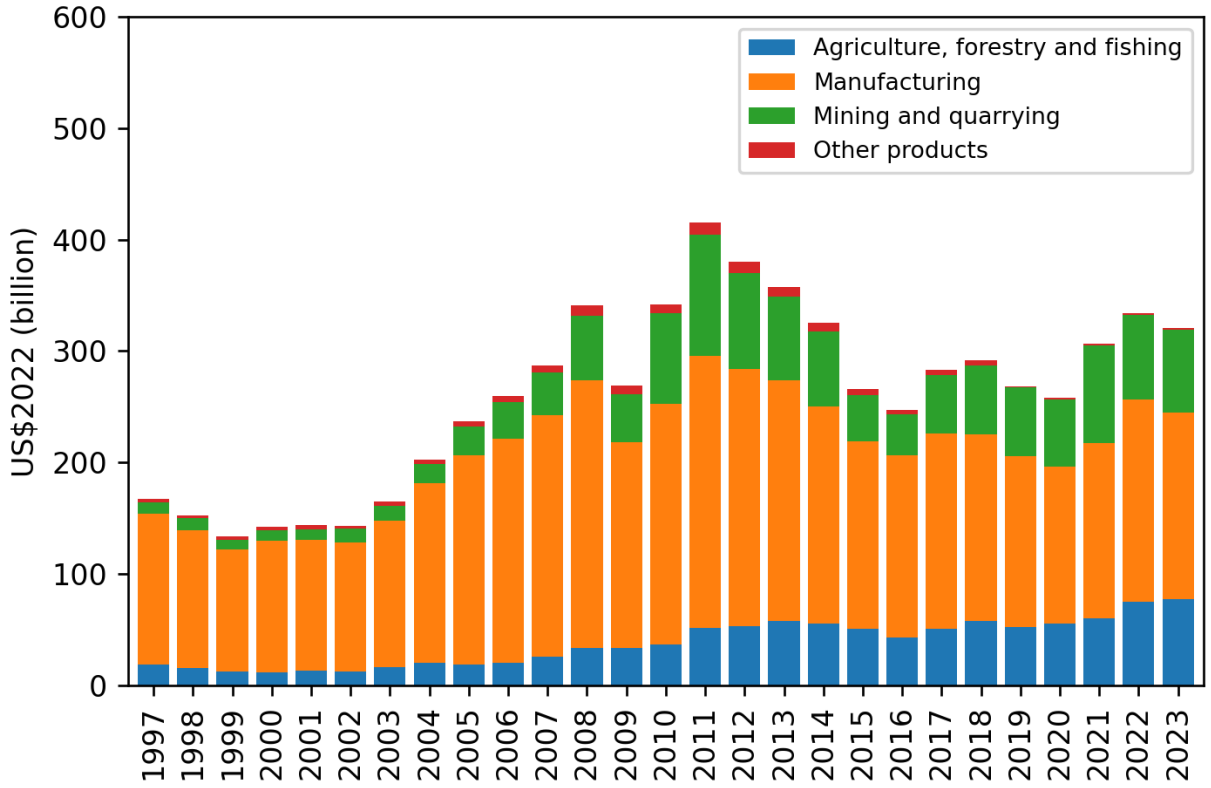
Exports and Regional Dynamics: Evidence from Brazil

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

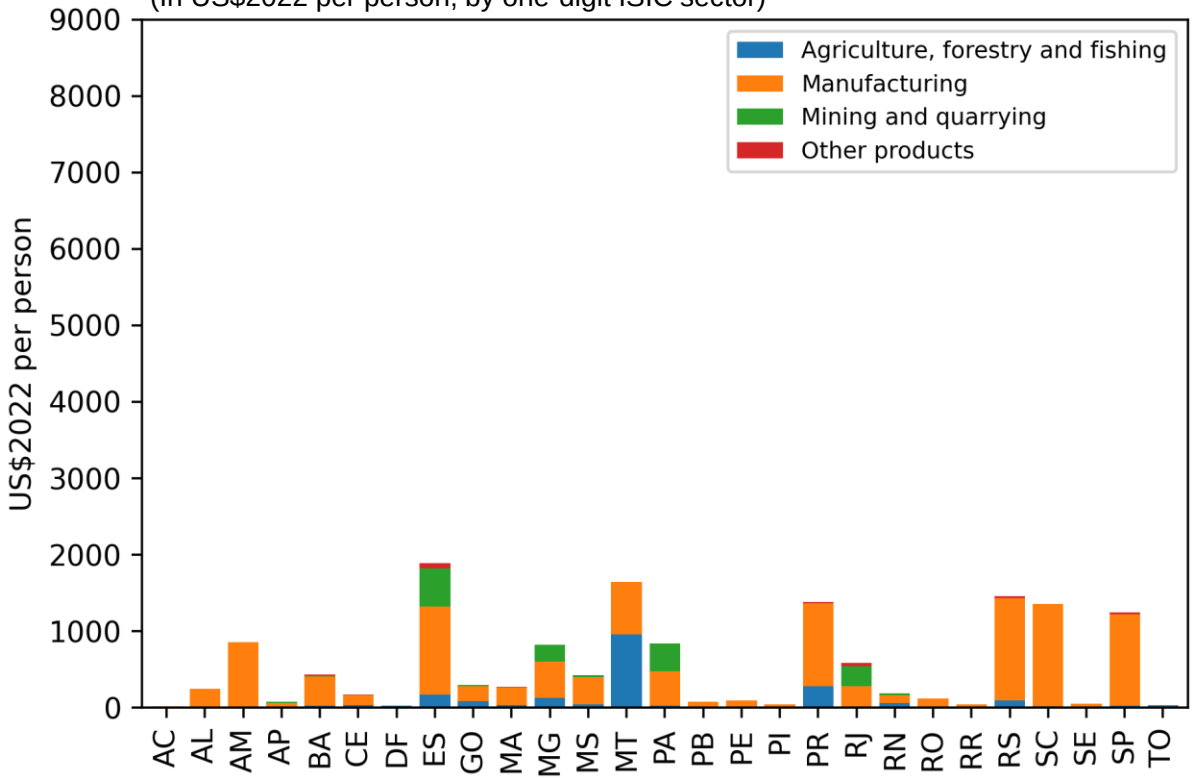


Sources: Own calculations with MDIC, IBGE and Fred data.

