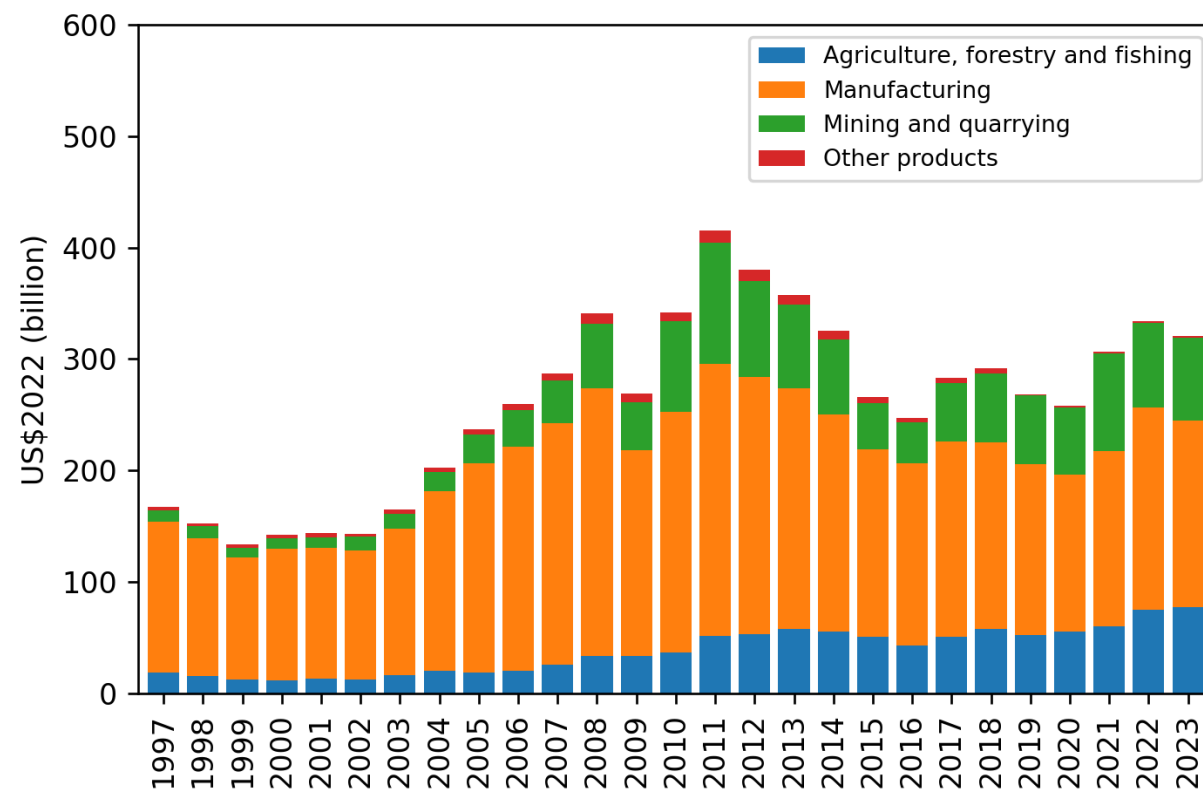


# Foreign Demand Shocks and Regional Dynamics: Evidence from Brazil

Carlos Góes, Otávio Conceição, Gabriel Lara, and Gladys Lopez-Acevedo

# The cycle of exports in Brazil

- In aggregate terms, real exports are about 3x from larger than 25 years ago but about 25% down from the 2010 peak.
- At a macro-level (1-digit industry) the cycle is a combination of a continuous expansion of agro; a large cycle of oil; and a volatile manufacturing sector



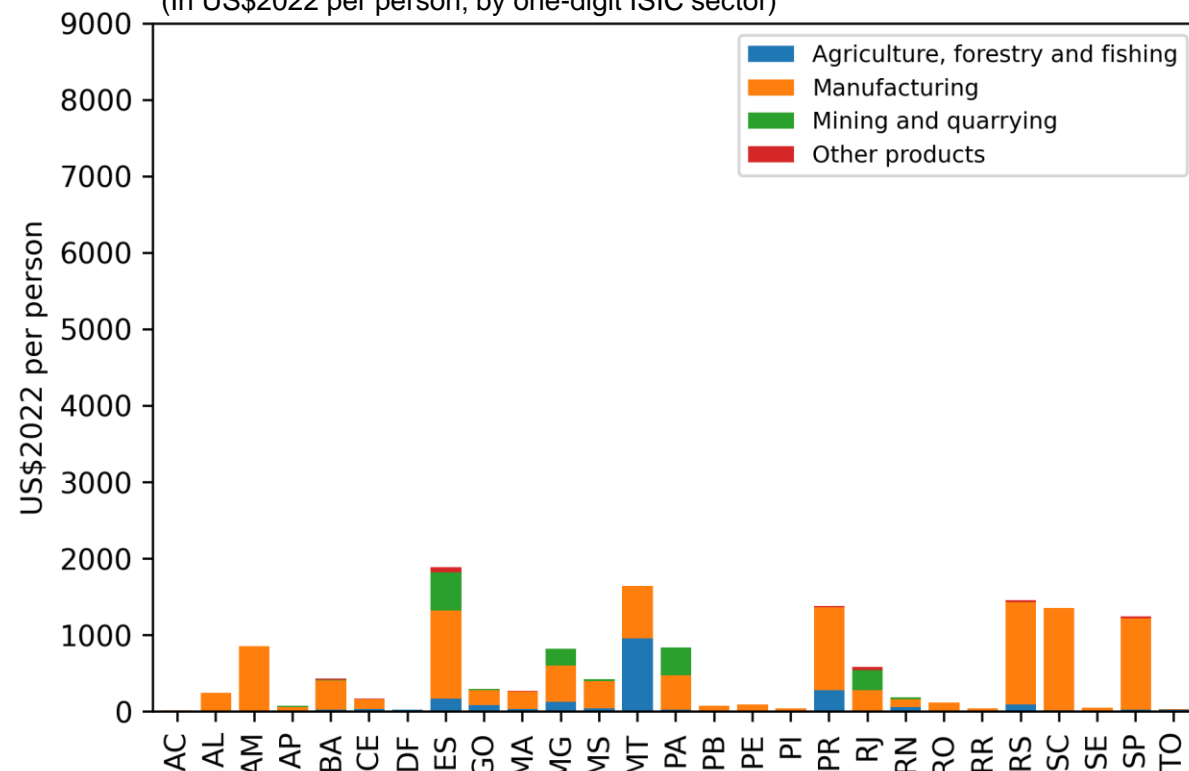
Sources: Own calculations with MDIC, IBGE and Fred data.

# How does this look across states?

Average levels of exports increased for most states...

