

# Trade, Labor Market Concentration, and Wages

Mayara Felix

Princeton University

# 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
- **This paper:** Trade → concentration → firm labor market power → wages.

This paper: Trade → concentration → firm labor market power → wages  
Context: Brazil's 1990s trade liberalization

- 1 **Model:** Link between trade, labor market concentration, and market power. 2 sufficient statistics
- 2 **Empirics:** Identification strategy and estimation of sufficient statistics
- 3 **Implication** of effect of trade on labor market concentration to average wages

This paper: Trade → concentration → firm labor market power → wages  
Context: Brazil's 1990s trade liberalization

**1 Model:** Link between trade, labor market concentration, and market power. 2 sufficient statistics

- Effect of trade on labor market concentration
- Gap between workers' key inverse elasticities of substitution

**2 Empirics:** Identification strategy and estimation of sufficient statistics

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

This paper: Trade → concentration → firm labor market power → wages  
Context: Brazil's 1990s trade liberalization

**1 Model:** Link between trade, labor market concentration, and market power. 2 sufficient statistics

- Effect of trade on labor market concentration
- Gap between workers' key inverse elasticities of substitution

**2 Empirics:** Identification strategy and estimation of sufficient statistics

- Effect of trade on labor market concentration:  $\beta$
- Workers' cross-market inverse elasticity of substitution:  $\frac{1}{\theta}$
- Workers' within-market cross-firm inverse elasticity of substitution:  $\frac{1}{\eta}$

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

This paper: Trade → concentration → firm labor market power → wages  
Context: Brazil's 1990s trade liberalization

**1 Model:** Link between trade, labor market concentration, and market power. 2 sufficient statistics

- Effect of trade on labor market concentration
- Gap between workers' key inverse elasticities of substitution

**2 Empirics:** Identification strategy and estimation of sufficient statistics

- Effect of trade on labor market concentration:  $\beta$
- Workers' cross-market inverse elasticity of substitution:  $\frac{1}{\theta}$
- Workers' within-market cross-firm inverse elasticity of substitution:  $\frac{1}{\eta}$

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

- ↓ wages by increasing firm labor market power
- ↑ wages by compositional reallocation to exporters

# Preview of findings

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

1 Effect of trade on local labor market concentration

2 Gap between workers' key elasticities of substitution

3 Implication to average wages

# Preview of findings

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

## 1 Effect of trade on local labor market concentration

- Trade increased labor market concentration by roughly 7%
- Effect driven by exit & compositional employment reallocation to exporters

## 2 Gap between workers' key elasticities of substitution

## 3 Implication to average wages

# Preview of findings

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

## 1 Effect of trade on local labor market concentration

- Trade increased labor market concentration by roughly 7%
- Effect driven by exit & compositional employment reallocation to exporters

## 2 Gap between workers' key elasticities of substitution

- Gap is small but statistically significant: changes in concentration matter for market power
- Implication of elasticity levels: pre-reform, workers took home 50 cents of the marginal dollar

## 3 Implication to average wages

# Preview of findings

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

## 1 Effect of trade on local labor market concentration

- Trade increased labor market concentration by roughly 7%
- Effect driven by exit & compositional employment reallocation to exporters

## 2 Gap between workers' key elasticities of substitution

- Gap is small but statistically significant: changes in concentration matter for market power
- Implication of elasticity levels: pre-reform, workers took home 50 cents of the marginal dollar

## 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.

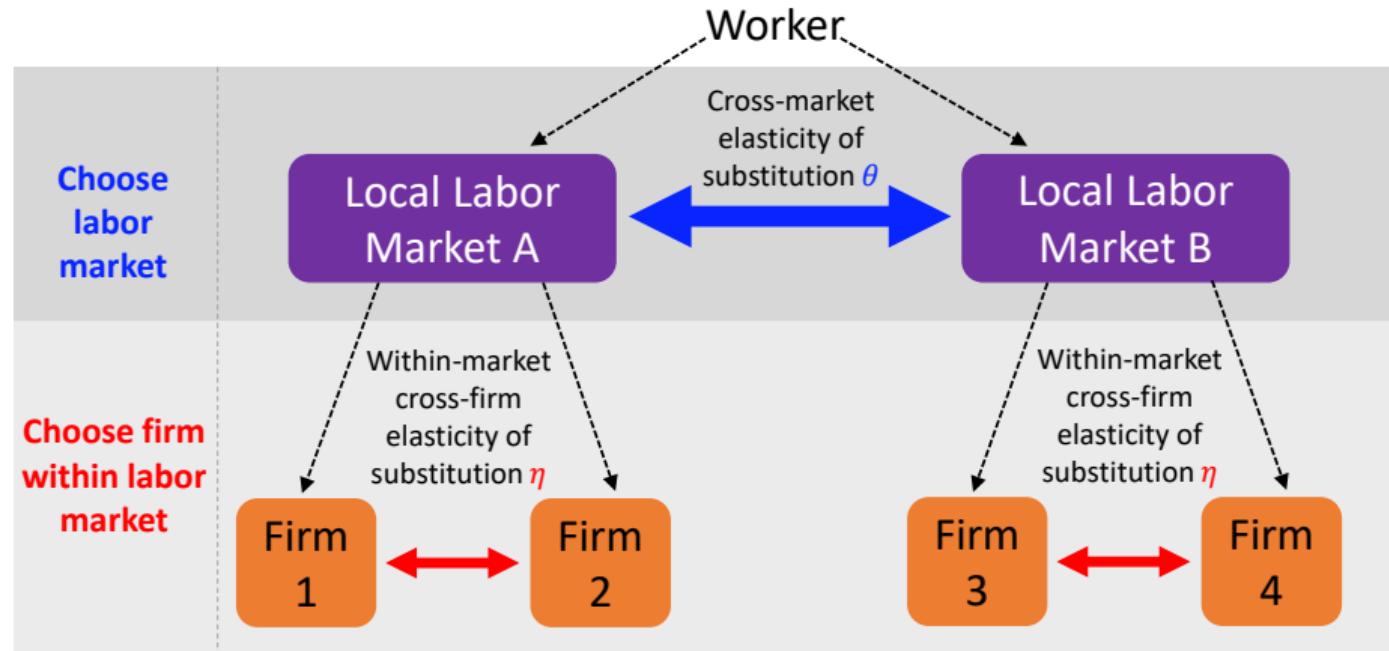
## 3 But increased market power does not explain bulk of trade-induced wage declines.

- 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.

# Roadmap

- 1 Model
- 2 Context
- 3 Empirics
- 4 Implications for wages
- 5 Conclusion

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



## Model summary

- **Supply.** NCES + idiosync. worker pref  $\xi_{zm}^j \sim$  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](#)

## Model summary

- **Supply.** NCES + idiosync. worker pref  $\xi_{zm}^j \sim$  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](#)

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

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

where  $\varepsilon_{zm}^{-1}$  is the **inverse elasticity of residual labor supply** faced by firm  $z$  in  $m$ . [Details](#)

## Model summary

- **Supply.** NCES + idiosync. worker pref  $\xi_{zm}^j \sim$  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](#)

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

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

where  $\varepsilon_{zm}^{-1}$  is the **inverse elasticity of residual labor supply** faced by firm  $z$  in  $m$ . [Details](#)

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

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

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  $\mu_m$  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  $\mu_m$  is given by:

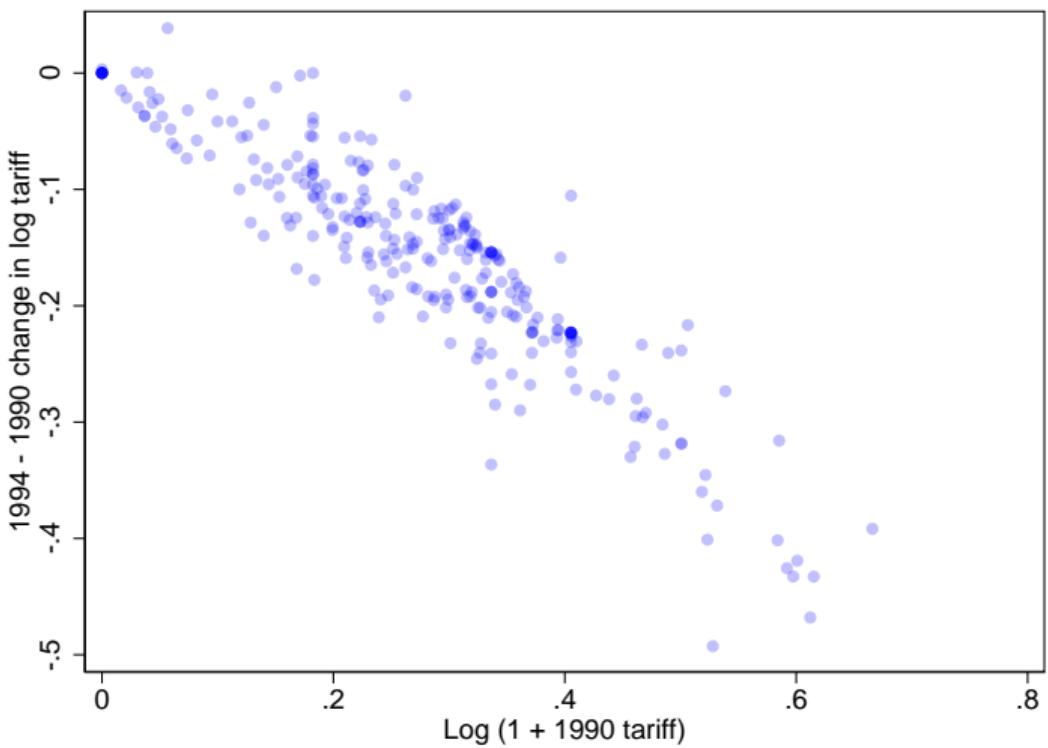
$$\mu_m = 1 + \frac{1}{\theta} HHI_m + \frac{1}{\eta} (1 - HHI_m)$$

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

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

where  $\beta$  is the effect of trade on  $HHI_m$ .