How does this look across states?

Average levels of exports increased for most states...

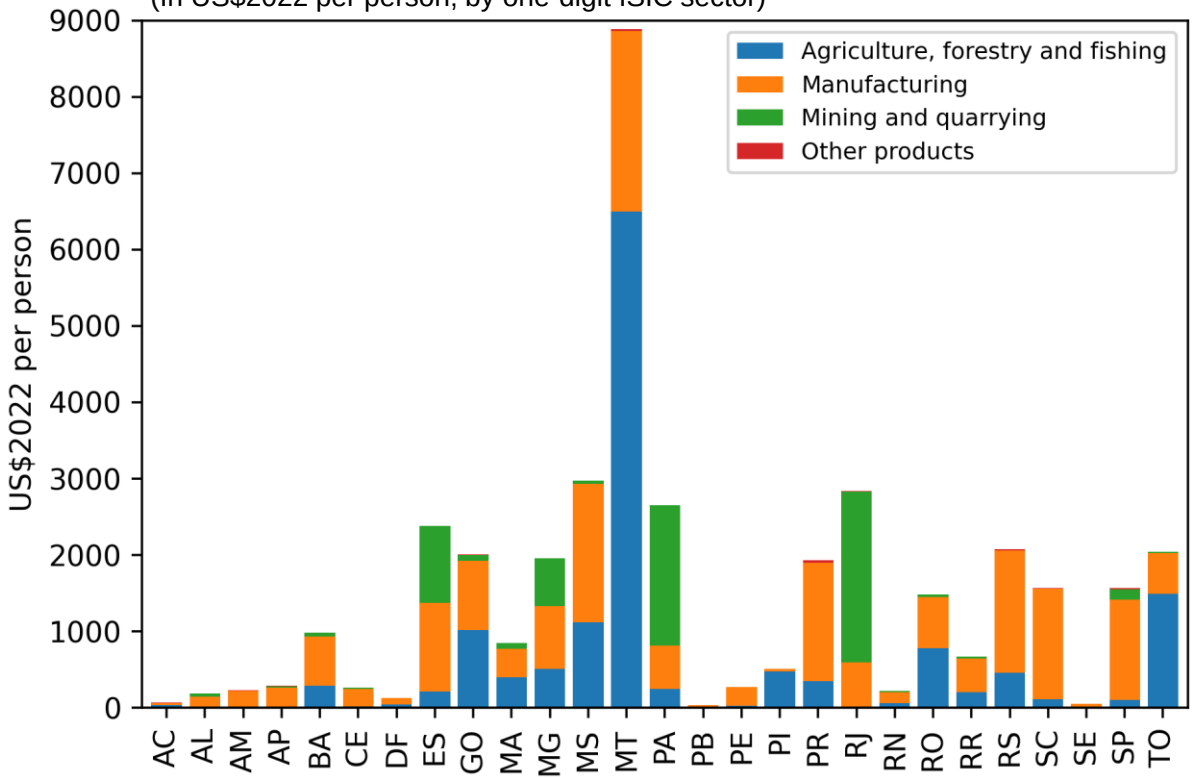
Brazilian States: Exports per Person, 2002
(In US$2022 per person; by one-digit ISIC sector)



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

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

Brazilian States: Exports per Person, 2022
(In US$2022 per person; by one-digit ISIC sector)