**Brazilian States: Exports per Person, 2002**

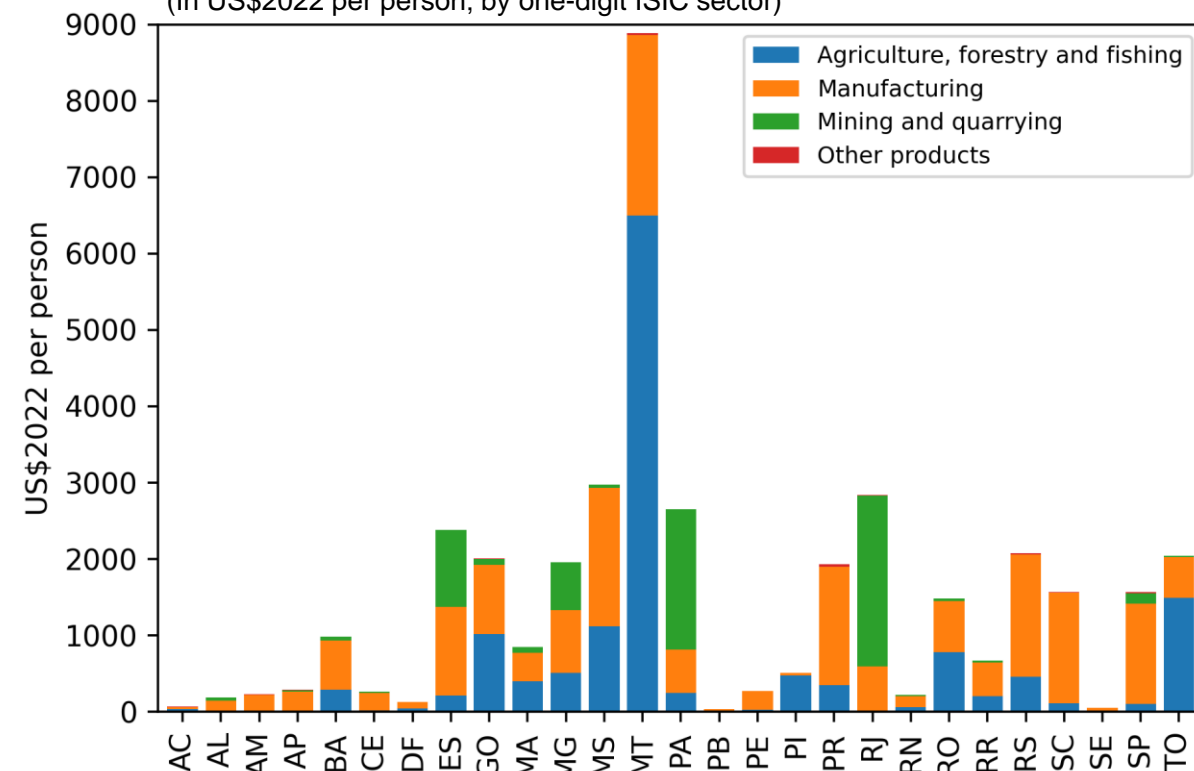
(In US\$2022 per person; by one-digit ISIC sector)



...and while the common story about agriculture does matter, there are some complementarities between agriculture and manufacturing at play...

**Brazilian States: Exports per Person, 2022**

(In US\$2022 per person; by one-digit ISIC sector)



Sources: Own calculations with MDIC, IBGE and Fred data.

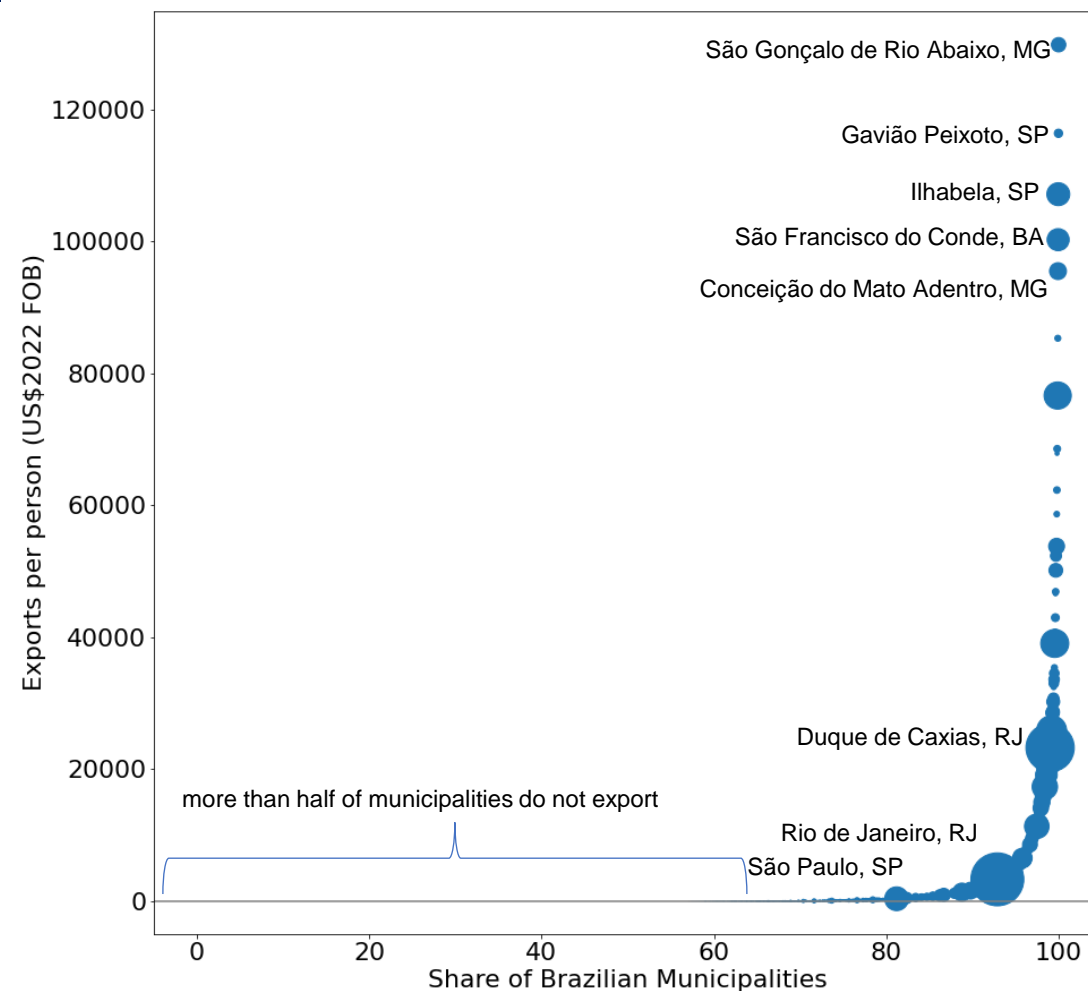
Sources: Own calculations with MDIC, IBGE and Fred data.

# Local exposure to exports

- More than half of Brazilian municipalities did not export in 2022
- Among the top 20 largest cities in Brazil, only Rio de Janeiro-RJ (\$3,303), Curitiba-PR (\$1,367), Guarulhos-SP (\$1,591), and São Luís-MA (\$1,838) have per capita exports larger than \$1,000.
- However, some smaller municipalities have very high exposure to exports.

## Brazilian Municipalities: Exports per Person, 2022

(In US\$2022 per person; bubbles are proportional to total municipal exports)



Sources: Own calculations with MDIC, IBGE and Fred data.