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

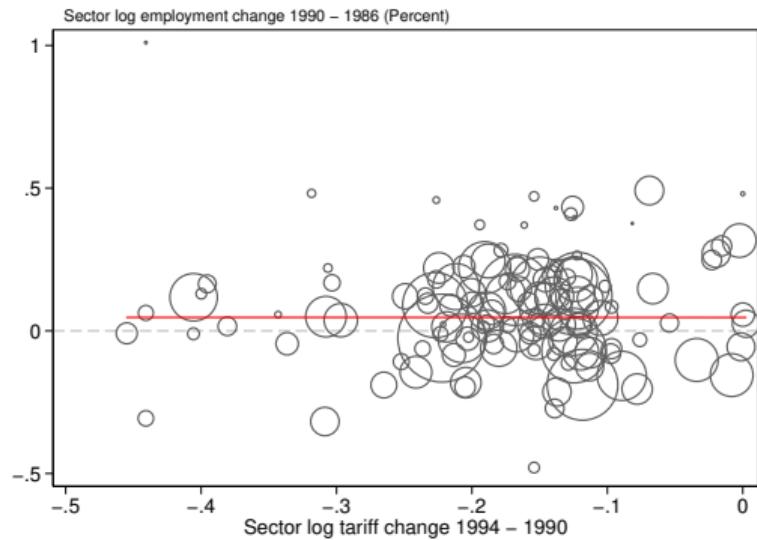


Timing

# Trade liberalization: Country-level Cross-sector employment effects



# Trade liberalization: Country-level Cross-sector employment effects



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

# Roadmap

## 1 Model

## 2 Empirics

- **Effect of trade on local labor market concentration:**  $\beta$
- Within-market cross-firm inverse elasticity of substitution:  $\frac{1}{\eta}$
- Cross-market inverse elasticity of substitution:  $\frac{1}{\theta}$

## 3 Implications for wages

## 4 Conclusion

# Effect of trade on local labor market concentration: Empirical strategy

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

# 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

- 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 ( $\Delta ICE$ )** as

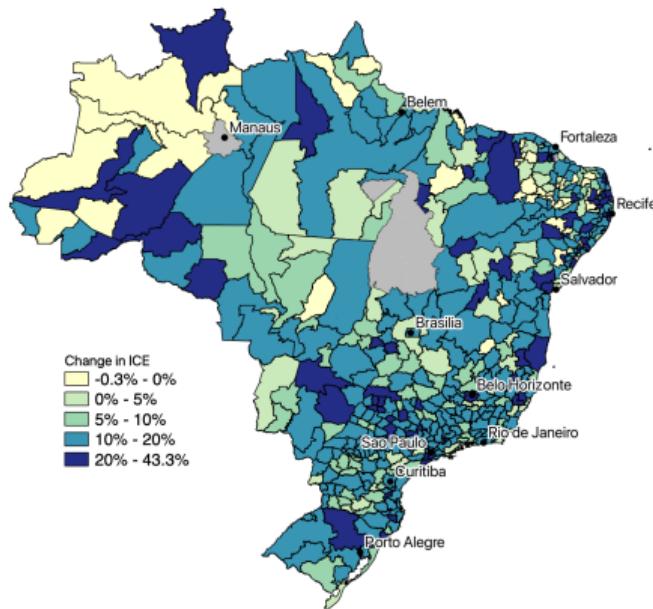
$$\Delta ICE_m \equiv - \sum_{z \in \Theta_m} \kappa_{zm} \ln \left( \frac{1 + \tau_{z,1994}}{1 + \tau_{z,1990}} \right)$$

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

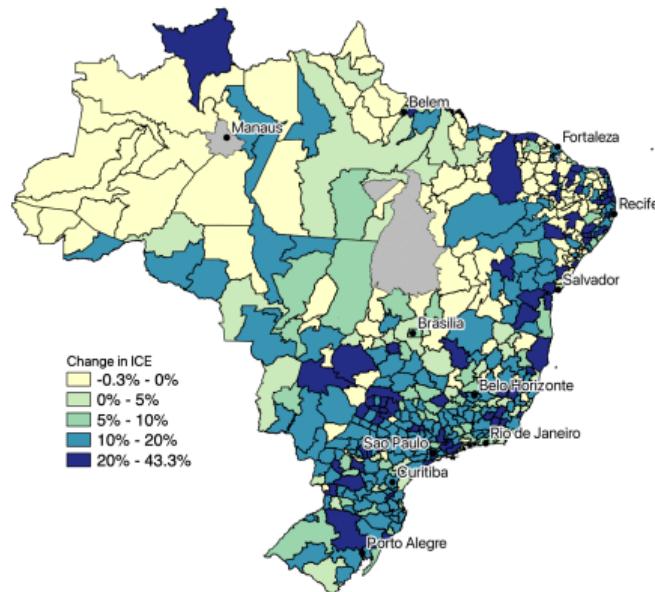
$\tau_z$  is the import tariff on firm  $z$ 's output sector, and  $s_{zm,1991}$  is firm  $z$ 's payroll share in market  $m$  in the baseline year of 1991. **Intuition?**

# Variation in $\Delta ICE_m$ for two occupational groups

**Office administration workers**



**Managers of industrial activities**



# Effect of trade on local labor market concentration: Regression equation

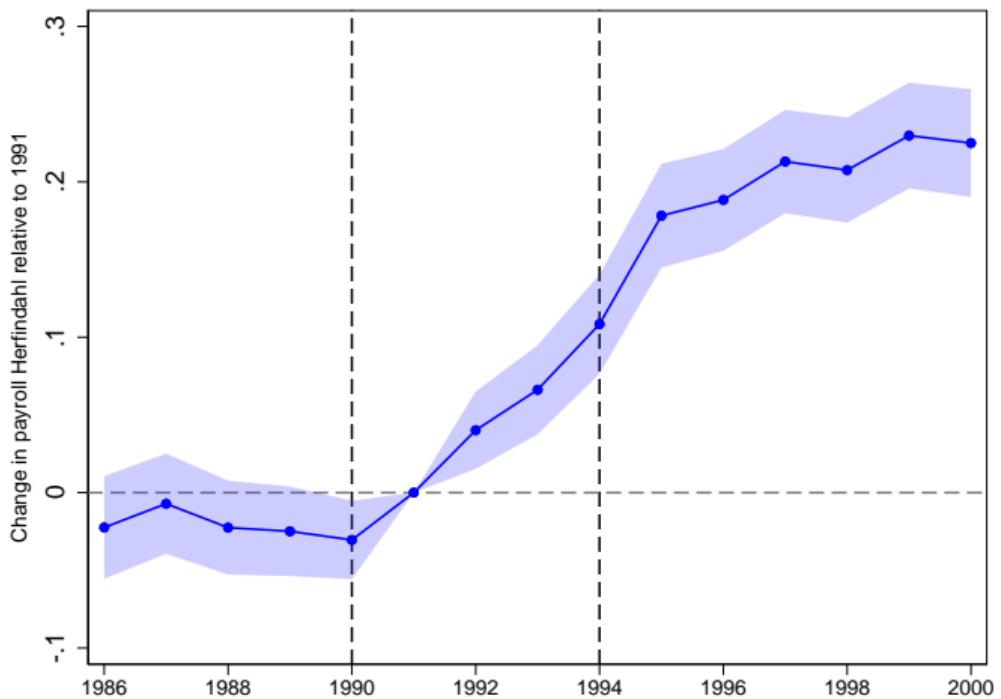
I then estimate the effect of  $\Delta ICE_m$  on the change in labor market  $m$ 's outcome  $Y_m$  with the following **difference-in-differences regression**:

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

where

- $\zeta_k$  is the cumulative effect of  $\Delta ICE_m$  at year  $k$
- $\delta_m$  and  $\delta_t$  are market and year fixed effects

