# 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
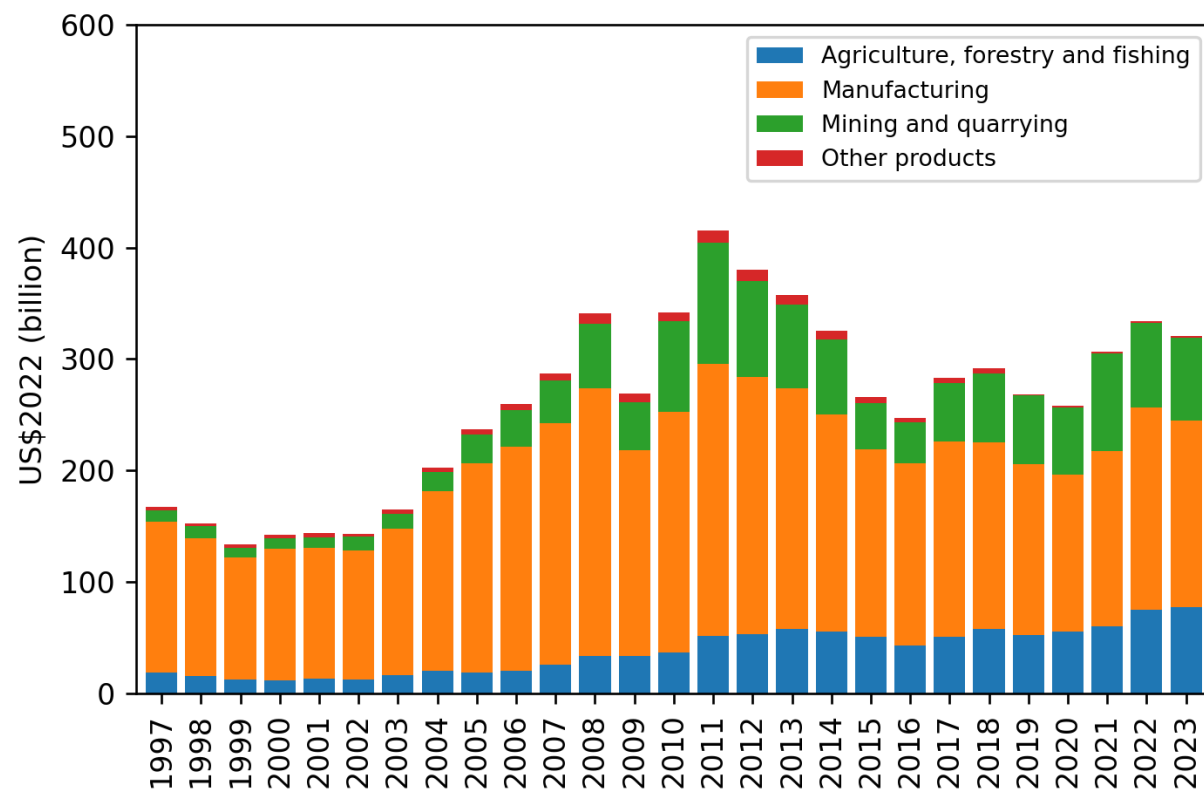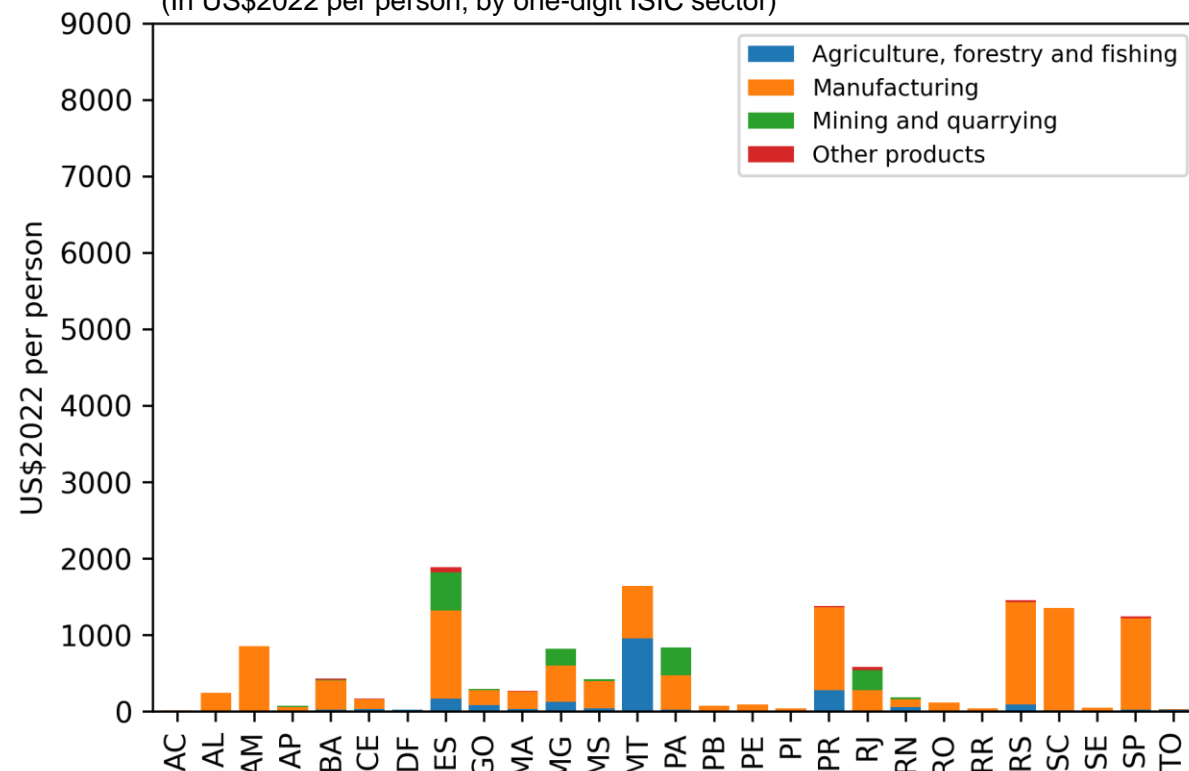