# Local exposure to exports

São Gonçalo de Rio Abaixo, MG

- (Vale *Brucutu* Mining Site)



Gavião Peixoto, SP

- (Embraer Production Plant)

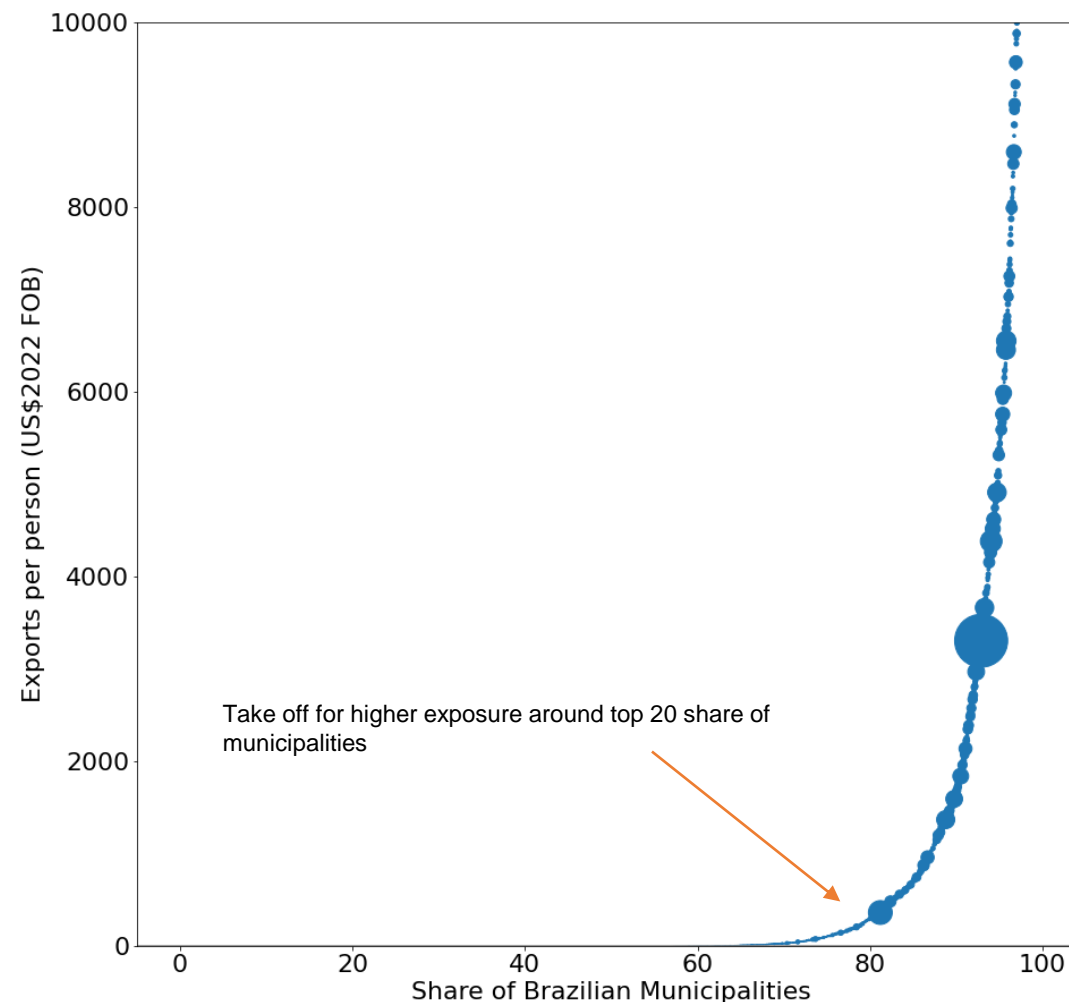


# Zooming in

- In 2022, the turning point seems to be around percentile 80...
- ...in other words, 20 percent of Brazilian municipalities were more exposed to exports.

## Brazilian Municipalities: Exports per Person, 2022

(In US\$2022 per person; bubbles are proportional to total municipal exports axis truncated at US\$2022 1000)



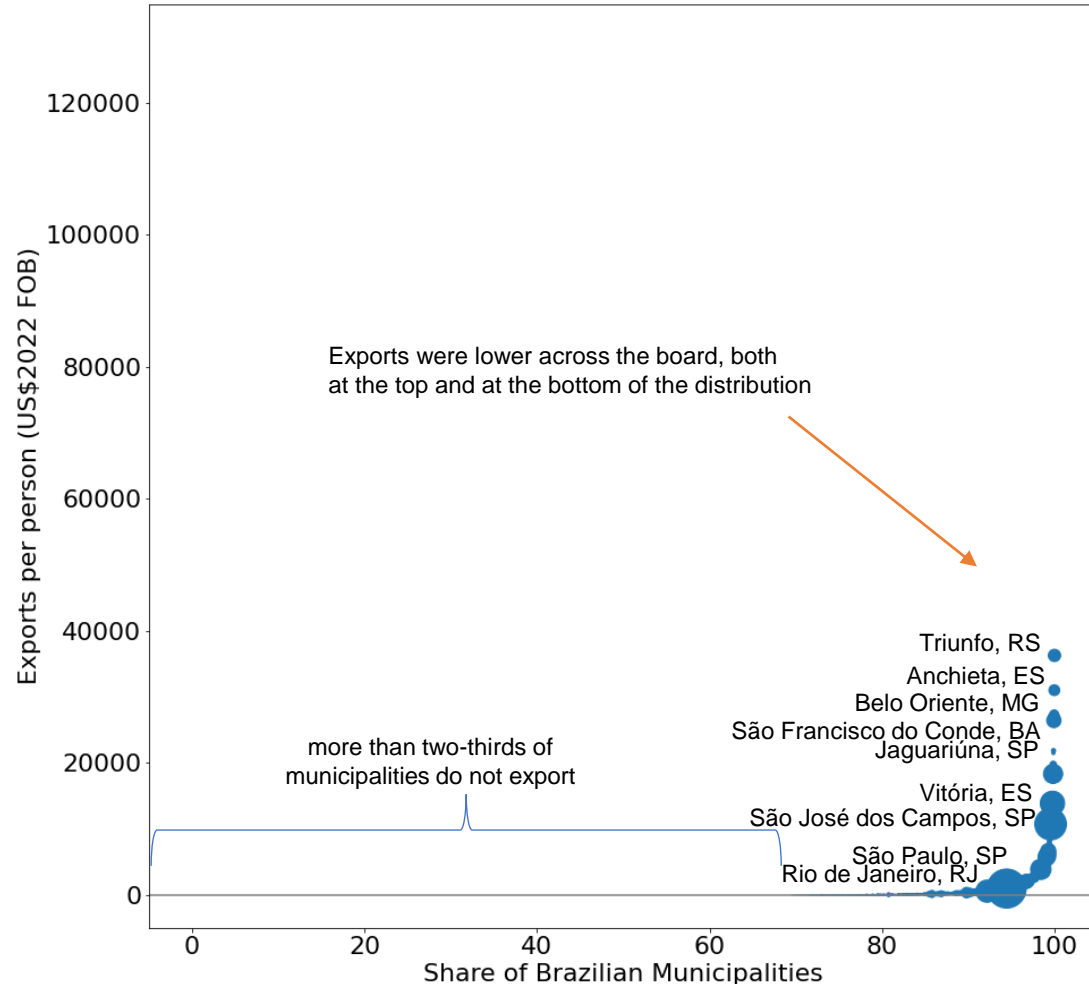
Sources: Own calculations with MDIC, IBGE and Fred data.