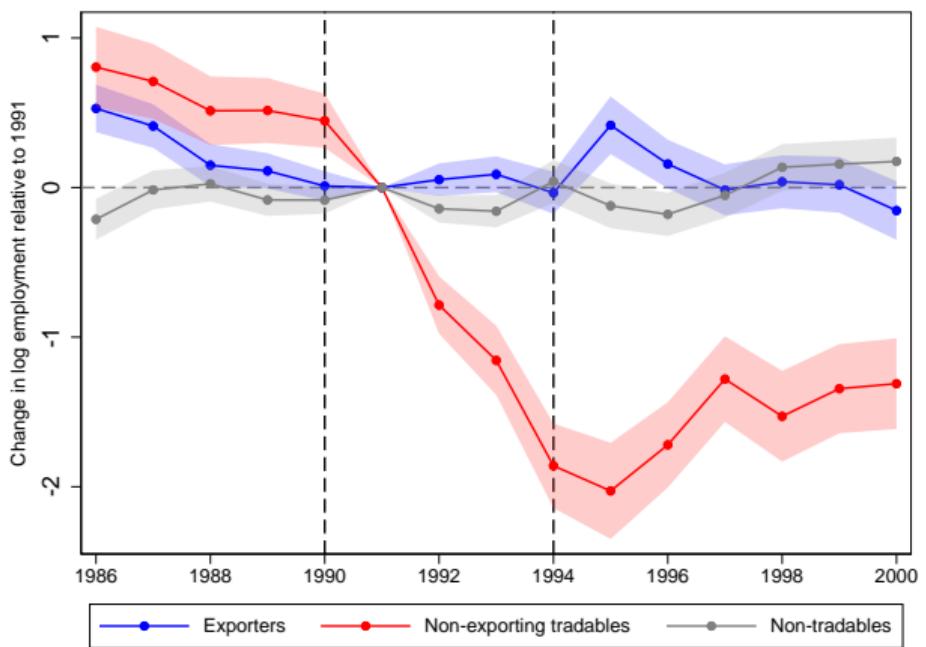
# Effect of trade on local labor market concentration: Findings



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

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

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



Firm size dist. Firm-level regs

# Roadmap

## 1 Model

## 2 Empirics

- Effect of trade on local labor market concentration:  $\beta$
- **Within-market cross-firm inverse elasticity of substitution:**  $\frac{1}{\eta}$
- Cross-market inverse elasticity of substitution:  $\frac{1}{\theta}$

## 3 Implications for wages

## 4 Conclusion

# Estimation of $\frac{1}{\eta}$ : Regression equation

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

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

# Estimation of $\frac{1}{\eta}$ : Regression equation

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

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

- ② Take logs

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

# Estimation of $\frac{1}{\eta}$ : Regression equation

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

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

- ② Take logs

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

- ③ Simplifies to

$$\ln w_{zmt} = \frac{1}{\eta} \ln I_{zmt} + \delta_{mt} + \epsilon_{zmt}$$

# Estimation of $\frac{1}{\eta}$ : Regression equation

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

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

- ② Take logs

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

- ③ Simplifies to

$$\ln w_{zmt} = \frac{1}{\eta} \ln I_{zmt} + \delta_{mt} + \epsilon_{zmt}$$

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

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

# 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  $m$ .

# 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  $m$ .

- ② **Threat to ID:** Changes in labor supplied to firm  $z$  in market  $m$  (i.e.,  $\Delta \ln l_{zm}$ ) might be correlated with changes in workers' labor supply taste for firm  $z$  in market  $m$  (i.e.,  $\Delta \epsilon_{zm}$ ).

# 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  $m$ .

- ② **Threat to ID:** Changes in labor supplied to firm  $z$  in market  $m$  (i.e.,  $\Delta \ln l_{zm}$ ) might be correlated with changes in workers' labor supply taste for firm  $z$  in market  $m$  (i.e.,  $\Delta \epsilon_{zm}$ ).
- 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  $\Delta d_m$  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

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

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

	Δ in Log Import Tariff faced by firm (1)
<i>Panel A: First stage</i>	
Δ Firm log employment in LLM	-0.554 (0.044)
First stage F	158.497
<i>Panel B: Reduced form</i>	
Δ Firm wage premium in LLM	-0.545 (0.024)
<i>Panel C: 2SLS</i>	
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.

# Heterogeneity of $\frac{1}{\eta}$ by worker demos

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

	Δ firm log wage premium in local market				
	(1)	(2)	(3)	(4)	(5)
Δ Firm log employment in local market	0.985 *** (0.089)	1.084 *** (0.142)	1.095 *** (0.087)	1.003 *** (0.087)	1.206 *** (0.147)
Δ Firm log employment in local market x (Baseline female share of employment)		-0.0024 (0.003)			-0.00267 (0.003)
Δ Firm log employment in local market x (Baseline college-educated share of employment)			-0.0170 *** (0.003)		-0.0176 *** (0.003)
Δ Firm log employment in local market x (Baseline over-40-years-old share of employment)				-0.000789 (0.001)	0.000067 (0.002)
Observations	854,068	854,068	854,068	854,068	854,068

Standard errors in parentheses. \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

- Overall: College-educated are most elastic

# Heterogeneity of $\frac{1}{\eta}$ by market characteristics

- Spec: Interact RHS ( $\Delta \ln I_{zm}$ ) with microregion characteristics

	$\Delta$ firm log wage premium in local market					
	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta$ Firm log employment in local market	0.985*** (0.089)	3.636*** (0.617)	3.169*** (0.459)	1.189** (0.409)	1.809*** (0.405)	3.068*** (0.869)
$\Delta$ Firm log employment in local market x (Baseline informal employment share, excl. self-employment)		-0.127*** (0.028)				0.0905 (0.093)
$\Delta$ Firm log employment in local market x (Baseline self-employment share)			-0.123*** (0.023)			-0.156** (0.048)
$\Delta$ Firm log employment in local market x (Baseline union employment share)				-0.565 (1.132)		-0.758 (1.331)
$\Delta$ Firm log employment in local market x (Baseline unemployment rate)					-0.103* (0.049)	-0.118 (0.077)
Observations	854,068	854,068	854,068	854,068	854,068	854,068

Standard errors in parentheses. \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

- Overall: In markets with more **self-employment**, firms face **more elastic supply**

# Roadmap

## 1 Model

## 2 Context

## 3 Empirics

- Effect of trade on local labor market concentration:  $\beta$
- Within-market cross-firm inverse elasticity of substitution:  $\frac{1}{\eta}$
- **Cross-market inverse elasticity of substitution:**  $\frac{1}{\theta}$

## 4 Implication for wages

## 5 Conclusion

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

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

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

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

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

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

- ② The expression in brackets implies

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

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

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

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

- ② The expression in brackets implies

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

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

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

- ② **Threat to ID:** Changes in the taste-adjusted labor supplied to market  $m$  (i.e.,  $\Delta \ln L_m$ ) might be correlated with changes in workers' labor supply taste for market  $m$  (i.e.,  $\Delta \epsilon_{zm}$ ).

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

- ② **Threat to ID:** Changes in the taste-adjusted labor supplied to market  $m$  (i.e.,  $\Delta \ln L_m$ ) might be correlated with changes in workers' labor supply taste for market  $m$  (i.e.,  $\Delta \epsilon_{zm}$ ).
- 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  $\eta$ , compute as

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

where  $\xi_{zm}$  can similarly be retrieved for each year using firm  $z$ 's inverse labor supply equation in market  $m$  and an estimate for  $\eta$ .

- ③  $\Delta ICE_m$ , whose measurement I introduced earlier.

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

	Δ Import Competition Exposure (1)
<i>Panel A: First stage</i>	
Δ LLM employment index	-0.396 (0.032)
First stage F	150.752
<i>Panel B: Reduced form</i>	
Δ LLM wage premium index	-0.108 (0.051)
<i>Panel C: 2SLS</i>	
$\frac{1}{\theta} - \frac{1}{\eta}$	0.272 (0.131)
<i>Panel D: Cross-market inverse elasticity of substitution</i>	
$\frac{1}{\theta}$	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

$$\frac{1}{\eta} = 0.985 \text{ and } \frac{1}{\theta} = 1.257$$

# 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:

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

- 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

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

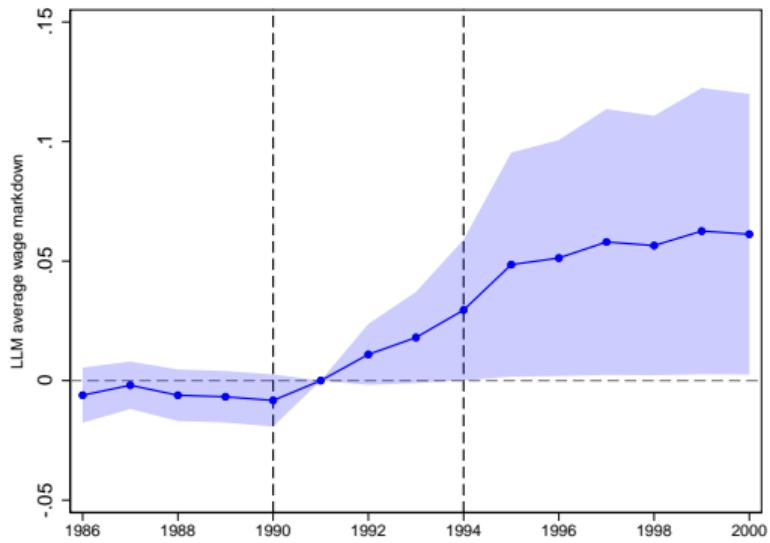
# Effect of trade on firm labor market power