Sources: Own calculations with MDIC, IBGE and Fred data.

How does this look across states?

Average levels of exports increased for most states...

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

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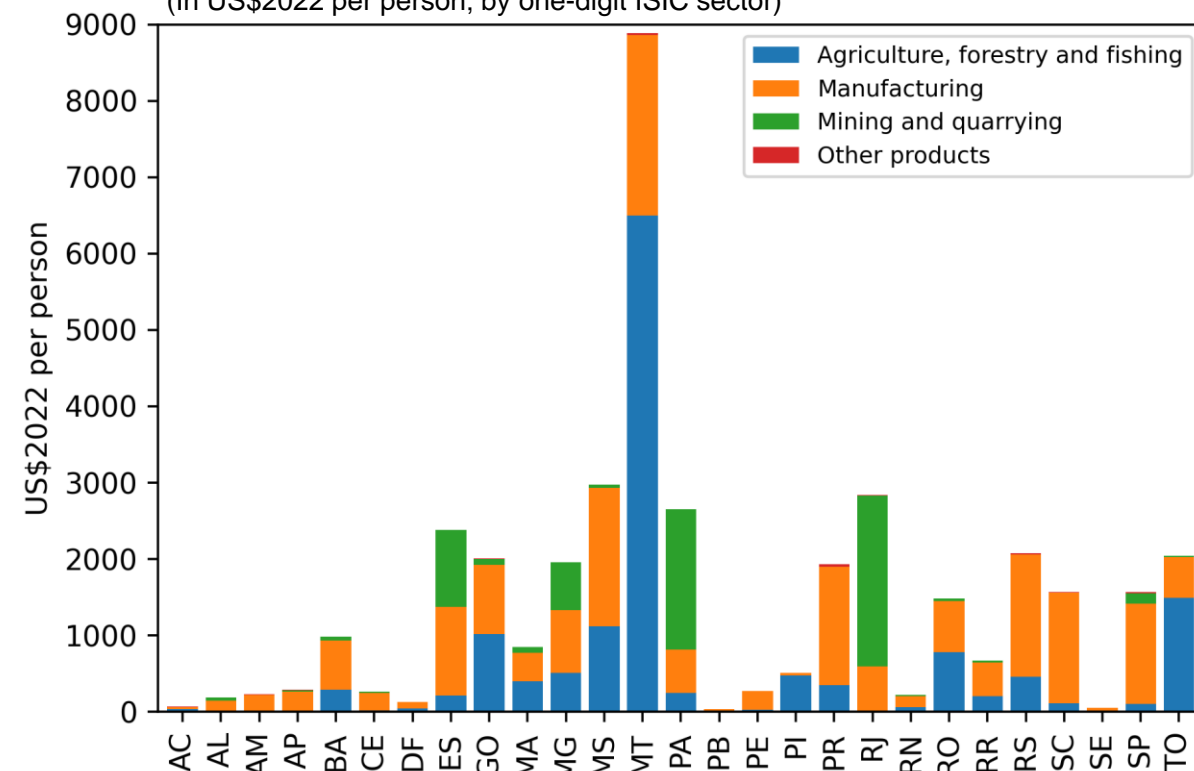
Brazilian States: Exports per Person, 2022
(In US$2022 per person; by one-digit ISIC sector)