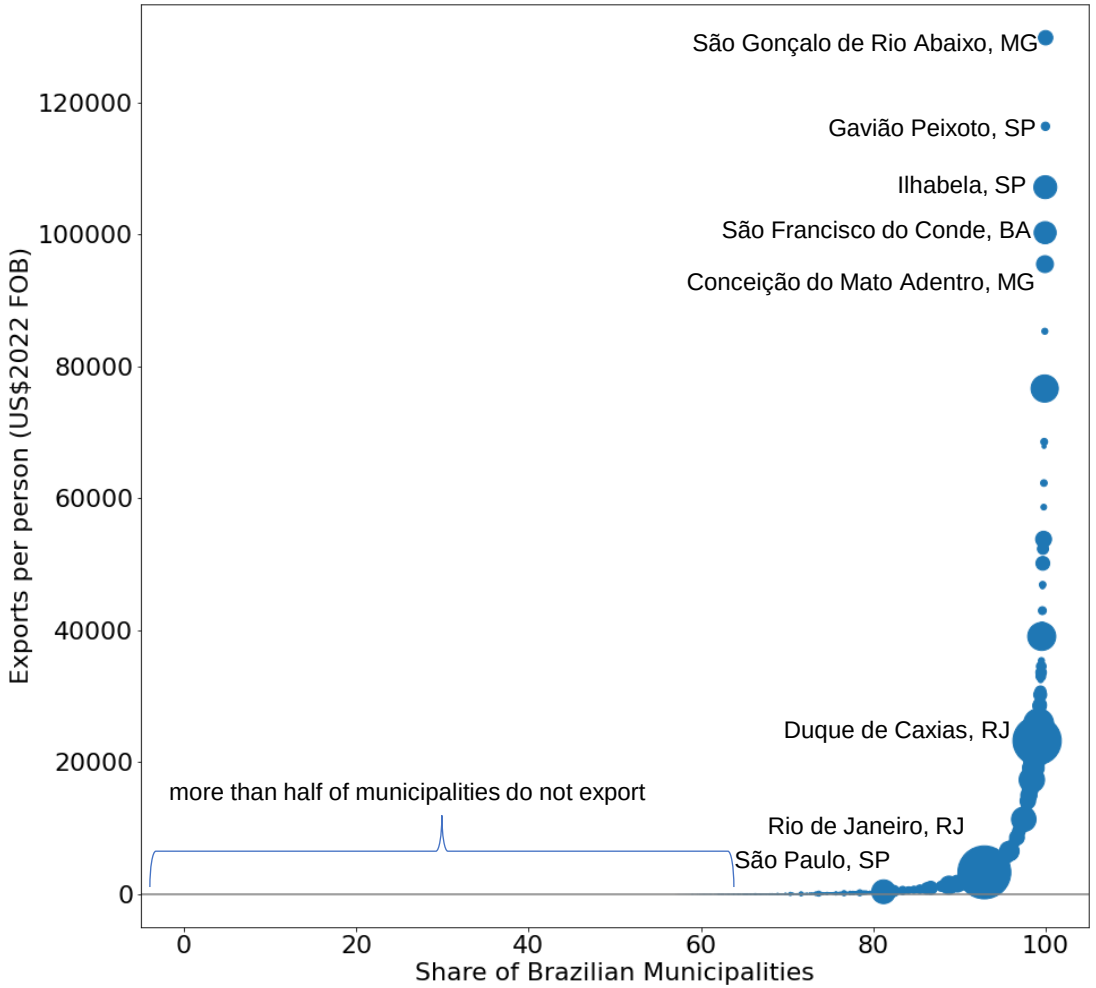


Sources: Own calculations with MDIC, IBGE and Fred data.

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.

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

Local exposure to exports

São Gonçalo de Rio Abaixo, MG

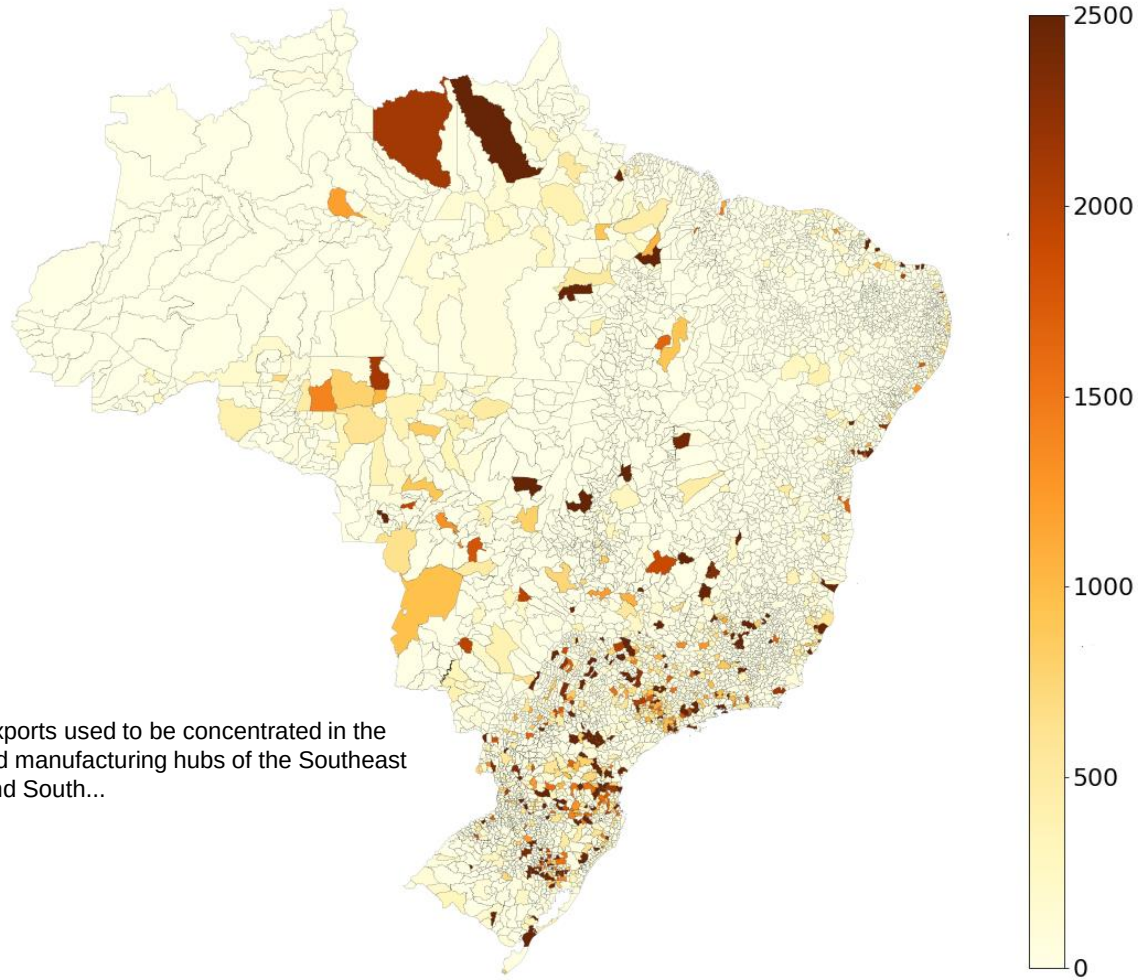
- (Vale *Brucutu* Mining Site)