- 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:

$$\text{Wage} = \underbrace{(\text{Take-home share})}_{\mu^{-1}[\text{mkt power}]} \times \underbrace{(\text{Marginal Revenue Product of Labor})}_r$$

[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:

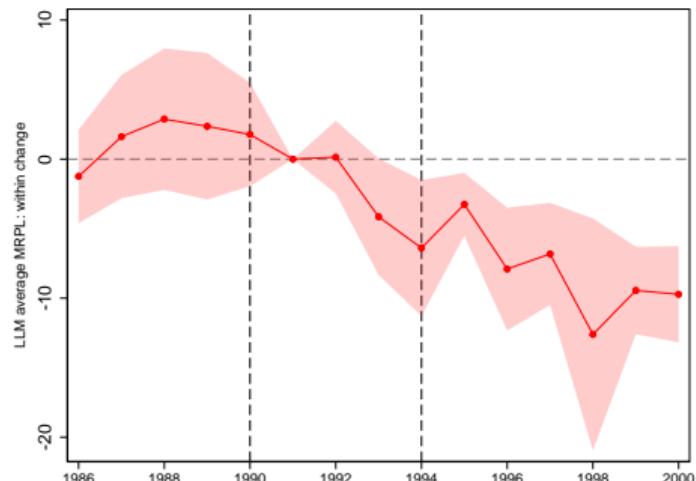
$$\frac{d\bar{r}_{mt}}{dICE_m} = \underbrace{\frac{d(\bar{r}_{mt}|_{s_{jm0}^e})}{dICE_m}}_{\text{Within-firm effect}} + \underbrace{\frac{d(\bar{s}_{mt}^e|_{r_{jm0}})}{dICE_m}}_{\text{Cross-firm reallocation}}$$

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

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

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

	$\Delta$ Import Competition Exposure	Effect per 10% increase in ICE
	(1)	(2)
$\Delta$ Average wage premium	-3.340 (0.454)	-0.334 (0.045)
$\Delta$ Average wage premium take-home share	-0.014 (0.007)	-0.0014 (0.001)
$\Delta$ Average marginal revenue product of labor	-6.735 (1.334)	-0.673 (0.133)
$\Delta$ Within-firm	-6.821 (1.876)	-0.682 (0.188)
$\Delta$ Cross-firm	0.132 (0.023)	0.013 (0.002)
Observations	243,750	243,750
Local labor markets	16,250	16,250



# 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%
$\Delta$ Within-firm	--	No	-0.340	- 13.68%	--
$\Delta$ 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.

- Adao, Rodrigo, Michal Kolesár, and Eduardo Morales.** 2019. "Shift-share designs: Theory and inference." *The Quarterly Journal of Economics*, 134(4): 1949–2010.
- Atkeson, Andrew, and Ariel Burstein.** 2008. "Pricing-to-market, trade costs, and international relative prices." *American Economic Review*, 98(5): 1998–2031.
- Autor, David, David Dorn, and Gordon Hanson.** 2013. "The China syndrome: Local labor market effects of import competition in the United States." *The American Economic Review*, 103(6): 2121–2168.
- Azar, José, Ioana Marinescu, Marshall Steinbaum, and Bledi Taska.** 2020. "Concentration in US labor markets: Evidence from online vacancy data." *Labour Economics*, 66: 101886.
- Benmelech, Efraim, Nittai Bergman, and Hyunseob Kim.** 2018. "Strong employers and weak employees: How does employer concentration affect wages?" National Bureau of Economic Research.
- Berger, David, Kyle Herkenhoff, and Simon Mongey.** 2022. "Labor market power." *American Economic Review*, 112(4): 1147–93.
- Berger, David W, Kyle Herkenhoff, and Simon Mongey.** 2021. "Labor Market Power." *University of Chicago, Becker Friedman Institute for Economics Working Paper*, , (2021-58).
- Card, David, Ana Rute Cardoso, Joerg Heining, and Patrick Kline.** 2018. "Firms and labor market inequality: Evidence and some theory." *Journal of Labor Economics*, 36(S1): S13–S70.

**Costinot, Arnaud, Dave Donaldson, and Cory Smith.** 2016. "Evolving comparative advantage and the impact of climate change in agricultural markets: Evidence from 1.7 million fields around the world." *Journal of Political Economy*, 124(1): 205–248.

**Dix-Carneiro, Rafael, and Brian K Kovak.** 2017. "Trade liberalization and regional dynamics." *American Economic Review*, 107(10): 2908–46.

**Dix-Carneiro, Rafael, Pinelopi K Goldberg, Costas Meghir, and Gabriel Ulyssea.** 2021. "Trade and informality in the presence of labor market frictions and regulations." National Bureau of Economic Research.

**Dorn, David, Gordon Hanson, Kaveh Majlesi, et al.** 2020. "Importing political polarization? The electoral consequences of rising trade exposure." *American Economic Review*, 110(10): 3139–83.

**Felix, Mayara.** 2021b. "Trade Liberalization and Modern Slavery: Evidence from Labor Inspections in Brazil." Research in progress.

**Hoang, Pham.** 2021. "Trade Reform, Oligopsony, and Labor Market Distortions: Theory and Evidence." Working paper.

**Iacoella, Francesco, Patricia Justino, and Bruno Martorano.** 2020. *Roots of dissent: Trade liberalization and the rise of populism in Brazil*. WIDER Working Paper.

**Kovak, Brian K.** 2013. "Regional effects of trade reform: What is the correct measure of liberalization?" *The American Economic Review*, 103(5): 1960–1976.

**Lamadon, Thibaut, Magne Mogstad, and Bradley Setzler.** 2022. "Imperfect competition, compensating differentials, and rent sharing in the US labor market." *American Economic Review*, 112(1): 169–212.

**Manning, Alan.** 2003. *Monopsony in motion: Imperfect competition in labor markets*. Princeton University Press.

**Marinescu, Ioana, Ivan Ouss, and Louis-Daniel Pape.** 2021. "Wages, hires, and labor market concentration." *Journal of Economic Behavior & Organization*, 184: 506–605.

**McFadden, Daniel.** 1978. "Modeling the choice of residential location." *Transportation Research Record*, , (673).

**Melitz, Marc J.** 2003. "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity." *Econometrica: Journal of the Econometric Society*, 71(6): 1695–1725.

**Nimczik, Jan Sebastian.** 2017. "Job mobility networks and endogenous labor markets."

**Schmutte, Ian M.** 2014. "Free to move? A network analytic approach for learning the limits to job mobility." *Labour Economics*, 29: 49–61.

**Schubert, Gregor, Anna Stansbury, and Bledi Taska.** 2019. "Getting labor markets right: Outside options and occupational mobility." Working paper.

**Schubert, Gregor, Anna Stansbury, and Bledi Taska.** 2021. "Employer concentration and outside options." Available at SSRN 3599454.

**Topalova, Petia.** 2007. "Trade liberalization, poverty and inequality: Evidence from Indian districts." In *Globalization and Poverty*. 291–336. University of Chicago Press.

**Topalova, Petia.** 2010. "Factor Immobility and Regional Impacts of Trade Liberalization: Evidence on Poverty from India." *American Economic Journal: Applied Economics*, 2(4): 1–41.

**Tortarolo, Dario, and Roman D Zarate.** 2018. "Measuring Imperfect Competition in Product and Labor Markets. An Empirical Analysis using Firm-level Production Data."

**Tucker, Lee.** 2017. "Monopsony for Whom? Evidence from Brazilian Administrative Data."

**Ulyssea, Gabriel.** 2018. "Firms, informality, and development: Theory and evidence from Brazil." *American Economic Review*, 108(8): 2015–47.

**Yeh, Chen, Claudia Macaluso, and Brad Hershbein.** 2022. "Monopsony in the US Labor Market." *American Economic Review*, 112(7): 2099–2138.

**Zarate, Roman David.** 2016. "Chinese Import Competition effects on Domestic Firms: Disentangling the role of firms on labor markets."