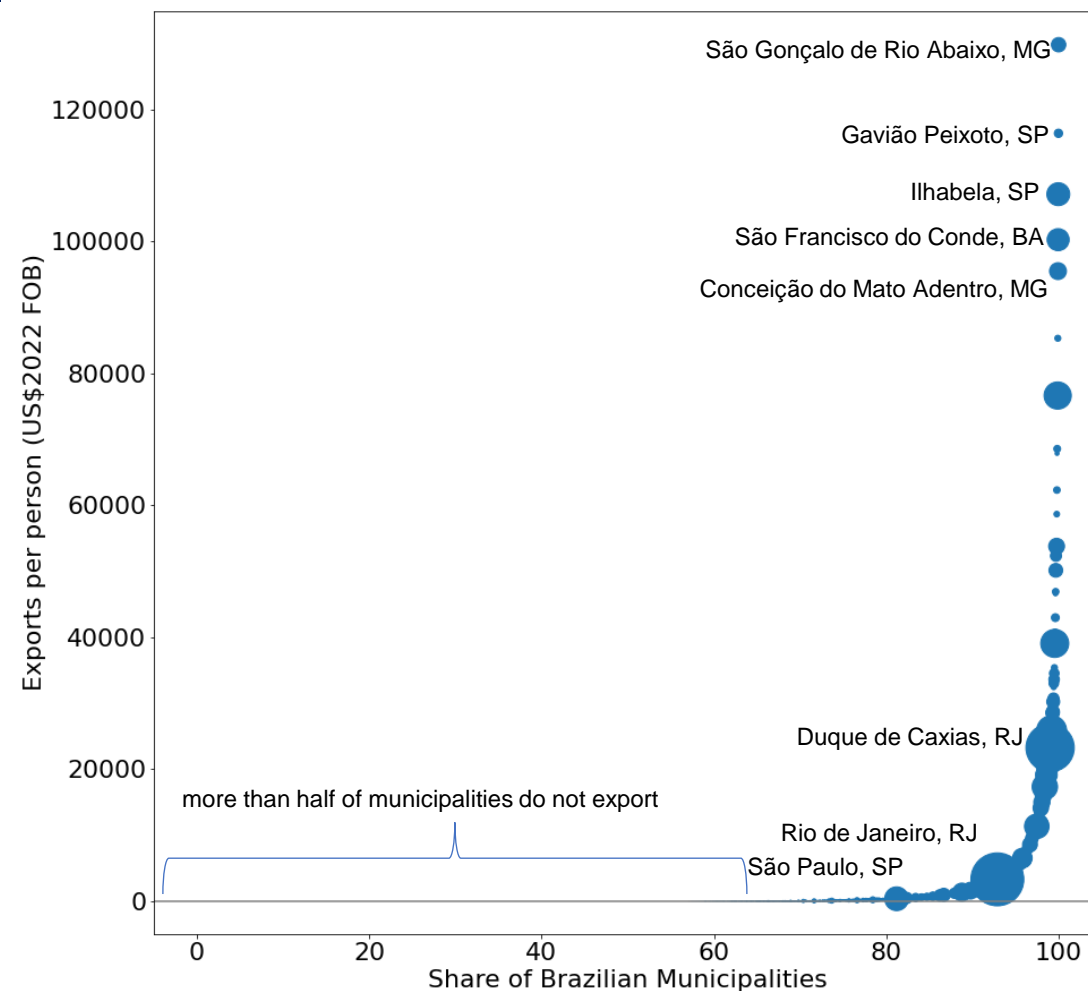Sources: Own calculations with MDIC, IBGE and Fred data.

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
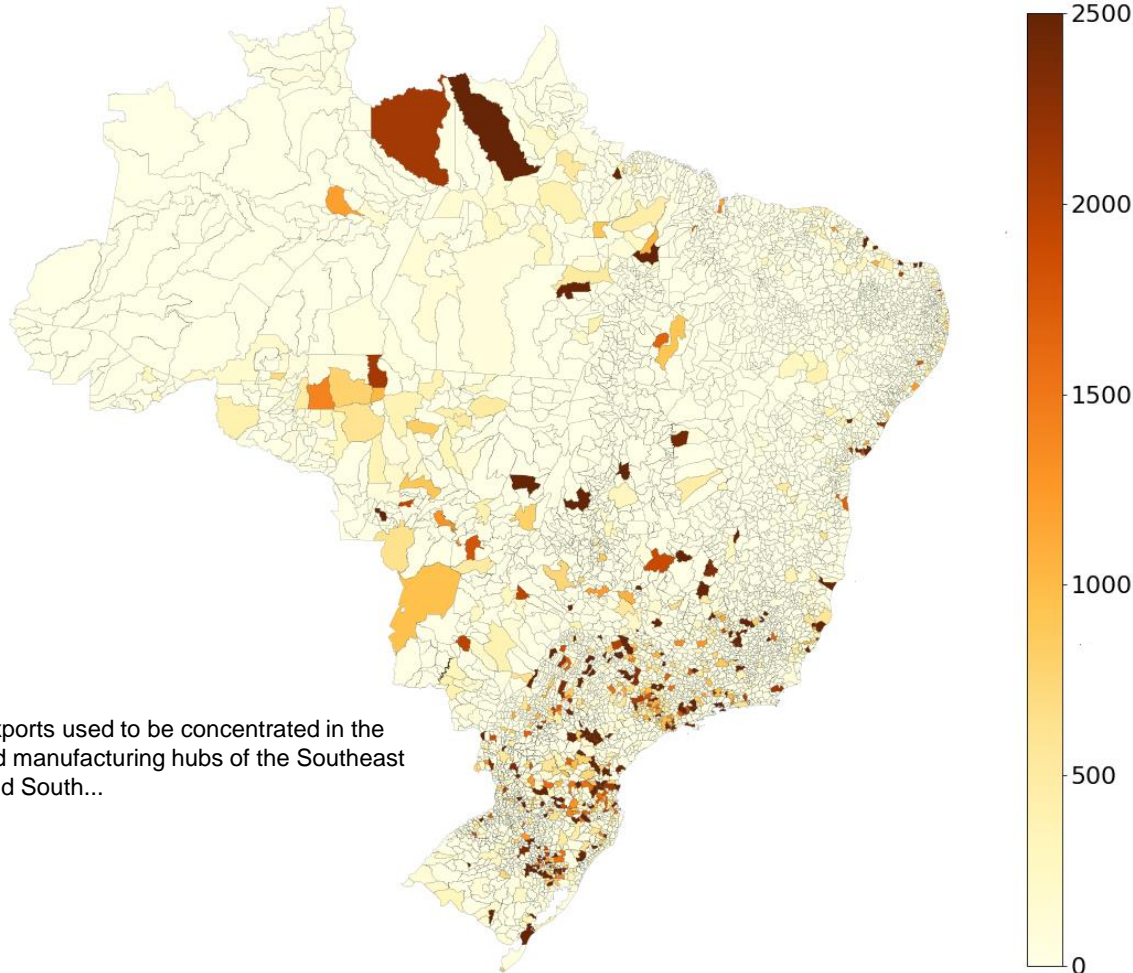- (Vale *Brucutu* Mining Site)