Gavião Peixoto, SP

- (Embraer Production Plant)

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

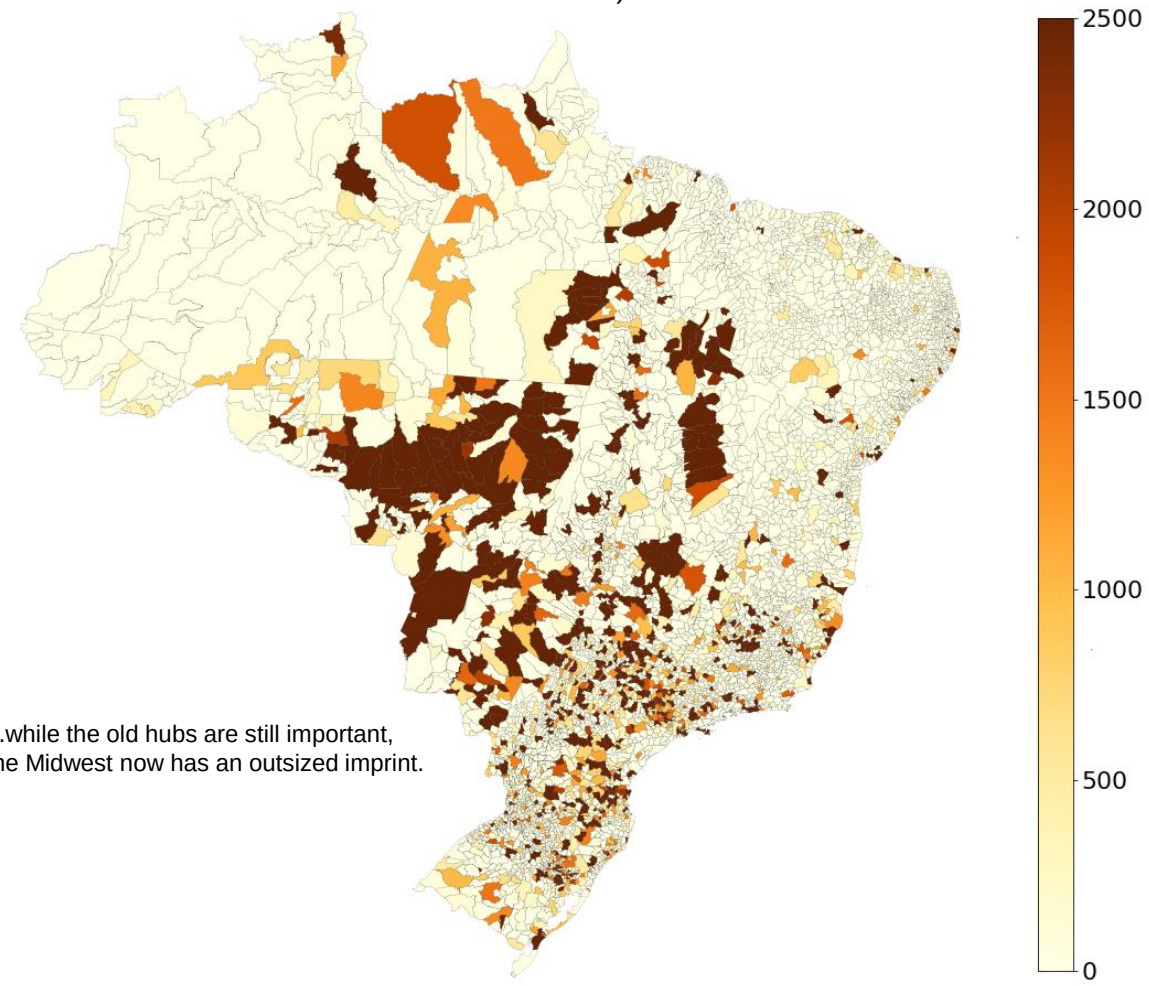
Brazilian Municipalities: Exports per Person, 2002
(In US$2022 per person; bubbles are proportional to total municipal exports; distribution truncated at US$2022 2500+)



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)

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

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

Since exports potentially endogenous, need IV

- Instrument: labor force weighted average of growth in global exports by ISIC 3-digit industry:

$$\Delta\overline{X}_{r,s,t} \equiv \sum_{i \in \mathcal{I}} \frac{L_{r,s,i,t-1}}{L_{r,s,t-1}} \Delta X^{f}_{i,t}$$

- $\Delta X^{f}_{i,t}$: change in the log of global exports (minus Brazil) in industry *i*
- Also re-estimate with alternative instrument based on GDP growth of trade partners, results qualitatively unchanged

Two stage least squares local projections

- Instrument: labor force weighted average of growth in global exports by ISIC 3-digit industry:

$$\Delta \bar{X}_{r,s,t} \equiv \sum_{i \in \mathcal{J}} \frac{L_{r,s,i,t-1}}{L_{r,s,t-1}} \Delta X^{f}_{i,t}$$

