)
First stage F	150.752	136.488
Panel B: Reduced form		
Δ LLM wage premium index	-0.108	-0.094
	(0.051)	(0.050)
Panel C: 2SLS		
$\frac{1}{\theta} - \frac{1}{\eta}$	0.272	0.234
	(0.131)	(0.125)
Panel D: Cross-market inverse elasticity of substitution		
$\frac{1}{\theta}$	1.257	1.186
	(0.096)	(0.089)
Implied lower bound on wage take-home share	44%	46%
Observations (Local labor markets)	15,717	15,717

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Cross-market inverse elasticity of substitution $1/\theta$: Robustness to alternative samples

	Main specification (1)	Robustness to key alternative samples: Unique producers (2)	Robustness to key alternative samples: Local labor market is microregion (3)
Panel A: First stage			
Δ LLM employment index	-0.396	-0.120	-0.224
	(0.032)	(0.042)	(0.133)
First stage F	150.752	8.156	2.819
Panel B: Reduced form			
Δ LLM wage premium index	-0.108	-0.097	-0.034
	(0.051)	(0.065)	(0.122)
Panel C: 2SLS			
$\frac{1}{\theta} - \frac{1}{\eta}$	0.272	0.809	0.153
	(0.131)	(0.602)	(0.536)
Panel D: Cross-market inverse elasticity of substitution			
$\frac{1}{\theta}$	1.257	1.942	1.122
	(0.096)	(0.559)	(0.528)
Implied lower bound on wage take-home share	44%	34%	47%
Observations (Local labor markets)	15,717	13,131	474

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Local Labor Markets: Descriptives for baseline year (1991)

		Market percentile				
	Mean	10th	25th	50th	75th	90th
	(1)	(2)	(3)	(4)	(5)	(6)
Total market employment	698	6	16	61	262	1,006
Tradables	293	0	3	20	101	416
Exporters	255	0	1	10	69	333
Non-tradables	405	6	13	41	161	590
Numer of firms	116	3	6	16	55	183
Number of exporters	18	0	1	2	8	26
Payroll Herfindahl (based on December wage premium)	0.28	0.04	0.09	0.21	0.40	0.64
Payroll Herfindahl (based on December wage)	0.29	0.04	0.10	0.21	0.41	0.65
Employment Herfindahl	0.23	0.03	0.06	0.16	0.33	0.56
Average December wage (multiples of min. wage)	5.86	1.67	2.35	3.85	6.92	12.35
Average December wage premium (multiples of min. wage)	2.48	1.11	1.47	2.07	3.03	4.40
Δ Import Competition Exposure	12%	0%	5%	13%	18%	23%

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Effect of ICE on employment of exporters vs. others

	Δ Import Competition Exposure (1)	Effect per 10% increase in ICE (2)
Δ Log total employment	-0.440	-4.400
	(0.064)	(0.640)
Δ Exporter log employment	-0.016	-0.156
	(0.087)	(0.867)
Δ Non-exporting tradables log employment	-1.280	-12.804
	(0.146)	(1.461)
Δ Non-tradables log employment	-0.052	-0.518
	(0.077)	(0.765)
Observations	296,400	296,400
Local labor markets	19,760	19,760

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Firm-level effects: exporters versus large firms

	Δ Firm log employment (1)	Δ Firm log wage premium (2)
Log tariff shock	-0.492	-1.176
	(0.154)	(0.270)
Log tariff shock x exporter	0.509	1.279
	(0.155)	(0.333)
Log tariff shock x large firm	-1.103	-0.408
	(0.413)	(0.215)
Log tariff shock x exporter x large firm	0.979	-0.212
	(0.553)	(0.376)
Observations	2,203,009	2,203,009
Firms	792,318	792,318
Local labor markets	25,052	25,052