Gavião Peixoto, SP
- (Embraer Production Plant)

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...

Brazilian Municipalities: Exports per Person, 2022
(In US$2022 per person; bubbles are proportional to total municipal exports; distribution truncated at US$2022 2500+)
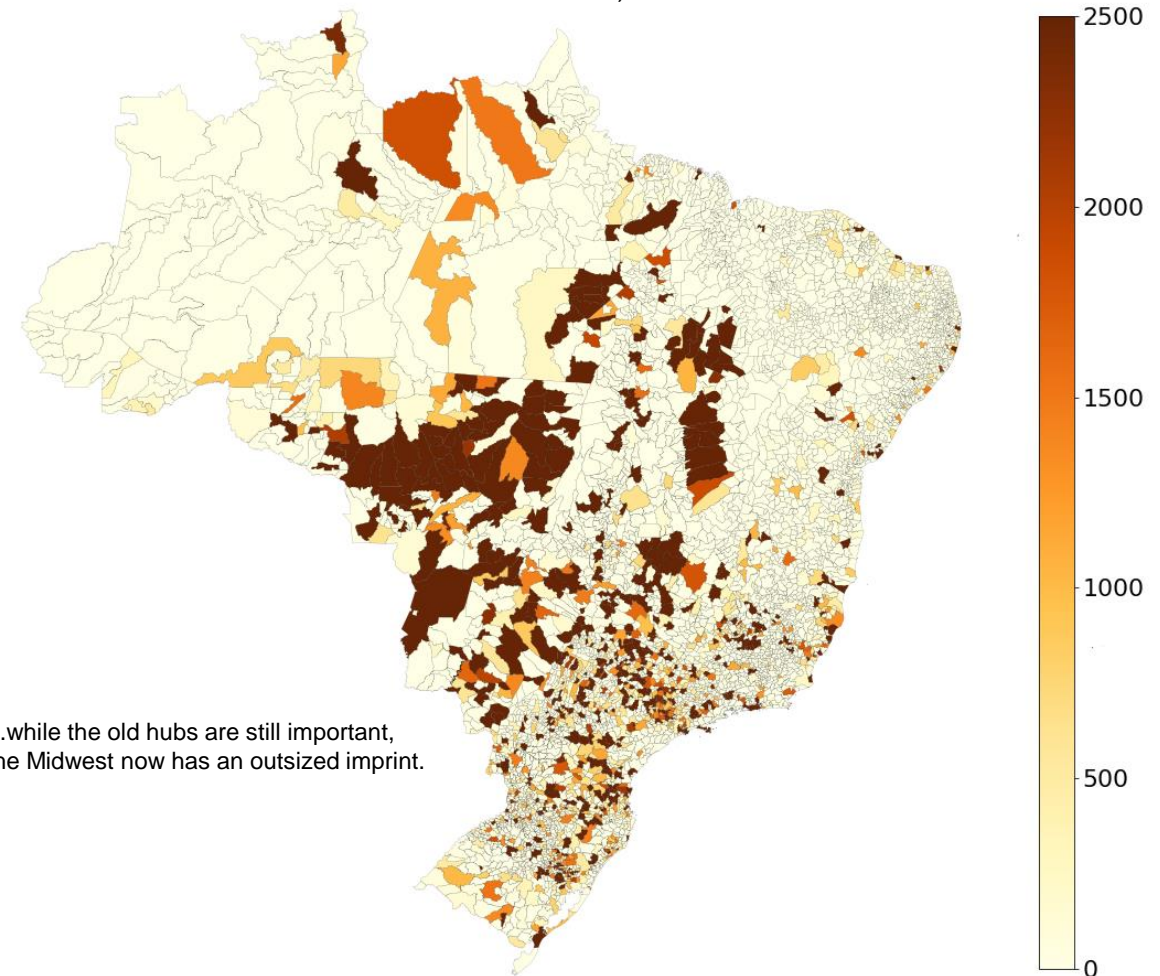
...while the old hubs are still important, the Midwest now has an outsized imprint.