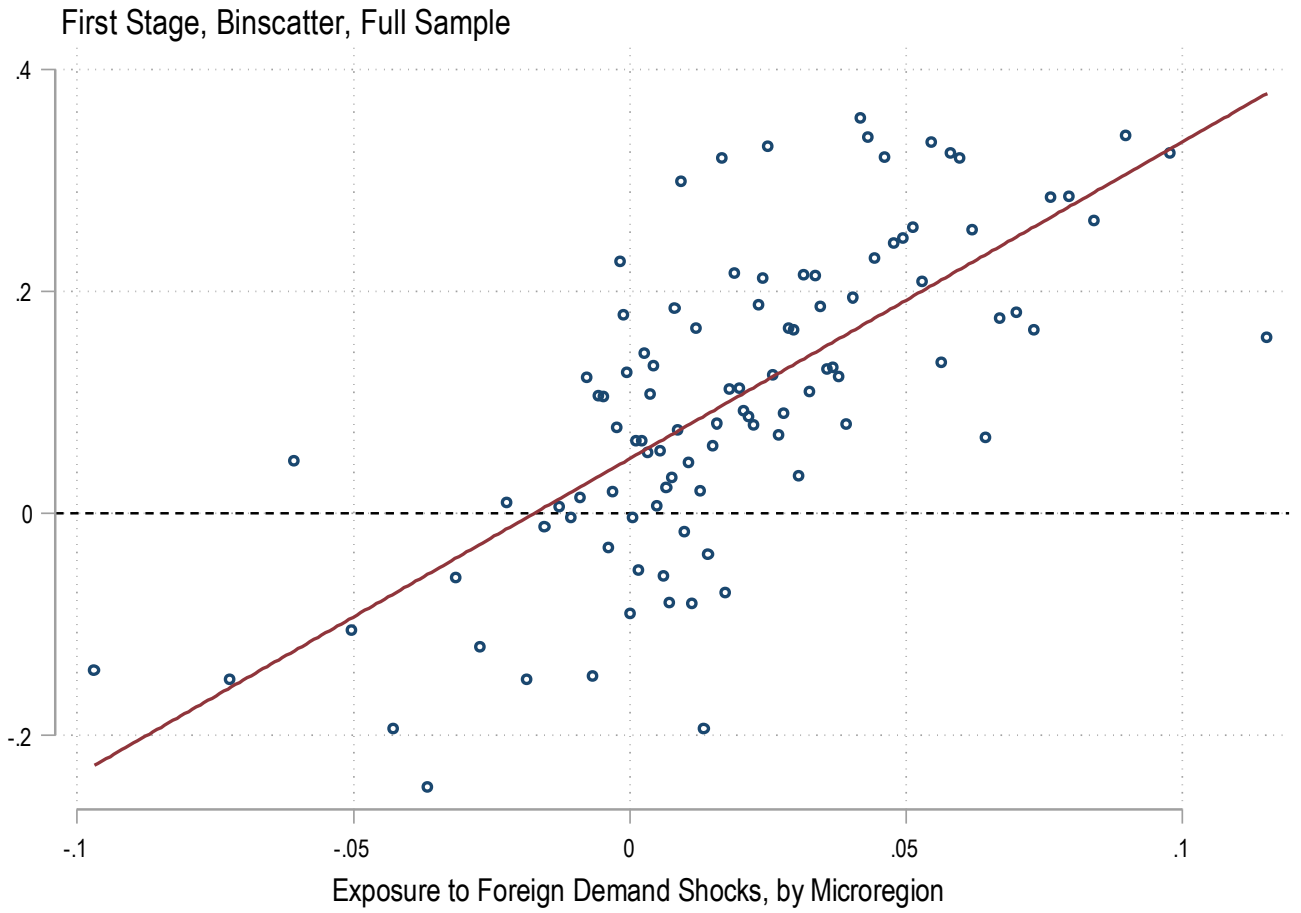
- First-stage

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

- Second Stage

$$O_{r,s,t+h} - O_{r,s,t-1} = \alpha_h + \beta_h \Delta \hat{X}_{r,s,t} + \boldsymbol{Z}'_{r,s,t-1}\boldsymbol{\Phi}_h + \varepsilon_{r,s,h},$$
$$\text{for} \quad h \in \{-5, \ldots, 0, \ldots, 6\}$$

Instrument is relevant: First Stage F-stat > 124



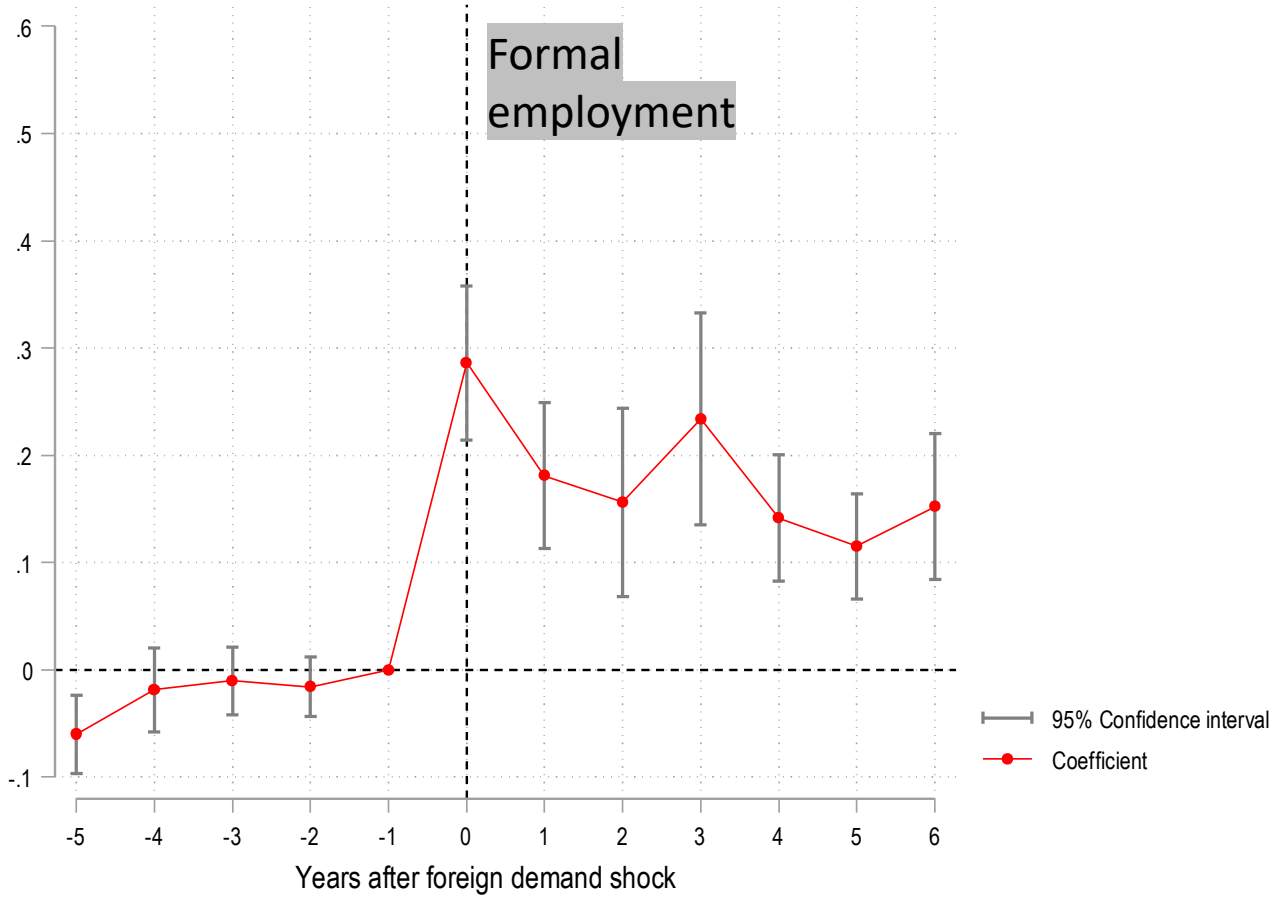
Note: this is a binscatter that reproduces the slope of regressing the observed growth in exports on the instrument, with region-fixed effects. The underlying regression has N=9,047, β=2.85 and t-stat = 11.15