# Going back 20 years, total exposure is lower and take off threshold was higher

## Brazilian Municipalities: Exports per Person, 2002

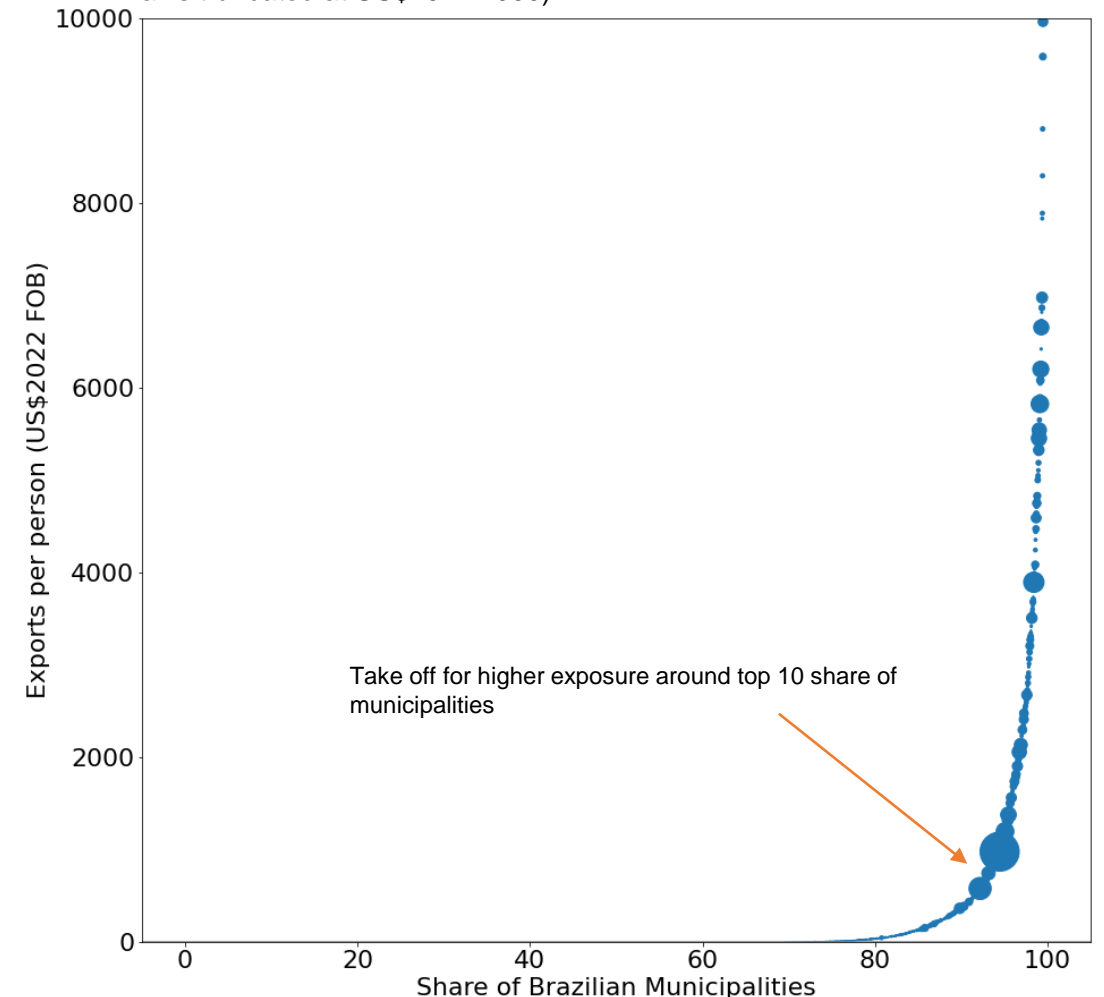
(In US\$2022 per person; bubbles are proportional to total municipal exports)



Sources: Own calculations with MDIC, IBGE and Fred data.

## Brazilian Municipalities: Exports per Person, 2002

(In US\$2022 per person; bubbles are proportional to total municipal exports; axis truncated at US\$2022 1000)



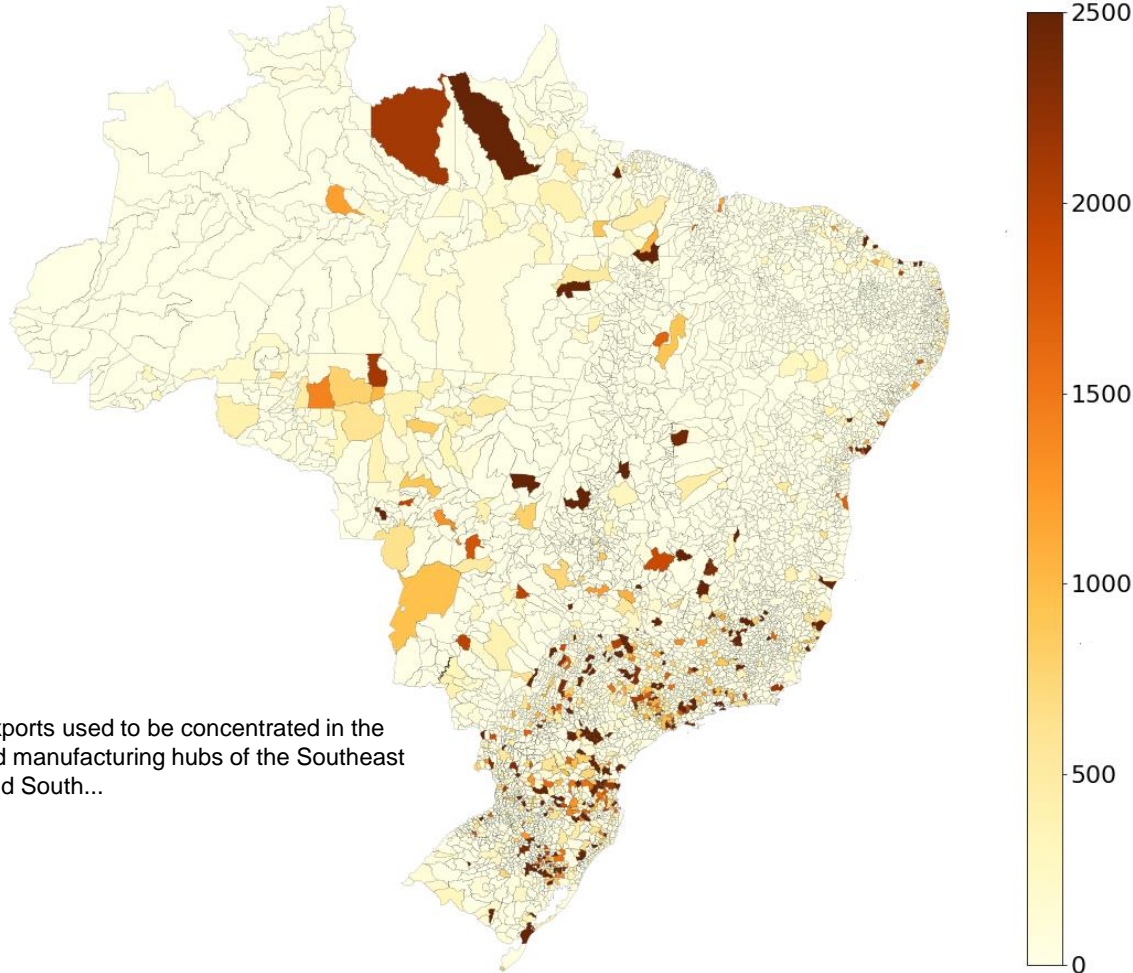
Sources: Own calculations with MDIC, IBGE and Fred data.