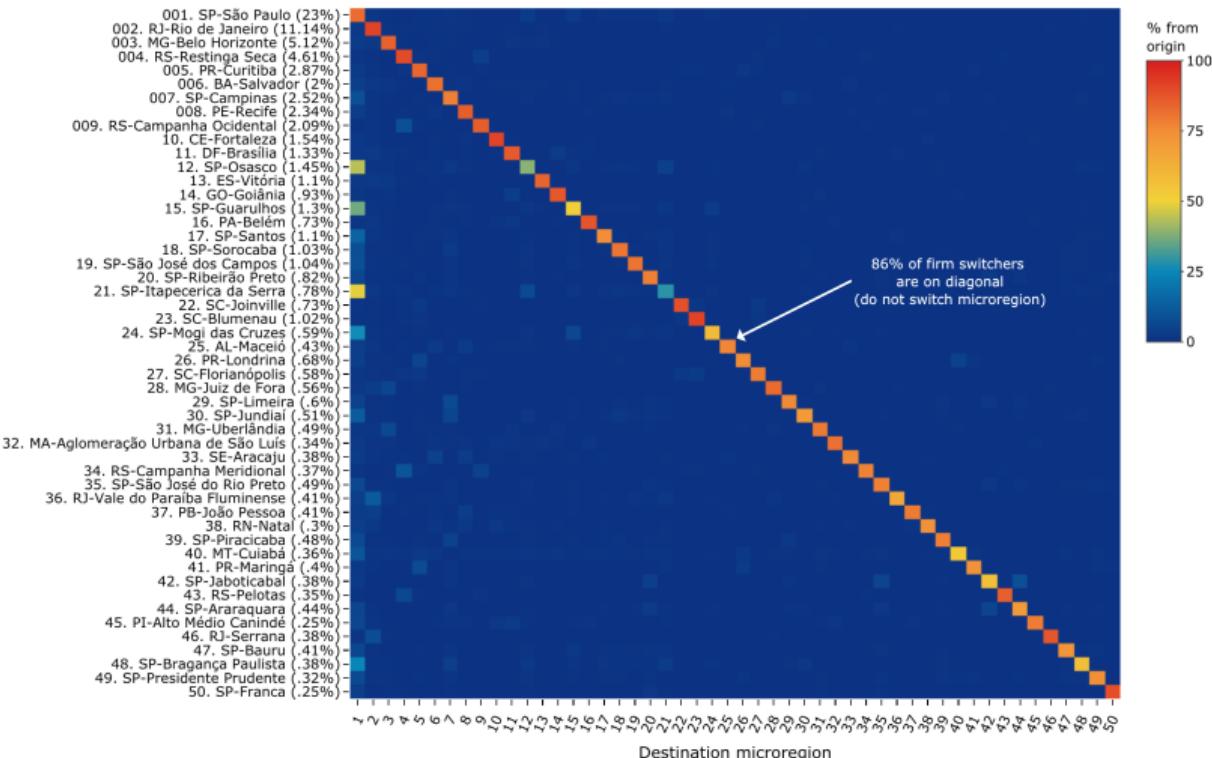
# A Local Labor Market (LLM) is a Microregion x Occupational Group pair

---

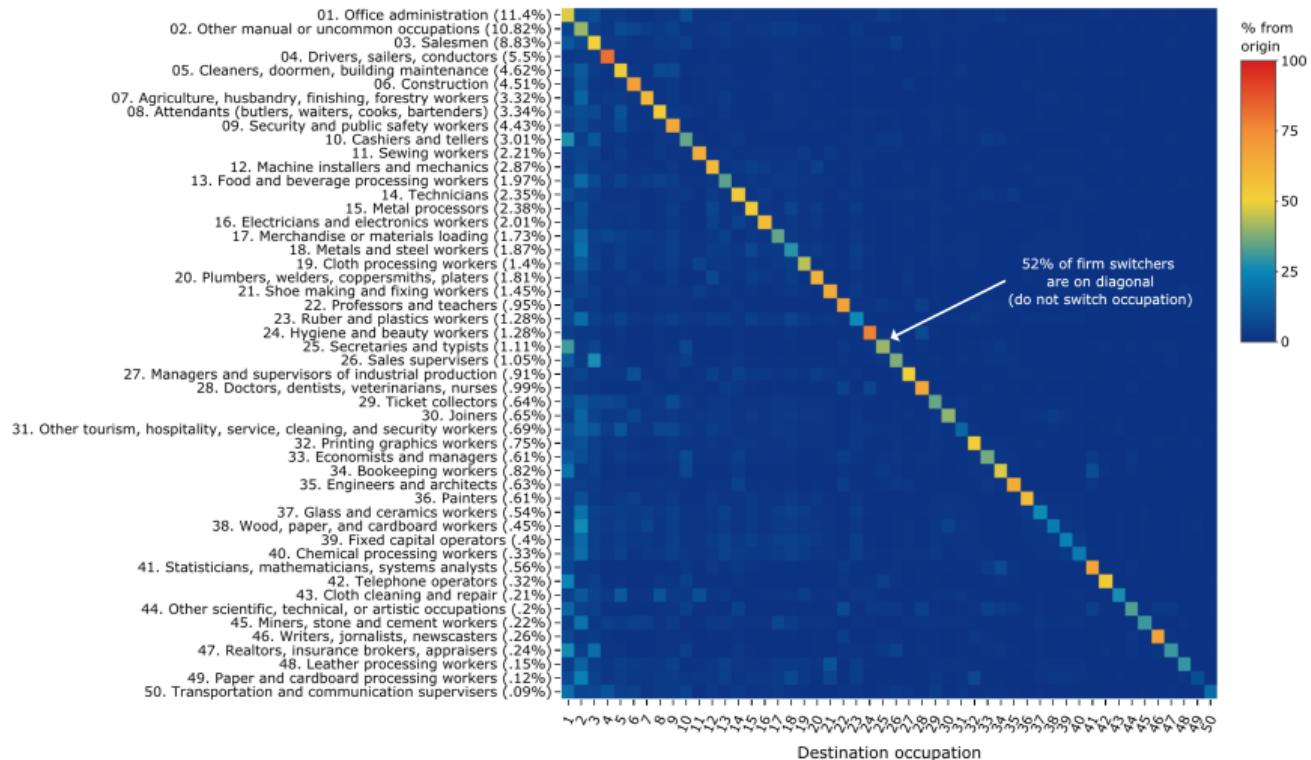
Total workers transitioning to different firm in 1990-1991	1,055,205
<i>Percent staying in...</i>	
Microregion (486 groups of municipalities)	79%
Occupational group (CBO94 / 2-digit / 65 groups)	50%
<i>Local labor market: Microregion x Occupational group cell</i>	40%
Economic sector group (CNAE95 / 2-digit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

---

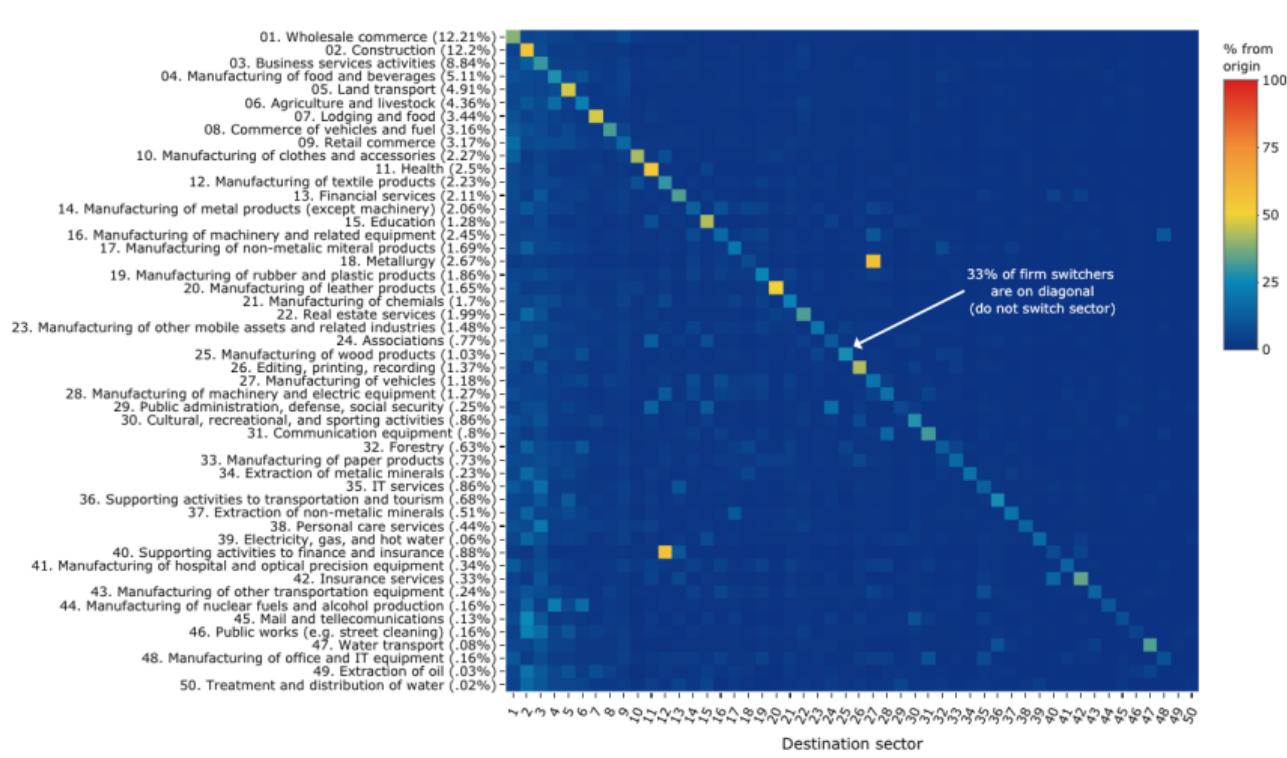
# 1990-1991 Transitions at Top 50 Microregions