Is the instrument valid?

- We are leveraging:
  - differential growth in global exports (minus Brazil) in each 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

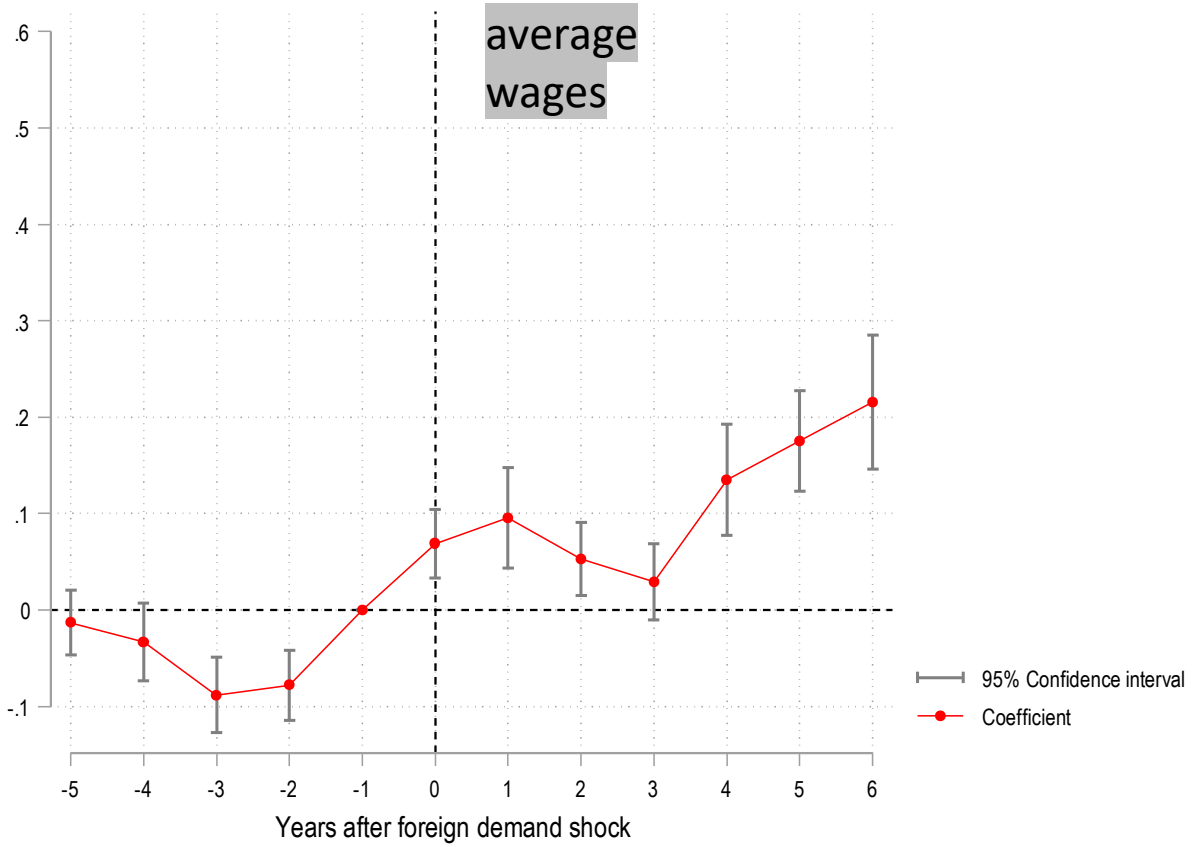
Preliminary results: horizon-specific elasticity of formal employment to foreign demand shocks

- No evidence of pre-trends
- Clear break in trend when the shock hits
- 1% exogenous increase in exports:
  - +0.3% increase in formal employment in SR
  - +0.15% increase in formal employment in MR
- Effects wear out over time