# Looking at the distribution over space, one can see the takeoff of the countryside

## Brazilian Municipalities: Exports per Person, 2002

(In US\$2022 per person; bubbles are proportional to total municipal exports; distribution truncated at US\$2022 2500+)

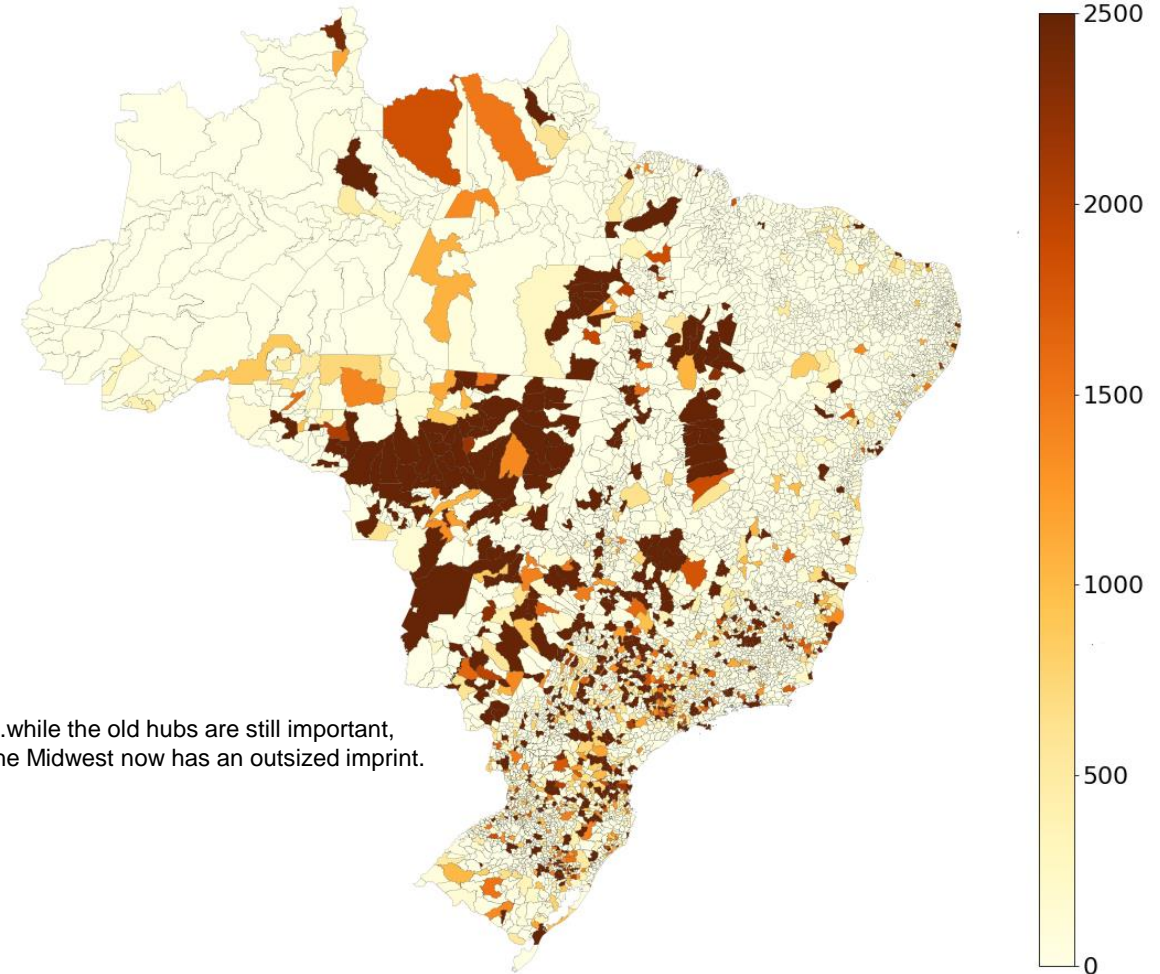


Exports used to be concentrated in the old manufacturing hubs of the Southeast and South...

Sources: Own calculations with MDIC, IBGE and Fred data.

## Brazilian Municipalities: Exports per Person, 2022

(In US\$2022 per person; bubbles are proportional to total municipal exports; distribution truncated at US\$2022 2500+)



...while the old hubs are still important, the Midwest now has an outsized imprint.

Sources: Own calculations with MDIC, IBGE and Fred data.





# Data

- Administrative customs data (SISCOMEX-MDIC)
  - Total aggregate exports at the microregion level
  - State-level exports at HS-6-digit product level
- Administrative formal labor market data (RAIS)
  - Employer reported formal employment, gender, education level, wages for the universe (35-45 million) of formal workers
- Final dataset: panel of 558 microregions from 1997-2022

# Methodology

- Observe growth in exports by region:  $\Delta X_{r,s,t} = \ln X_{r,s,t} - \ln X_{r,s,t-1}$
- Local Projections (Jordà, 2005)

$$\underbrace{O_{r,s,t+h} - O_{r,s,t-1}}_{\text{cumulative change in outcome since t-1}} = \alpha_h + \underbrace{\beta_h}_{\text{exports}} \Delta X_{r,s,t} + \underbrace{\mathbf{Z}'_{r,s,t-1} \boldsymbol{\Phi}_h}_{\text{controls}} + \varepsilon_{r,s,h}, \quad \text{for } h \in \{0,1,2,3 \dots \}$$

- the coefficients are estimated for each h: they will form impulse response functions!

# Since exports potentially endogenous, need IV

- Instrument: weighted average of foreign GDP growth by industry exposure

$$\Delta \bar{X}_{r,s,t} \equiv \sum_{i \in \mathcal{I}} \underbrace{\frac{L_{r,s,i,t-1}}{L_{r,s,t-1}}}_{\text{exposure of region } r \text{ to industry } i} \cdot \sum_{d \in \mathcal{C} \setminus o} \underbrace{\frac{X_{d,s,i,t-1}}{X_{s,i,t-1}}}_{\text{exposure of industry } i \text{ in state } s \text{ to destination } d} \cdot \Delta Y_{d,t}$$

# Two stage least squares with local projections

- Instrument: weighted average of foreign GDP growth by industry exposure

$$\Delta \bar{X}_{r,s,t} \equiv \sum_{i \in \mathcal{I}} \frac{L_{r,s,i,t-1}}{L_{r,s,t-1}} \cdot \sum_{d \in \mathcal{C} \setminus o} \frac{X_{d,s,i,t-1}}{X_{s,i,t-1}} \cdot \Delta Y_{d,t}$$