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

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)

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

- 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

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

Two stage least squares with local projections

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

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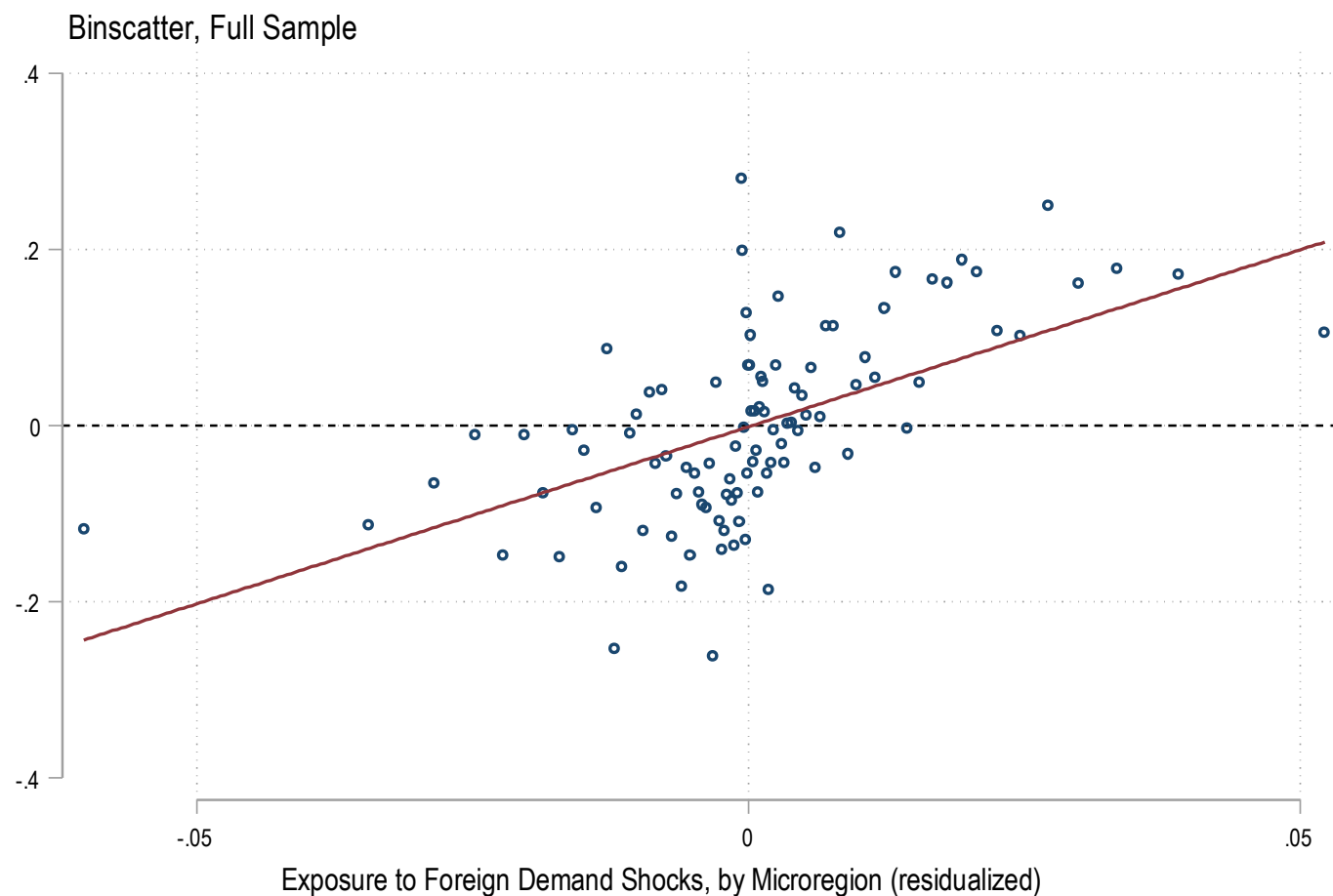
- First-stage

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

- Second Stage

$$O_{r,s,t+h} - O_{r,s,t-1} = \alpha_h + \beta_h \Delta \hat{X}_{r,s,t} + \mathbf{Z}'_{r,s,t-1} \boldsymbol{\phi}_h + \varepsilon_{r,s,h},$$
$$\text{for} \quad h \in \{-3, -2, 0, 1, 2, 3 \dots \}$$

Instrument is relevant: First Stage F-stat > 53

Binscatter, Full Sample

Exposure to Foreign Demand Shocks, by Microregion (residualized)