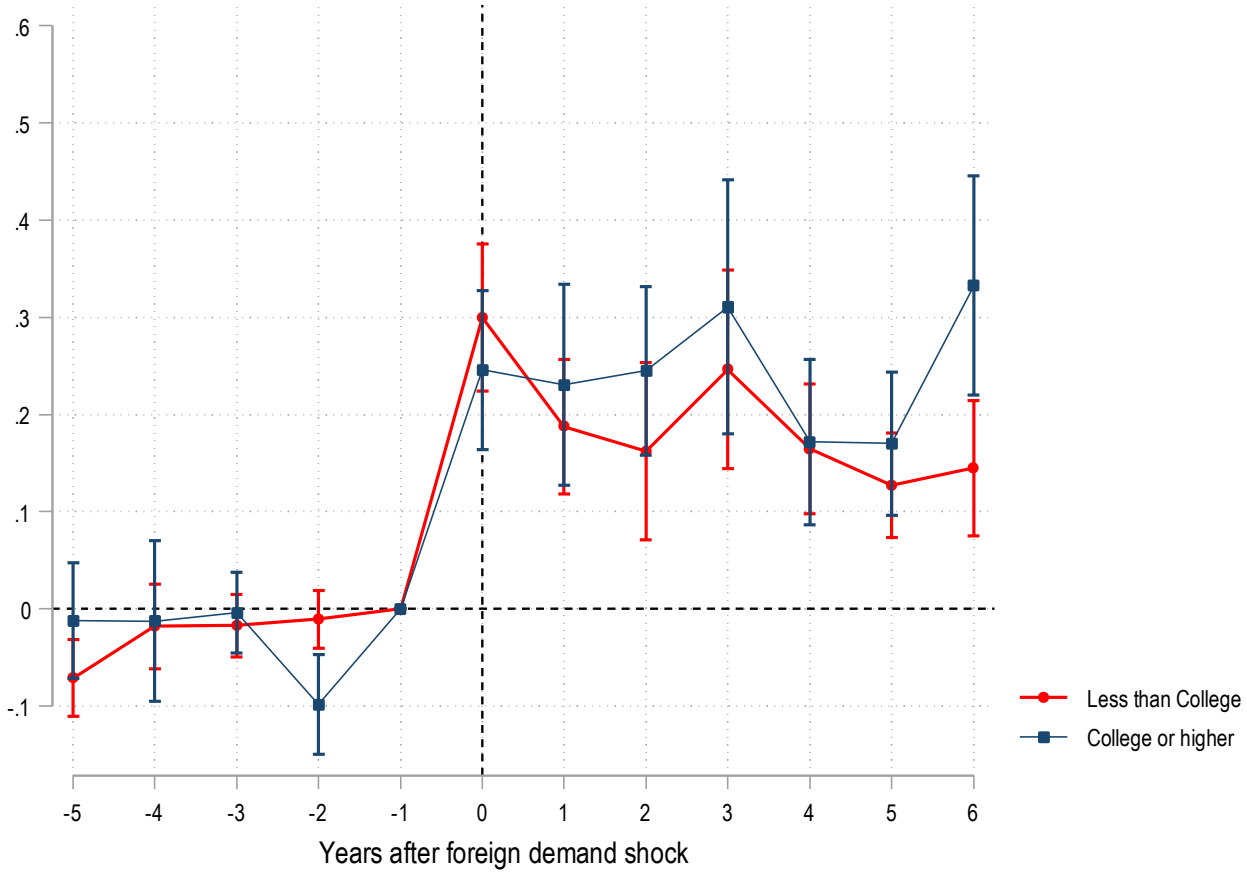
Preliminary results: horizon-specific elasticity of average wages to foreign demand shocks

- Effect builds up with a lag
  - sticky wages?
  - are the gains for incumbents or entrants?
- Estimation not as clean
  - possible anticipation / pre-trends
- 1% exogenous increase in exports:
  - <0.1% increase in wages in SR
  - >0.2% increase in wages in MR



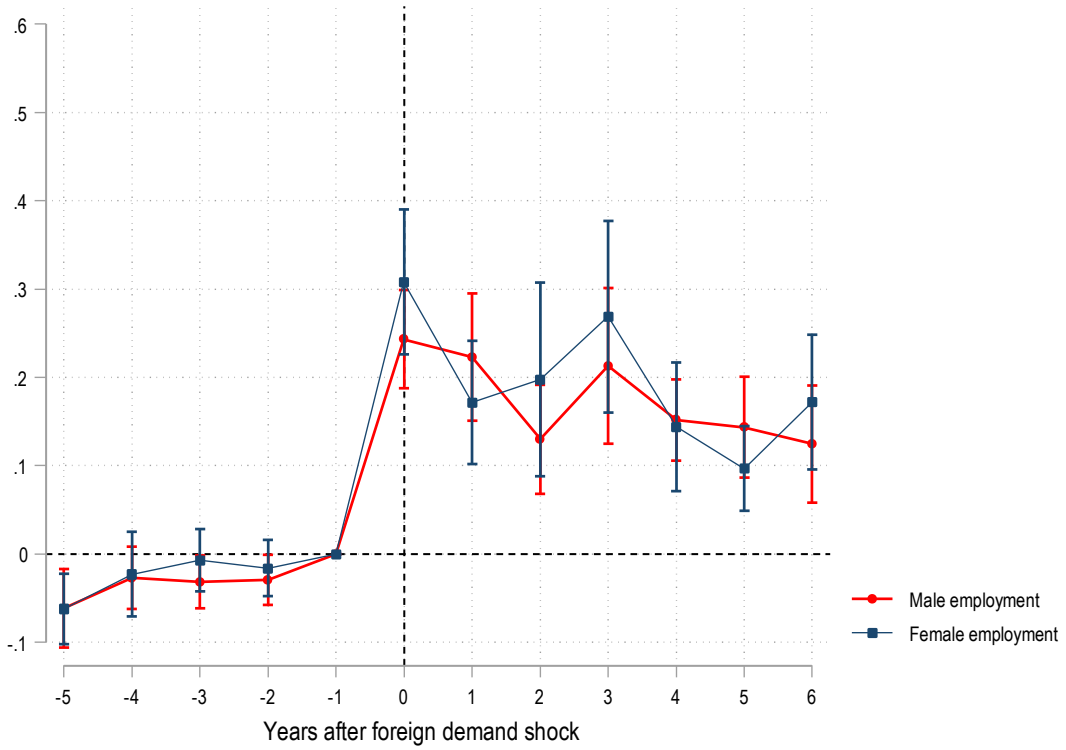
Preliminary results: heterogeneity by education