- First-stage

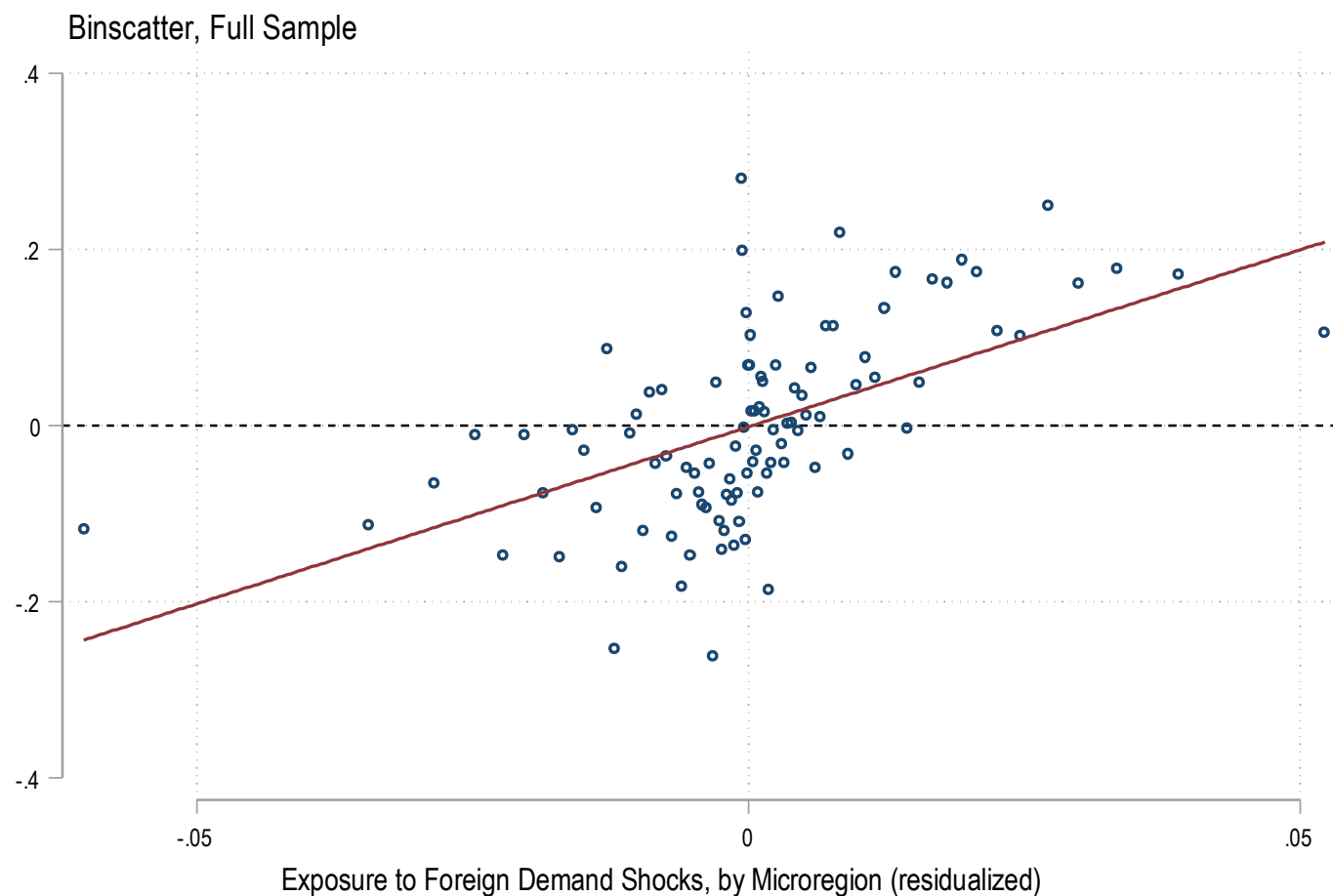
$$\Delta X_{r,s,t} = \alpha + \beta \Delta \bar{X}_{r,s,t} + \mathbf{Z}'_{r,s,t-1} \boldsymbol{\Phi} + \bar{\varepsilon}_{r,s,t}$$

- Second Stage

$$O_{r,s,t+h} - O_{r,s,t-1} = \alpha_h + \beta_h \Delta \hat{X}_{r,s,t} + \mathbf{Z}'_{r,s,t-1} \boldsymbol{\Phi}_h + \varepsilon_{r,s,h},$$

for  $h \in \{-3, -2, 0, 1, 2, 3 \dots\}$

# Instrument is relevant: First Stage F-stat > 53



Note: this is a binscatter that reproduces the slope of regressing the observed growth in exports on the instrument, with region-fixed effects. The underlying regression has  $N=10,715$ ,  $\beta=4.025$  and  $t\text{-stat} = 7.3$

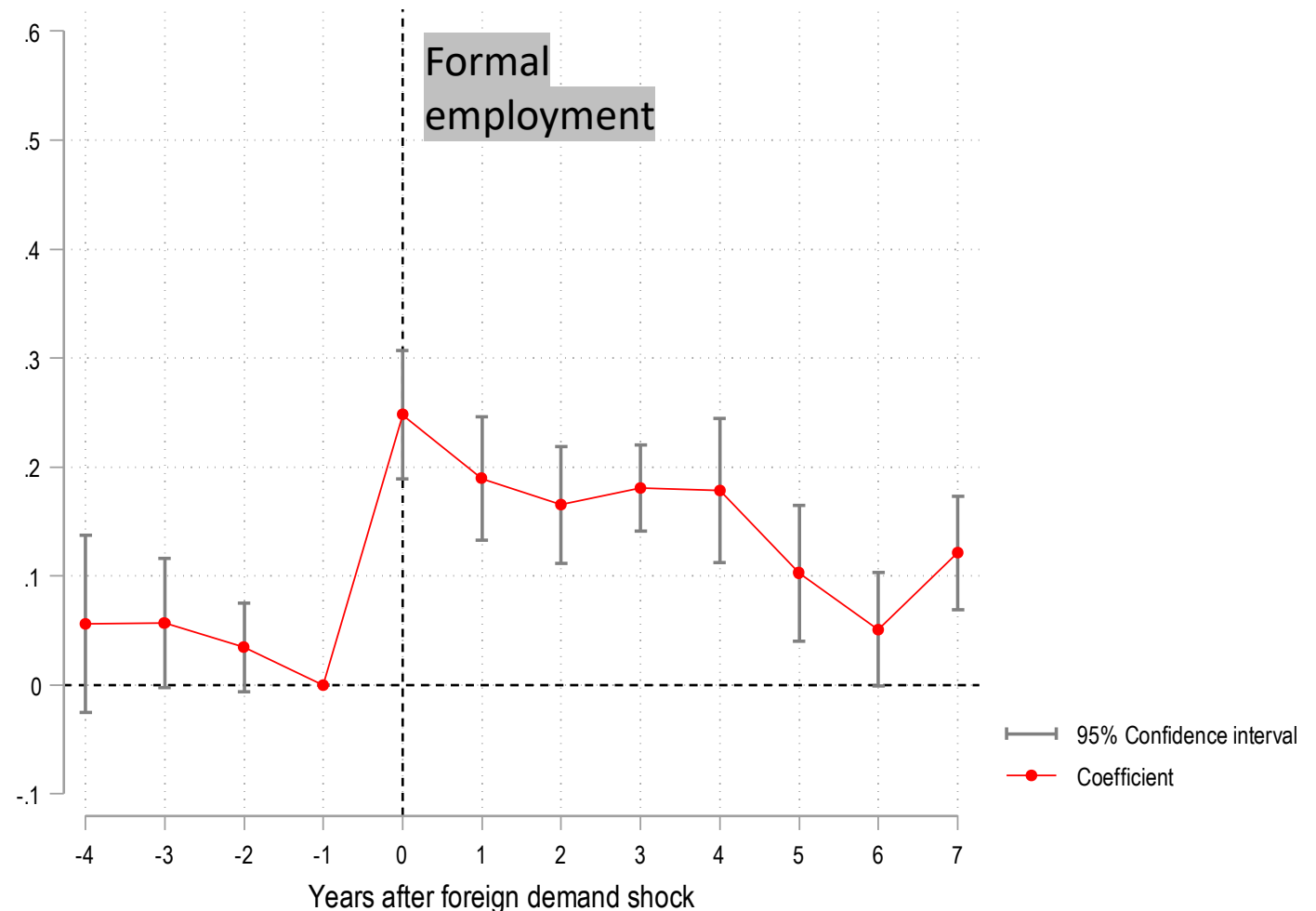


# Is the instrument valid?

- We are leveraging:
  - differential exposure of each industry within a state to foreign demand shocks in each destination market
  - differential exposure of each local labor market to different industries
- Critical assumption: every microregion in Brazil is small relative to global demand of a given industry
- Exclusion restriction: changes in foreign demand are uncorrelated with the distribution of unobserved factors that drive changes across 558 local labor markets