# 1990-1991 Transitions at Top 50 Occupational Groups

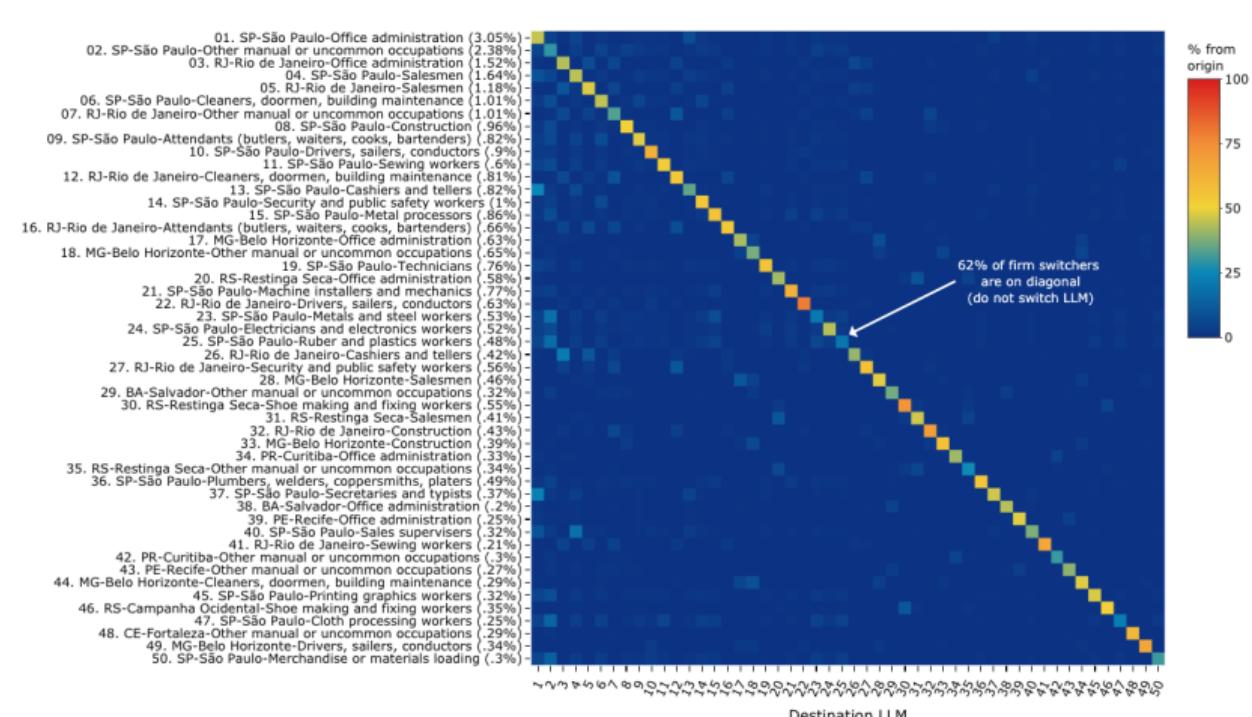


# 1990-1991 Transitions at Top 50 Sectoral Groups



# An LLM is a Microregion × Occupational Group cell (~ 20K markets)

## Plotted: 1990-1991 transitions for Top 50



## 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  $\xi_{zm}^j \sim \text{GEV}$  with shape parameters  $\theta$  and  $\eta$ .

## 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  $\xi_{zm}^j \sim \text{GEV}$  with shape parameters  $\theta$  and  $\eta$ .
- Since  $\xi_{zm}^j \sim \text{GEV}$ , by McFadden (1978) total **labor supplied to firm  $z$  in market  $m$**  is given by:

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

where  $L, W, W_m$  are CES labor supply and wage indices (see [Aggregation](#) and [Indices](#)). **Intuition?**

## 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  $\xi_{zm}^j \sim \text{GEV}$  with shape parameters  $\theta$  and  $\eta$ .
- Since  $\xi_{zm}^j \sim \text{GEV}$ , by McFadden (1978) total **labor supplied to firm  $z$  in market  $m$**  is given by:

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

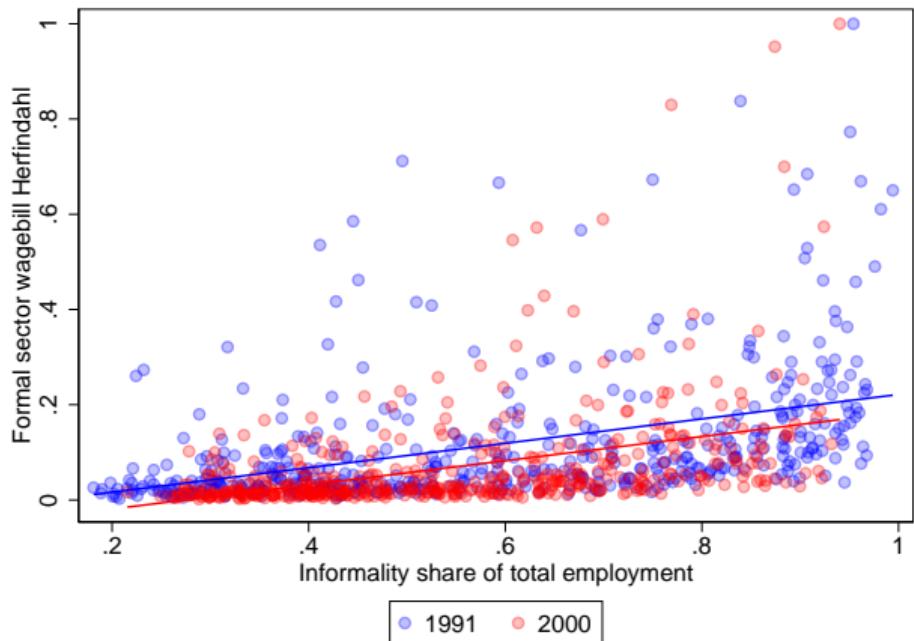
where  $L, W, W_m$  are CES labor supply and wage indices (see [Aggregation](#) and [Indices](#)). **Intuition?**

- 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](#)

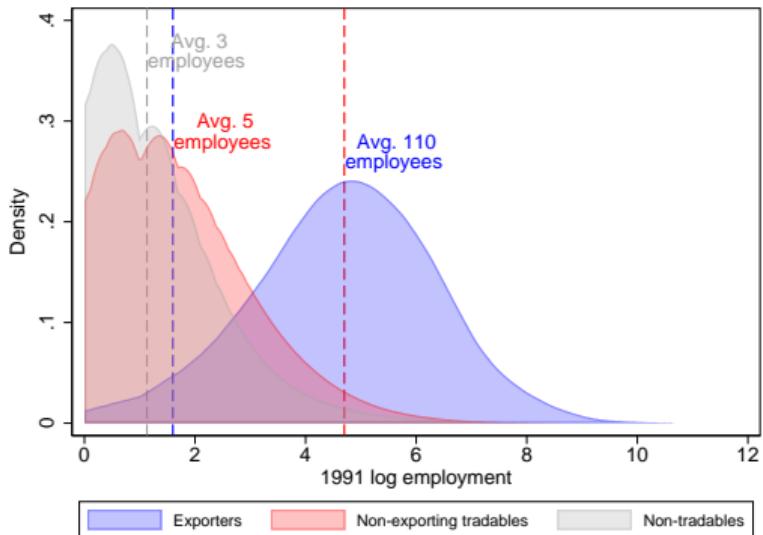
# Local labor market concentration vs. Informality



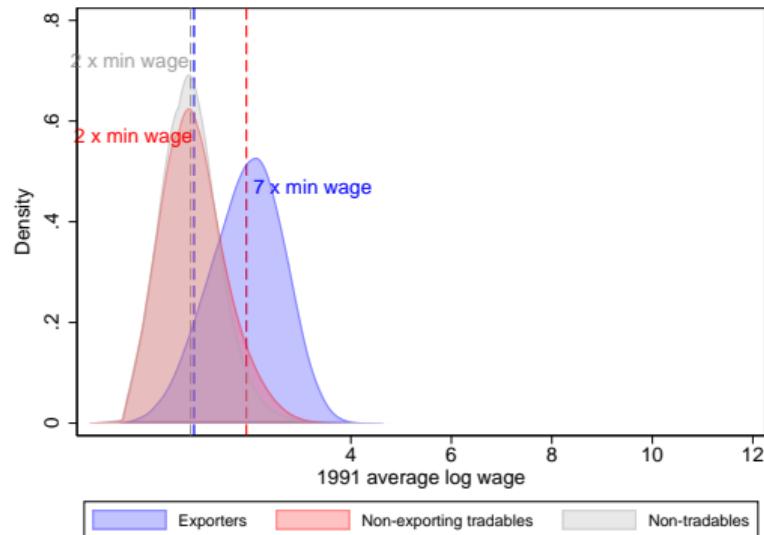
Back

# Exporter vs. Others: size and wages

Log employment



December monthly wage



Back

## 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

Back

## Labor supply: Discrete choice

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

$$\begin{aligned}\min_{zm} V_{zm}^j &= \ln \ell_{zm}^j + \ln \xi_m + \ln \xi_{zm} - \xi_{zm}^j \\ \text{s.t. } \ell_{zm}^j w_{zm} &\geq y^j\end{aligned}$$