- Effects similar over SR, w/ elasticities:
  - ~0.25-0.3 over short run
- Effects on high skilled employment more persistent over mid-horizon
  - 0.15 for below college education
  - 0.33 for college or higher

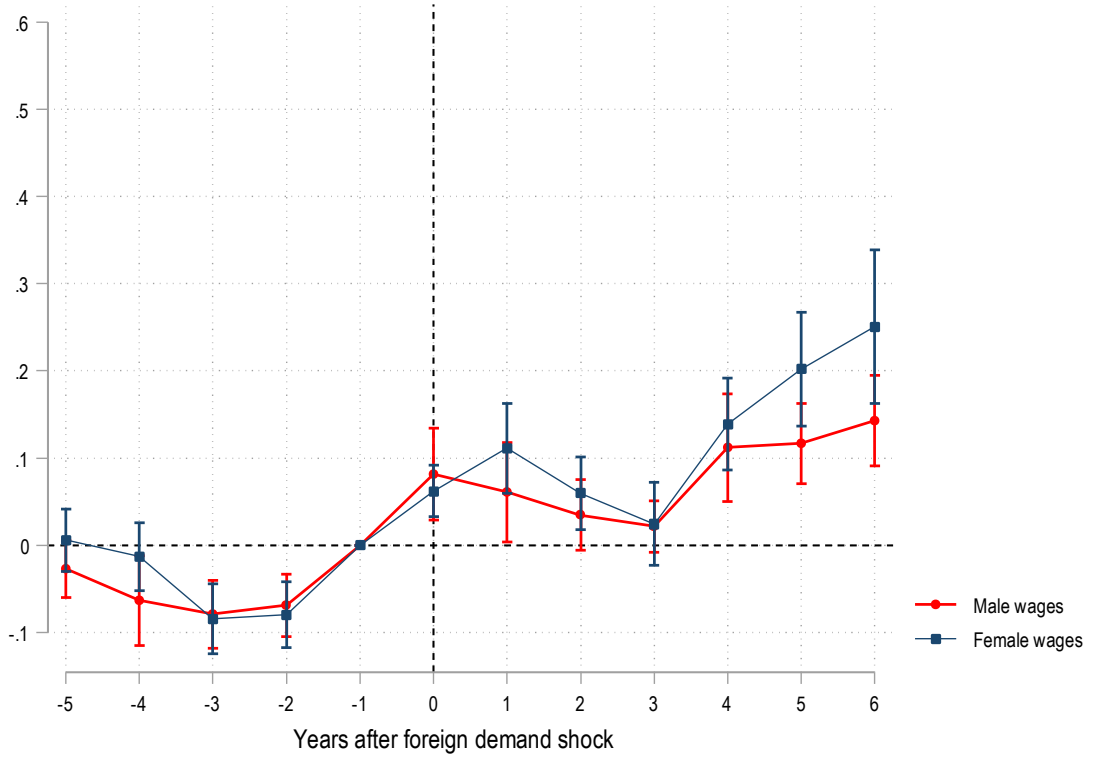


Preliminary results: heterogeneity by gender

Results on formal employment are similar…



Female wages slightly more responsive over mid-horizon



Preliminary results: the long-run

- Re-estimate results with two waves of Census data (2000-2010)
- Waves coincide with increase in exports
- Effects on fomal employment are positive but small and insignificant over LR
- Regions with higher exposure to export shocks are less likely to see increase in informal employment
- Differential effects on wages close to zero
- Baseline instruments has F-stat > 10, alternative faces weak instrument problem
- Baseline results in column (1)

Elasticities with respect to exports

	(1)	(2)	(3)	(4)
Instrument:	Global Exports		Partners GDP Growth	
Dependent variables:				
Formal employment	0.03	0.03	0.17	-0.48
	(0.03)	(0.09)	(0.33)	(0.45)
First stage f-stat	10.85	1.17	0.30	1.20
N	416	417	411	413
Informal employment	-0.09	-0.22	-0.33	-0.63
	(0.03)	(0.15)	(0.52)	(1.34)
First stage f-stat	12.83	2.37	0.43	0.23
N	416	417	411	413
Formal wages	0.01	0.02	0.08	1.84
	(0.01)	(0.03)	(0.15)	(15.26)
First stage f-stat	11.00	2.43	0.41	0.01
N	416	417	411	413
Informal wages	0.02	0.01	0.29	4.13
	(0.02)	(0.04)	(0.38)	(34.42)
First stage f-stat	11.90	4.32	0.60	0.01
N	416	417	411	413
State Fixed Effects	Y	N	Y	N

Next steps

- Exploratory: identify ‘green’ or ‘brown’ sectors in the economy and estimate heterogeneous effects