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Literature

1. **Regional incidence of trade**: Topalova (2007); Kovak (2013); Autor, Dorn and Hanson (2013); Dix-Carneiro and Kovak (2017)
2. **Labor market monopsony**: Manning (2003); Card et al. (2018); Tucker (2017); Azar et al. (2020); Berger, Herkenhoff and Mongey (2022); Yeh, Macaluso and Hershbein (2022); Lamadon, Mogstad and Setzler (2022)
3. **Trade and monopsony**: Zarate (2016); Benmelech, Bergman and Kim (2018); Tortarolo and Zarate (2018); Hoang (2021)
4. **Labor market boundaries**: Schmutte (2014); Nimczik (2017); Schubert, Stansbury and Taska (2019)

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Contributions to the literature

1. **Theoretical**: Sufficient statistics for effect of trade shocks on firm local labor market power
   - Trade and concentration: Benmelech, Bergman and Kim (2018); Hoang (2021)
   - Plus: Estimate offsetting effects of trade concentration on wages
2. **Methodological/Empirical**: Key elasticities using IV with firm-level labor demand shocks
   - Concentration and wages: Berger, Herkenhoff and Mongey (2021); Hoang (2021)
   - No simulation needed; adapt demand estimation from Costinot, Donaldson and Smith (2016) Details
3. **Descriptive**: Understanding of labor markets in developing countries
   - Worker mobility: Schmutte (2014); Nimczik (2017); Schubert, Stansbury and Taska (2021)
     - 1st job-to-job transition matrices for a developing country
   - Concentration and wages: Azar et al. (2020); Marinescu, Ouss and Pape (2021); Schubert, Stansbury and Taska (2021)
     - 1st estimates using *universe* of formal sector employment for a *developing* country setting

Back

Labor supplied to firm z in local labor market m: Nested CES

- Follow BHM's microfoundation of nested CES labor supply (Atkeson and Burstein (2008) for labor mkts)
  - Extend to incorporate (dis)taste-shifters $\{\xi_{zm}, \xi_m\}$. Details
  - Workers j consider: wages$\{w_{zm}\}$,(dis)taste-shifters $\{\xi_m, \xi_{zm}\}$, idiosyn. taste $\xi^j_{zm} \sim$ GEV with shape parameters θ and η.

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- Since $\xi^j_{zm} \sim$ GEV, by McFadden (1978) total **labor supplied to firm z in market m** is given by:

$$l_{zm} = L \left(\frac{w_{zm}}{W_m} \right)^{\eta} \left(\frac{W_m}{W} \right)^{\theta} \left(\xi_{zm}^{1+\eta} \xi_m^{1+\theta} \right)^{-1}$$

where L, W, W_m are CES labor supply and wage indices (see Aggretation and Indices). **Intuition?**

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- The wage firm z must pay to attract l_{zm} workers is its **inverse labor supply curve**:

$$w_{zm} = W \left(\frac{l_{zm}}{L_m}\right)^{\frac{1}{\eta}} \left(\frac{L_m}{L}\right)^{\frac{1}{\theta}} \xi_{zm}^{1+\frac{1}{\eta}} \xi_m^{1+\frac{1}{\theta}}$$

where L_m is market m's CES labor supply index (i.e., taste-adjusted employment). **Intuition?** Back

Labor demanded by firm z in market m: Cournot competition

- Labor markets are not perfectly competitive. Firms compete for workers à la Cournot, choosing l_{zm} to maximize profits, given by

$$\Pi_z = R_z\left(\{l_{zm}, l_{-zm}\}, X\right) - \sum_m w_{zm}\left(\{l_{zm}, l_{-zm}\}\right) l_{zm}$$

where $R_z(\cdot)$ is firm z's revenue function (incl tech, goods market structure, exogenous shock X).

- Firm z's FOC for profit max **equates marginal revenue to marginal cost**:

$$\frac{\partial R_z}{\partial l_{zm}} = w_{zm} \times \underbrace{\left(1 + \varepsilon_{zm}^{-1}\right)}_{\mu_{zm}\text{: markdown}}$$

where ε_{zm}^{-1} **is the inverse elasticity of residual labor supply faced by firm z in m.**

- Question is: Does nested CES labor supply imply anything about the shape of ε_{zm}^{-1} ? It does. Back

Effect of trade on labor market concentration is robust to...