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, β=4.025 and t-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
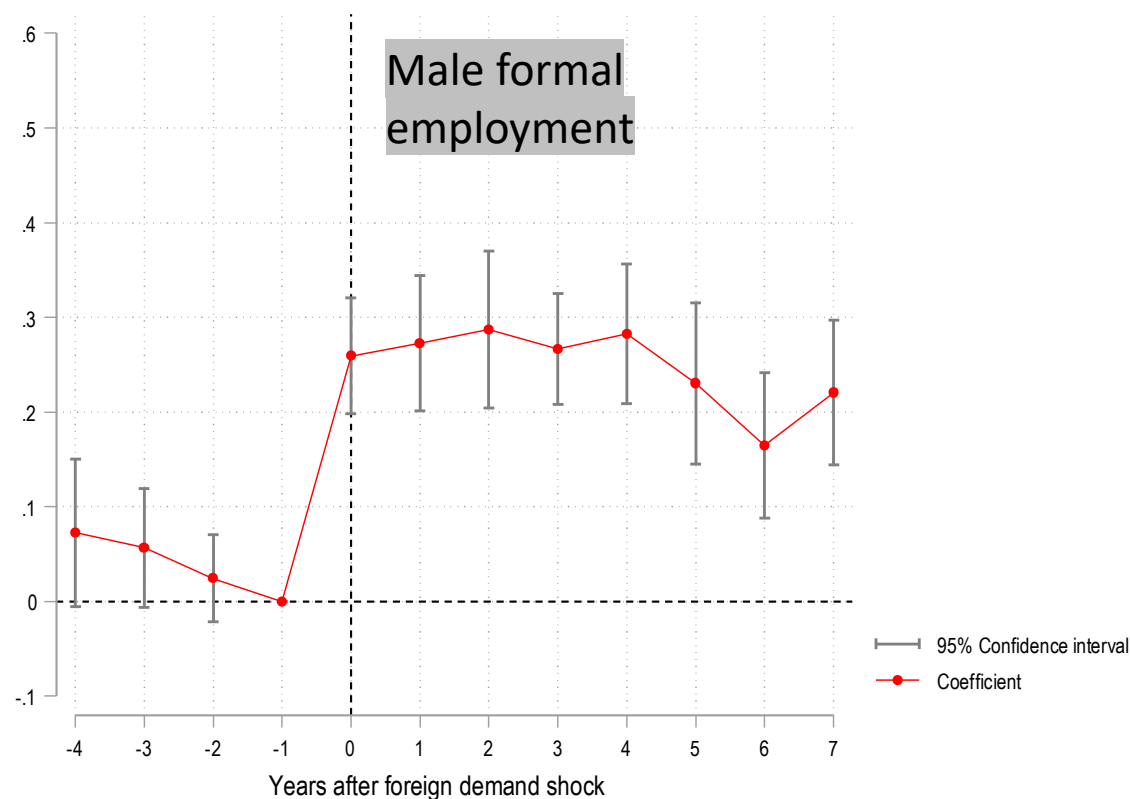
Preliminary results: horizon-specific elasticity of formal employment to foreign demand shocks