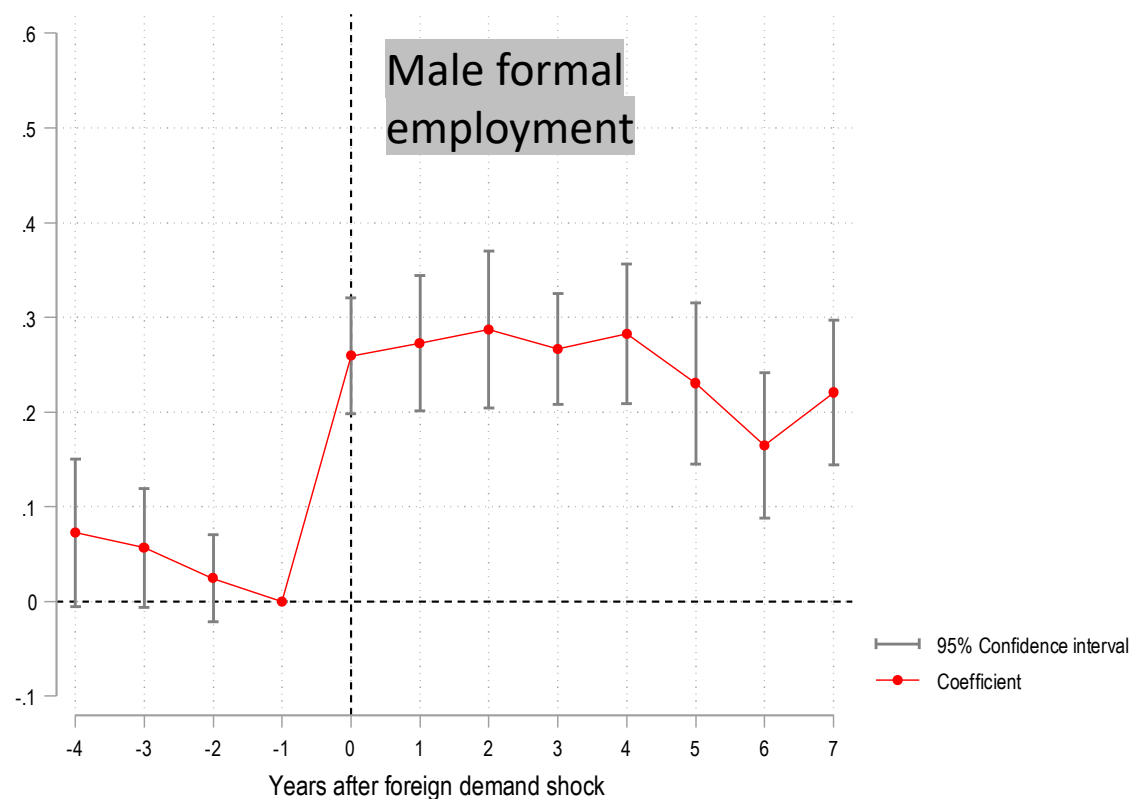
# Preliminary results: horizon-specific elasticity of formal employment to foreign demand shocks

- No evidence of pre-trends
- Clear break in trend when the shock hits
- 1% exogenous increase in exports:
  - +0.25% increase in formal employment in SR
  - +0.10% increase in formal employment in LR

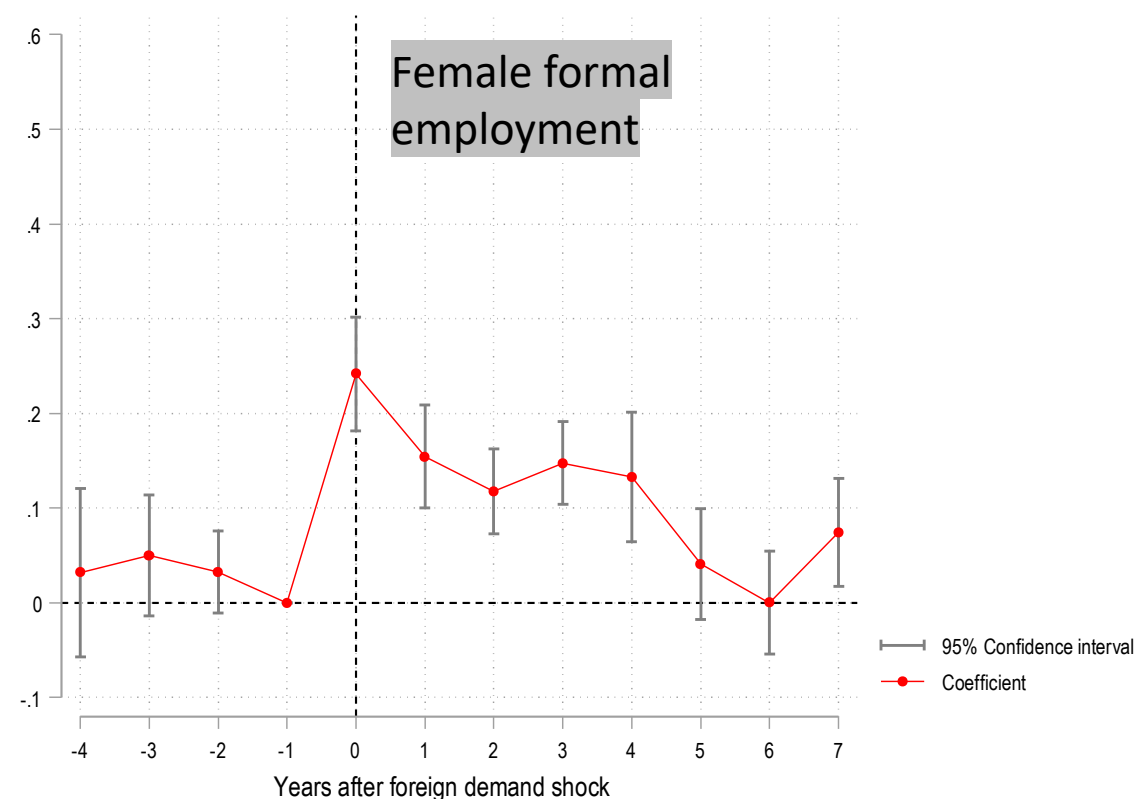


# Preliminary results: heterogeneity by gender

Both male and female employment respond positively...