1. ... alternative measures of concentration (e.g., see above)
   - But Payroll HHI is the theory-consistent measure for firm labor market power.
2. ... alternative weights for constructing ΔICE_m. Robust shock
   - Using $s^2_{zm,1991}$ as weights is least noisy, consistent with framework prediction.
3. ... weighing regressions by market baseline employment. Robust weights
   - Which shows the effect is not driven by a handful of small markets.
4. ... two-way clustering by microregion and occupation. Robust clust
   - SE of 0.003 instead of 0.002.

Effect is also present, and about half as large:

- When labor markets are defined more broadly, by microregions. only. Robust boundary
- When effective rates of protection – noisier tariff shocks – are used to construct ΔICE_m. Robust shock

Placebo regressions following Adao, Kolesár and Morales (2019): Placebo Back

A note: Estimating markdowns under strategic interaction (Cournot)

BHM: "Top-down"
Focus on ε_{zm}^{-1}: **elast. of supply**
Method: **Indirect inference**

Key issue: Share-dependent ε_{zm}^{-1} (Nash eq.) can't be identified using differential wage and emp shock responses by firm shares (Partial eq.). **Solution**:

1. Estimate "reduced form" $\hat{\epsilon}_{zm}^{-1}$ from shock het by firm shares
2. Simulate data (draw prod + shocks; guess θ, η). Compute shares, wages, emp per model. Run (1) in sim data, compute sim$\hat{\epsilon}_{zm}^{-1}$. Use sim $\left\{\hat{\epsilon}_{zm}^{-1}, s_{ijt}\right\}$ as moments for η and θ.
3. Compute ε_{zm}^{-1} given η, θ and data on shares.

Shock variation used: cross-market

This paper: "Bottom-Up"
Focus on η, θ: **elast. of subs.**
Method: **IV**

Key insight: Leverage nested CES structure. Firm-level shocks + appropriate FEs, wage and emp responses do identify η instead. No need for simulation. **Solution**:

1. Estimate η with cross-firm within-mkt shocks
2. Given η, estimate θ with cross-mkt shocks
3. Compute ε_{zm}^{-1} given η, θ and data on shares

Shock variation used: cross-market + within-market cross-firm

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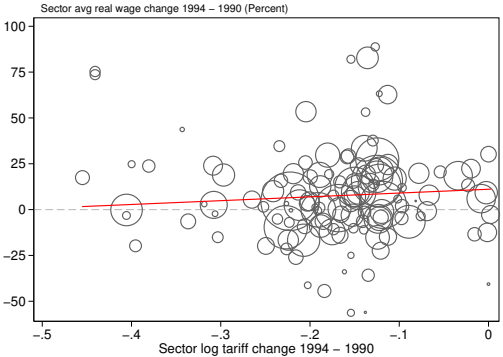
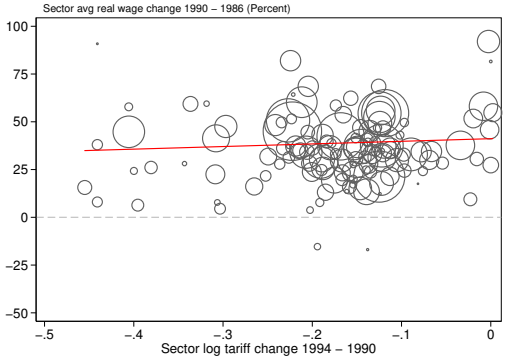
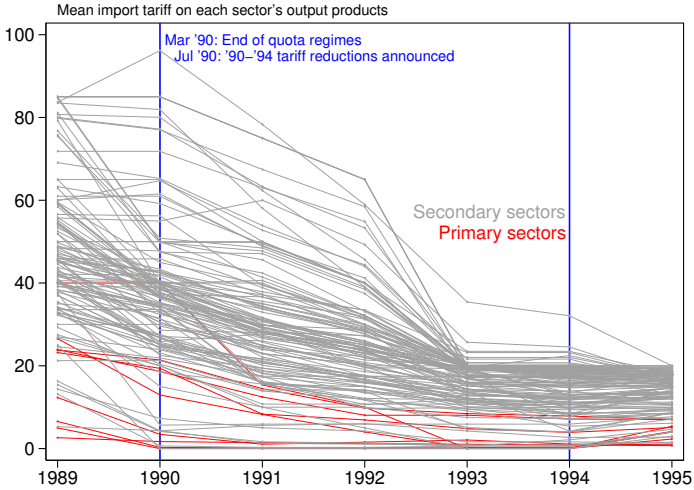
Trade liberalization: Cross-sector wage effects