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

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

- Due to equivalence to representative agent setup with **nested CES labor supply preferences**:
  - $\eta$  is workers' within-market cross-firm elasticity of substitution
  - $\theta$  is workers' cross-market elasticity of substitution

Back

# Labor supply aggregation

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

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

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

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

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

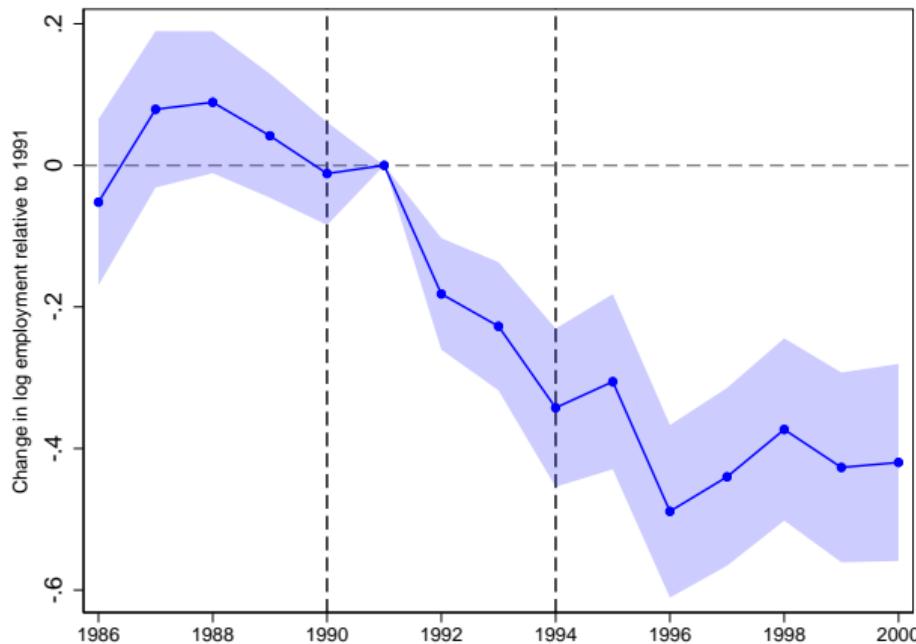
$$W_m \equiv \left[ \sum_z \left( \frac{w_{zm}}{\xi_{zm}} \right)^{1+\eta} \right]^{\frac{1}{1+\eta}}, \quad W \equiv \left[ \sum_m \left( \frac{W_m}{\xi_m} \right)^{1+\theta} \right]^{\frac{1}{1+\theta}}, \quad L_m \equiv \left[ \sum_z (\xi_{zm} l_{km})^{\frac{1+\eta}{\eta}} \right]^{\frac{\eta}{1+\eta}},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

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

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

Back

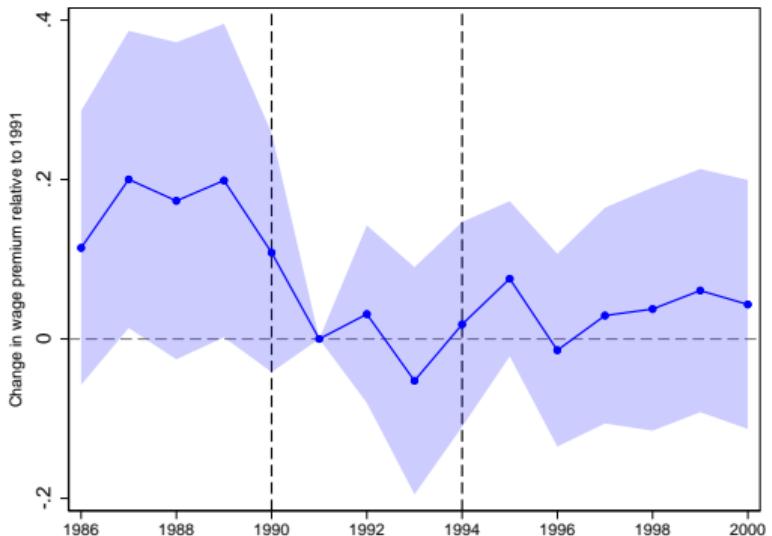
## ICE effect on LLM employment



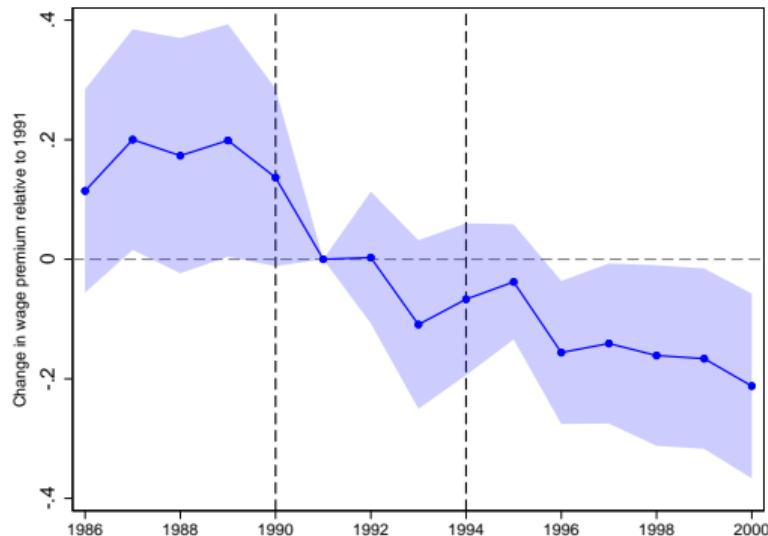
Back

# ICE effect on LLM wage premia

LLM wage premia (DD)