- 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
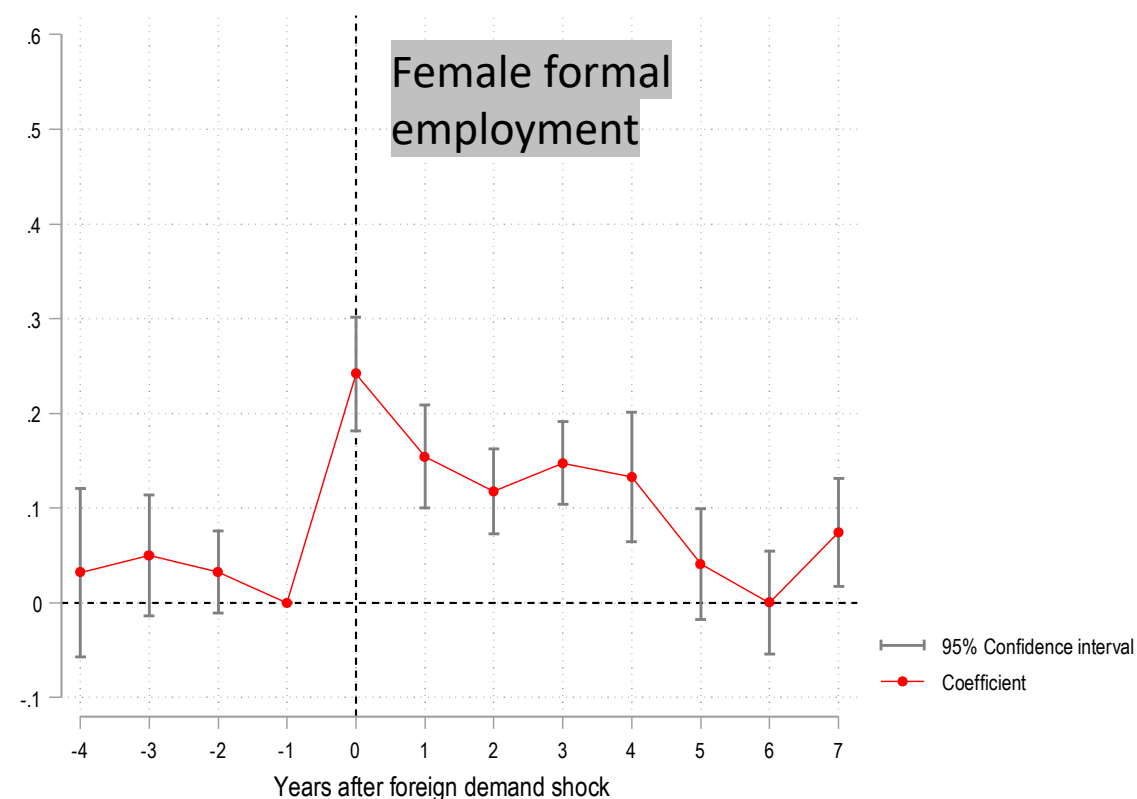 - +0.10% increase in formal employment in LR
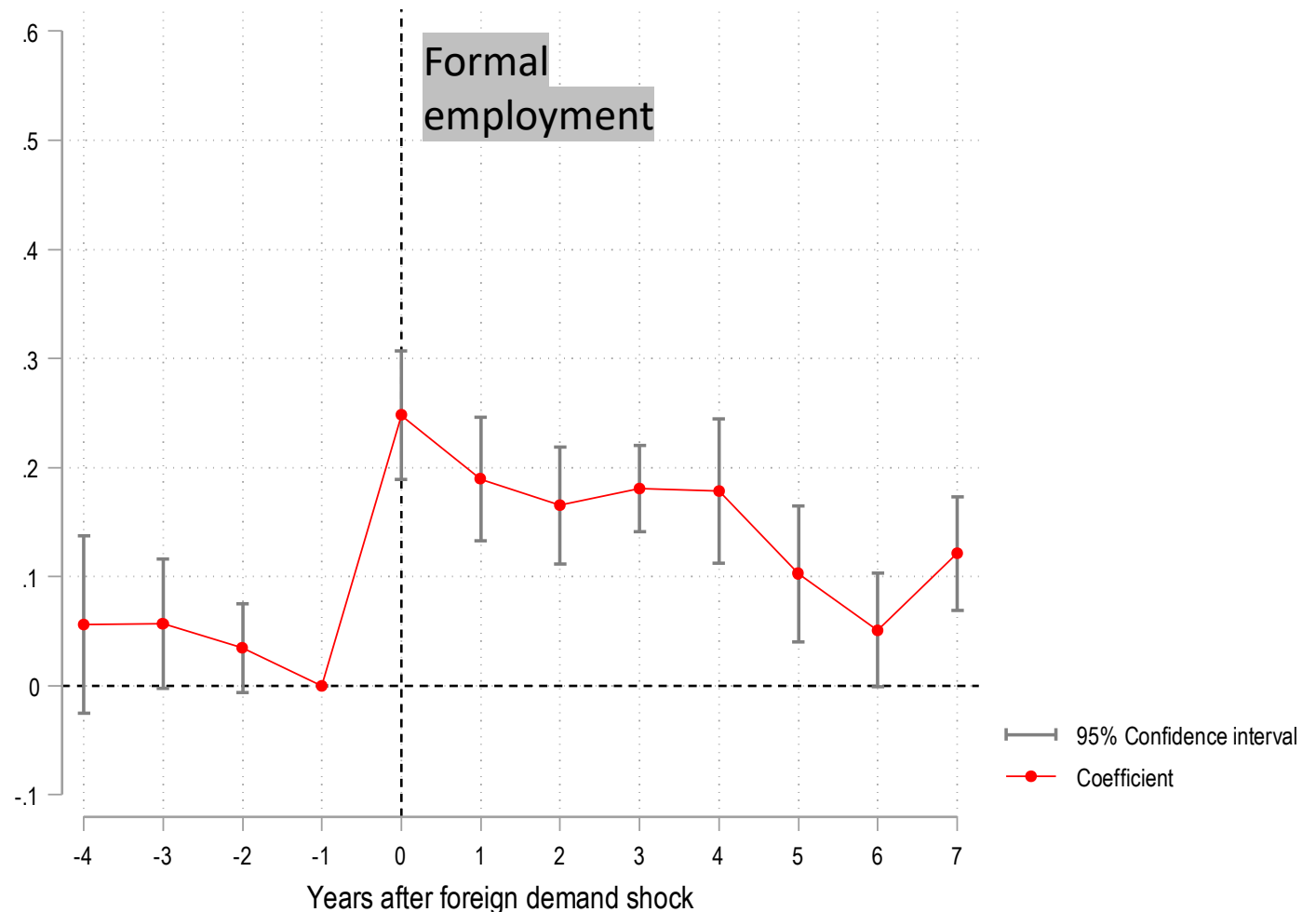
Preliminary results: heterogeneity by gender