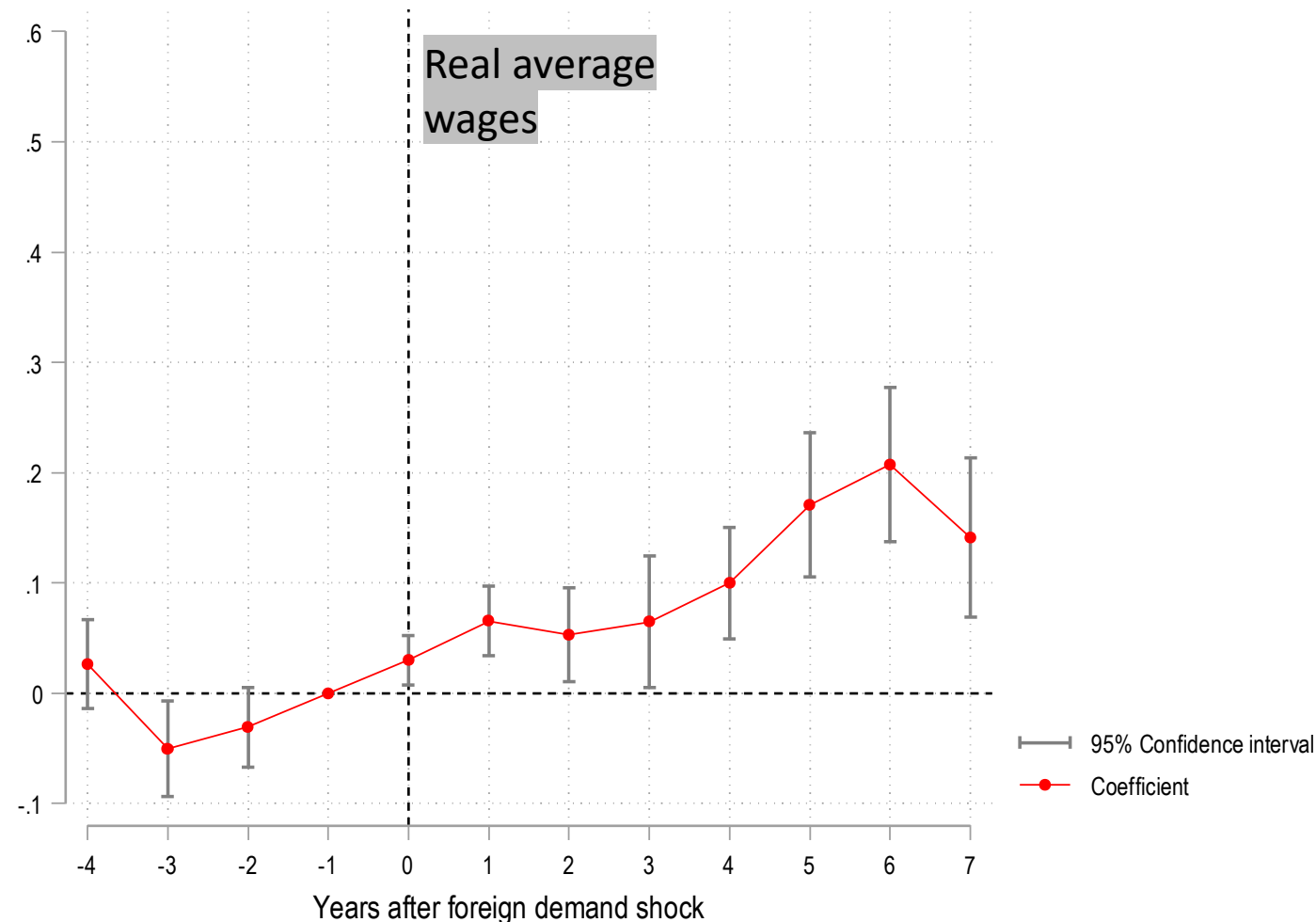


...but effects on female employment are subdued faster.



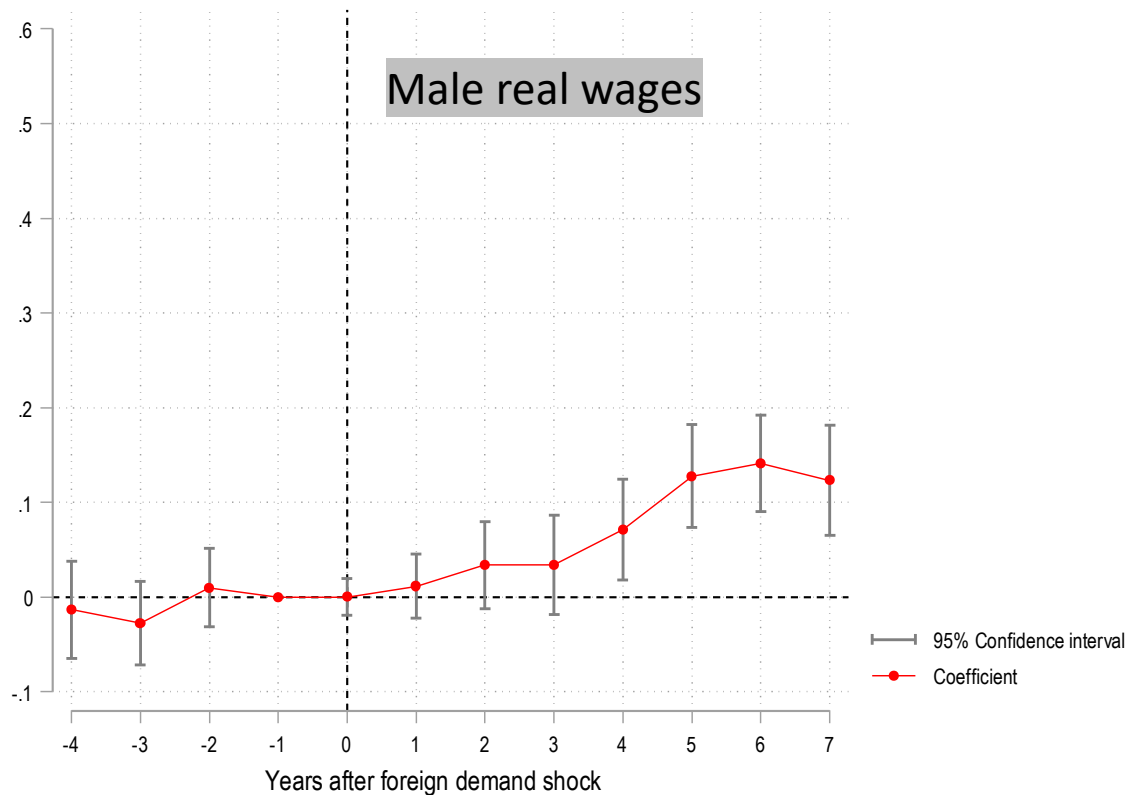
# Preliminary results: horizon-specific elasticity of real average wages to foreign demand shocks

- Effect builds up with a lag
  - sticky wages?
  - are the gains for incumbents or entrants?
- 1% exogenous increase in exports:
  - <0.1% increase in real wages in SR
  - +0.2% increase in real wages in LR



# Preliminary results: heterogeneity by gender

Effects on male wages are positive...



...but smaller than effects on female wages