Time series Min wages

Timining of import tariff reductions



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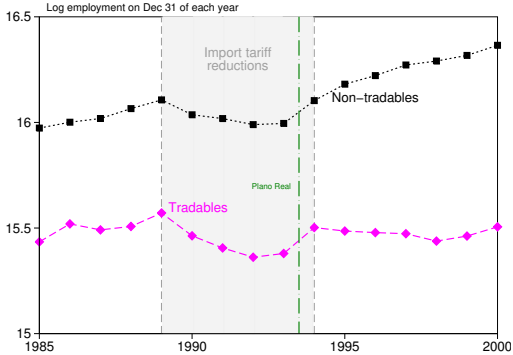
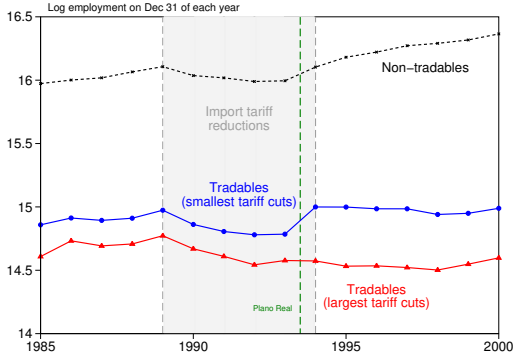
Country-level employment time series





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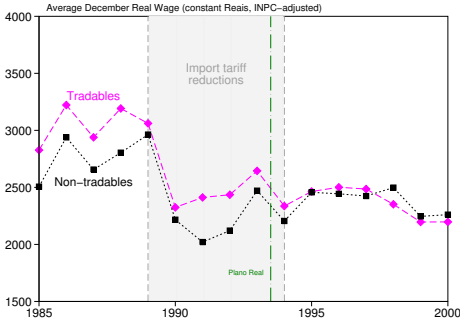
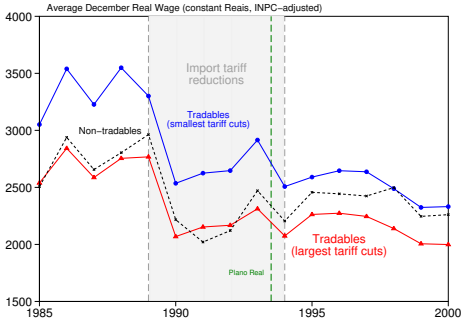
Country level average wage





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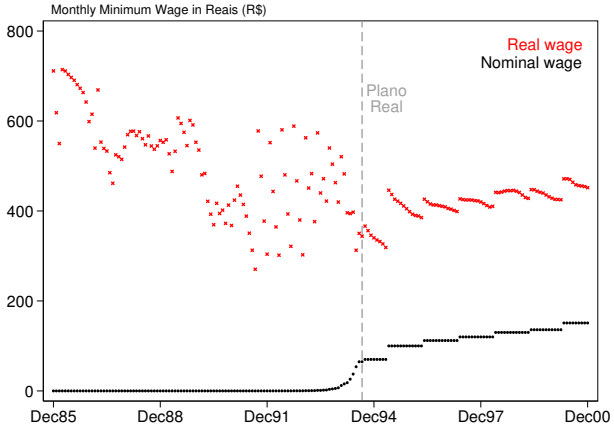
Minimum wages: nominal versus real



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