Effect relative to trend

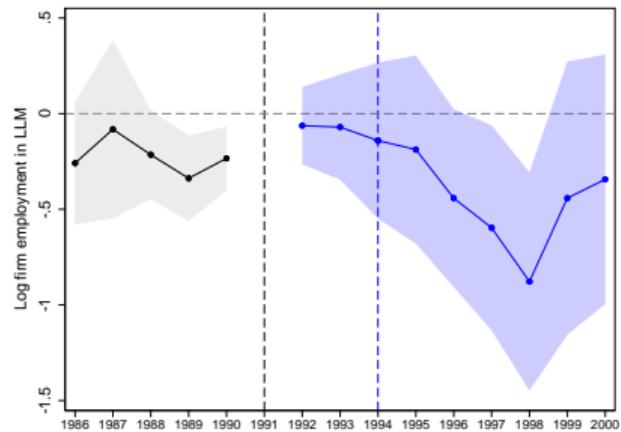


Back

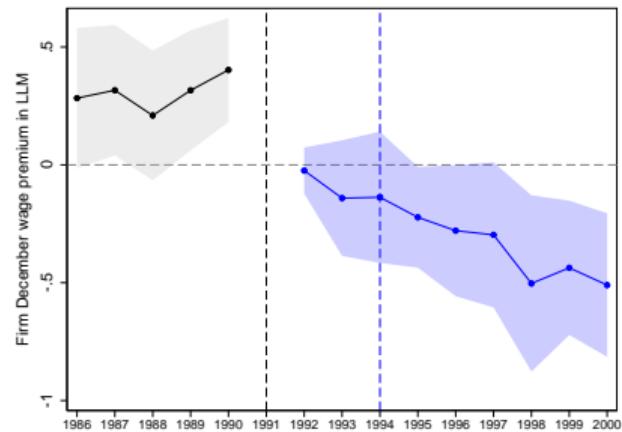
Relative to trend details

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

Log employment



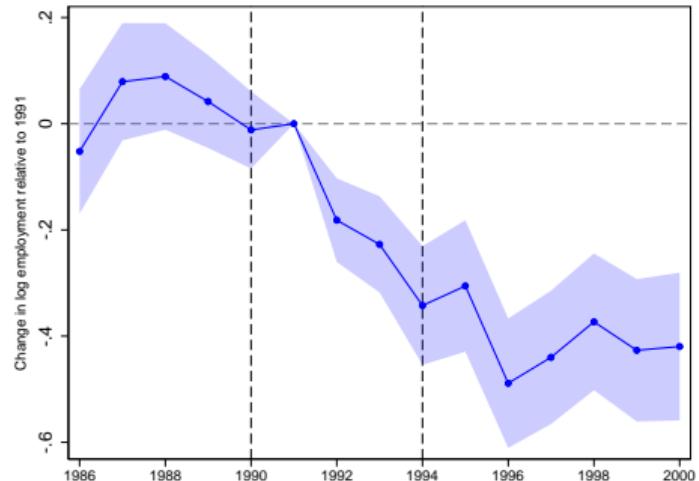
Firm wage premium



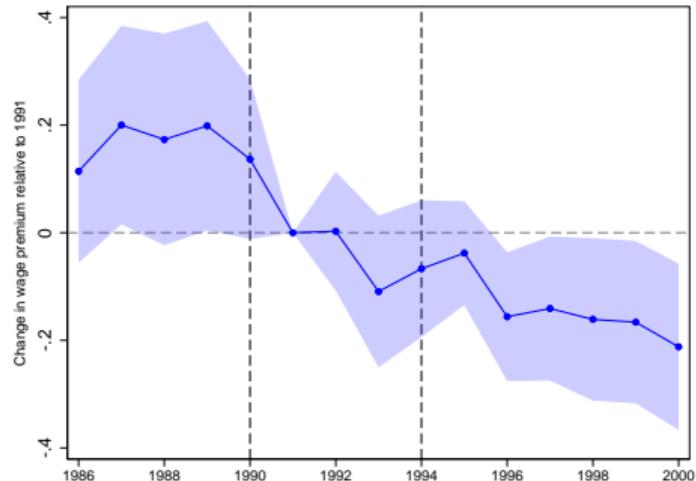
Back

# 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:

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

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

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

in which  $\nu_m$  and  $\nu_t$  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

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

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

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

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:

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

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:

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

Back

## Standard errors for $\gamma_t$

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

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

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

Back

# Estimates for labor share in Brazil based on BHM formula

## Brazil

Estimated		Scale of production			
		IRS	CRS	DRS	
$\frac{1}{\theta} = 1.257$	$\frac{1}{\eta} = 0.985$	$\widehat{HHI} = 0.08$	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			
		IRS	CRS	DRS	
$\frac{1}{\theta} = 2.2$	$\frac{1}{\eta} = 0.14$	$\widehat{HHI} = 0.11$	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 exist, 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.
- 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.

Scatter

## 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.
  - 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.
- 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)
<i>Panel A: Labor market concentration</i>		
Δ Payroll Herfindahl (based on wage premium)	0.213 (0.017)	0.213 (0.029)
Δ Payroll Herfindahl	0.213 (0.017)	0.213 (0.028)
Δ Employment Herfindahl	0.247 (0.016)	0.247 (0.028)
<i>Panel B: Log number of firms and log employment</i>		
Δ Log number of firms	-0.549 (0.045)	-0.549 (0.131)
Δ Log total employment	-0.440 (0.064)	-0.440 (0.153)
<i>Panel C: Log wage premium</i>		
Δ Log wage premium	0.029 (0.031)	0.029 (0.068)
Δ De-trended log wage premium	-0.141 (0.031)	-0.141 (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)
<i>Panel A: Labor market concentration</i>		
Δ Payroll Herfindahl (based on wage premium)	0.213 (0.017)	0.102 (0.046)
Δ Payroll Herfindahl	0.213 (0.017)	0.110 (0.064)
Δ Employment Herfindahl	0.247 (0.016)	0.058 (0.056)
<i>Panel B: Log number of firms and log employment</i>		
Δ Log number of firms	-0.549 (0.045)	-0.367 (0.208)
Δ Log total employment	-0.440 (0.064)	-0.338 (0.335)
<i>Panel C: Log wage premium</i>		
Δ Log wage premium	0.029 (0.031)	0.116 (0.131)
Δ De-trended log wage premium	-0.141 (0.031)	0.106 (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)
<i>Panel A: Labor market concentration</i>				
Δ Payroll Herfindahl (based on wage premium)	0.213 (0.017)	0.259 (0.020)	0.278 (0.020)	0.119 (0.011)
Δ Payroll Herfindahl	0.213 (0.017)	0.259 (0.020)	0.277 (0.020)	0.121 (0.012)
Δ Employment Herfindahl	0.247 (0.016)	0.303 (0.019)	0.329 (0.020)	0.141 (0.011)
<i>Panel B: Log number of firms and log employment</i>				
Δ Log number of firms	-0.549 (0.045)	-0.673 (0.050)	-0.736 (0.052)	-0.309 (0.030)
Δ Log total employment	-0.440 (0.064)	-0.527 (0.073)	-0.577 (0.076)	-0.225 (0.044)
<i>Panel C: Log wage premium</i>				
Δ Log wage premium	0.029 (0.031)	0.037 (0.035)	0.046 (0.037)	0.059 (0.021)
Δ De-trended log wage premium	-0.141 (0.031)	-0.156 (0.035)	-0.150 (0.037)	-0.090 (0.021)
Observations	296,400	296,400	296,400	296,400
Local labor markets	19,760	19,760	19,760	19,760

Back

# Effect of ICE on LLM outcomes: Robustness to weights

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

Back

# 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)
<i>Panel A: First stage</i>			
Δ Firm log employment in LLM	-0.554 (0.044)	-0.554 (0.070)	-0.554 (0.107)
First stage F	158.497	62.719	26.720
<i>Panel B: Reduced form</i>			
Δ Firm wage premium in LLM	-0.545 (0.024)	-0.545 (0.104)	-0.545 (0.103)
<i>Panel C: 2SLS</i>			
Labor supply within-market cross-firm inverse elasticity of substitution	0.985 (0.089)	0.985 (0.207)	0.985 (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)
<i>Panel A: First stage</i>					
Δ Firm log employment in LLM	-0.554 (0.044)	-0.609 (0.054)	-0.606 (0.074)	-0.554 (0.044)	-0.358 (0.035)
First stage F	158.497	129.572	66.895	158.497	107.143
<i>Panel B: Reduced form</i>					
Δ Firm wage premium in LLM	-0.545 (0.024)	-0.497 (0.028)	-0.513 (0.041)	-0.527 (0.025)	-0.351 (0.019)
<i>Panel C: 2SLS</i>					
Labor supply within-market cross-firm inverse elasticity of substitution	0.985 (0.089)	0.815 (0.081)	0.847 (0.121)	0.952 (0.088)	0.980 (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

Back

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

	Robustness to key alternative samples		
	Main specification (1)	Unique producers (2)	Local labor market defined as microregion (3)
<i>Panel A: First stage</i>			
A Firm log employment in LLM	-0.554 (0.044)	-0.289 (0.043)	-0.417 (0.037)
First stage F	158.497	44.304	124.666
<i>Panel B: Reduced form</i>			
A Firm's wage premium in LLM	-0.545 (0.024)	-0.327 (0.044)	-0.404 (0.017)
<i>Panel C: 2SLS</i>			
Labor supply within-market cross-firm inverse elasticity of substitution	0.985 (0.089)	1.134 (0.224)	0.969 (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

Back

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

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

Back

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

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

Back

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

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

Back

# Local Labor Markets: Descriptives for baseline year (1991)

	Mean (1)	Market percentile				
		10th (2)	25th (3)	50th (4)	75th (5)	90th (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%

Back

## Effect of ICE on employment of exporters vs. others

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

Back

## Firm-level effects: exporters versus large firms

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

Back

# 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)

Back

# 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  $\xi_{zm}^j \sim \text{GEV}$  with shape parameters  $\theta$  and  $\eta$ .

## 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  $\xi_{zm}^j \sim \text{GEV}$  with shape parameters  $\theta$  and  $\eta$ .
- Since  $\xi_{zm}^j \sim \text{GEV}$ , by McFadden (1978) total **labor supplied to firm  $z$  in market  $m$**  is given by:

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

where  $L, W, W_m$  are CES labor supply and wage indices (see [Aggregation](#) and [Indices](#)). **Intuition?**

## 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  $\xi_{zm}^j \sim \text{GEV}$  with shape parameters  $\theta$  and  $\eta$ .
- Since  $\xi_{zm}^j \sim \text{GEV}$ , by McFadden (1978) total **labor supplied to firm  $z$  in market  $m$**  is given by:

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

where  $L, W, W_m$  are CES labor supply and wage indices (see [Aggregation](#) and [Indices](#)). **Intuition?**

- 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

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

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**:

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

where  $\varepsilon_{zm}^{-1}$  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  $\varepsilon_{zm}^{-1}$ ? 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  $\Delta ICE_m$ .  
Robust shock
  - Using  $s_{zm, 1991}^2$  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  $\Delta ICE_m$ .  
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  $\varepsilon_{zm}^{-1}$ : elast. of supply

Method: Indirect inference

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

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

**Shock variation used:** cross-market

This paper: "Bottom-Up"

Focus on  $\eta, \theta$ : elast. of subs.

Method: IV

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

- ① Estimate  $\eta$  with cross-firm within-mkt shocks
- ② Given  $\eta$ , estimate  $\theta$  with cross-mkt shocks
- ③ Compute  $\varepsilon_{zm}^{-1}$  given  $\eta, \theta$  and data on shares

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

# Trade liberalization: Cross-sector wage effects