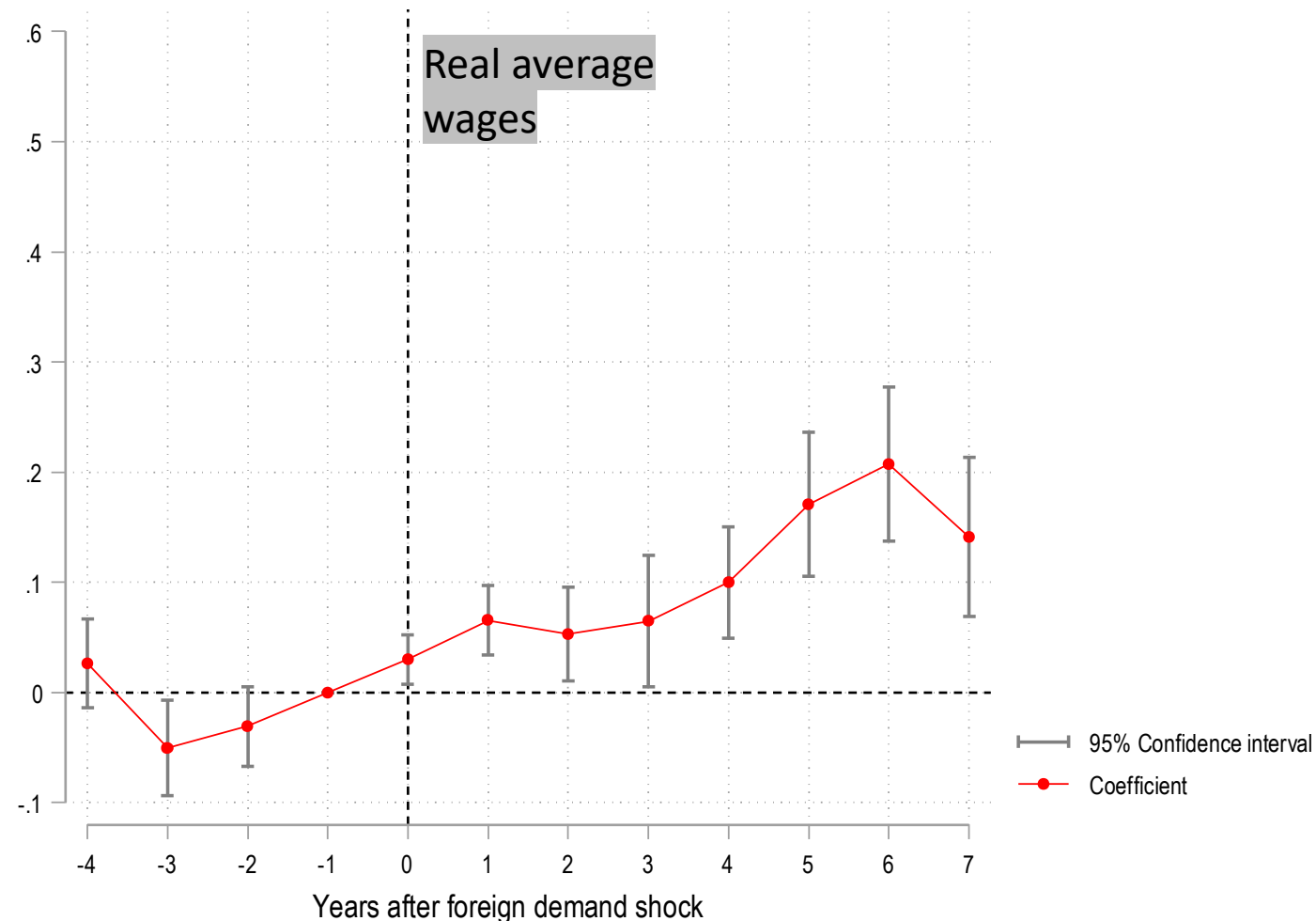Both male and female employment respond positively...

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

Male formal employment

95% Confidence interval

Coefficient

Years after foreign demand shock

Female formal employment

95% Confidence interval

Coefficient
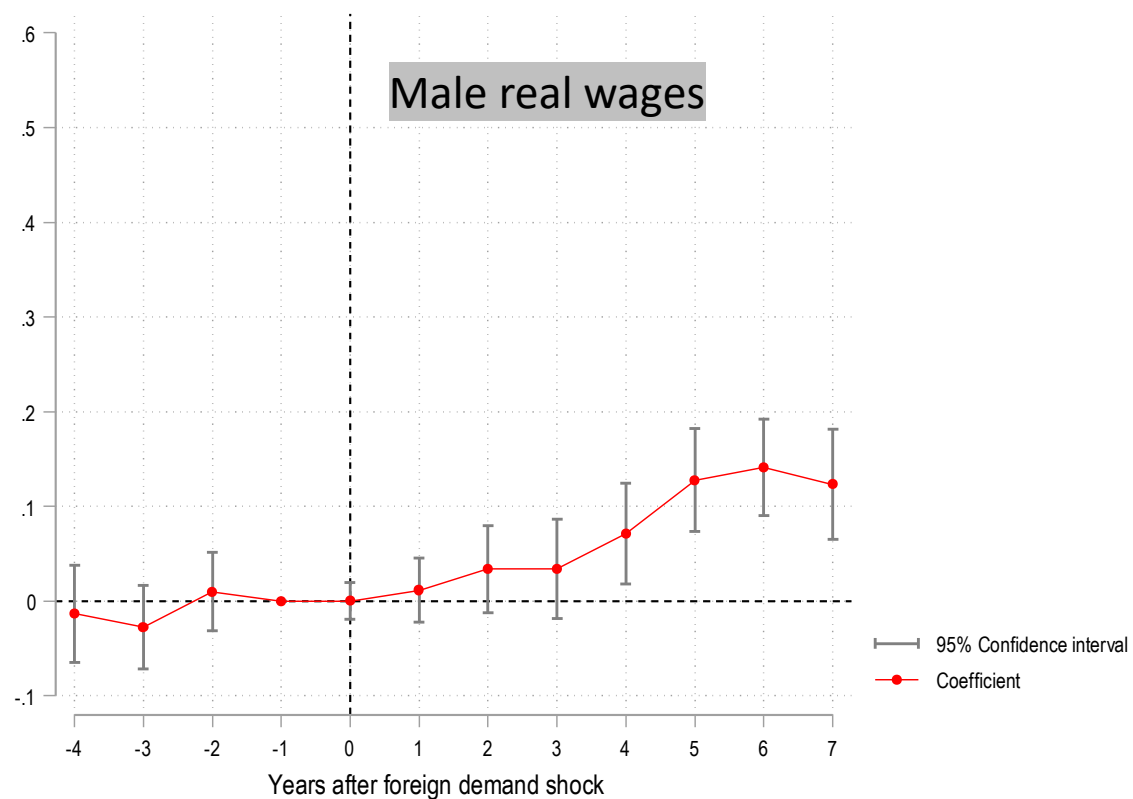
Years after foreign demand shock

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
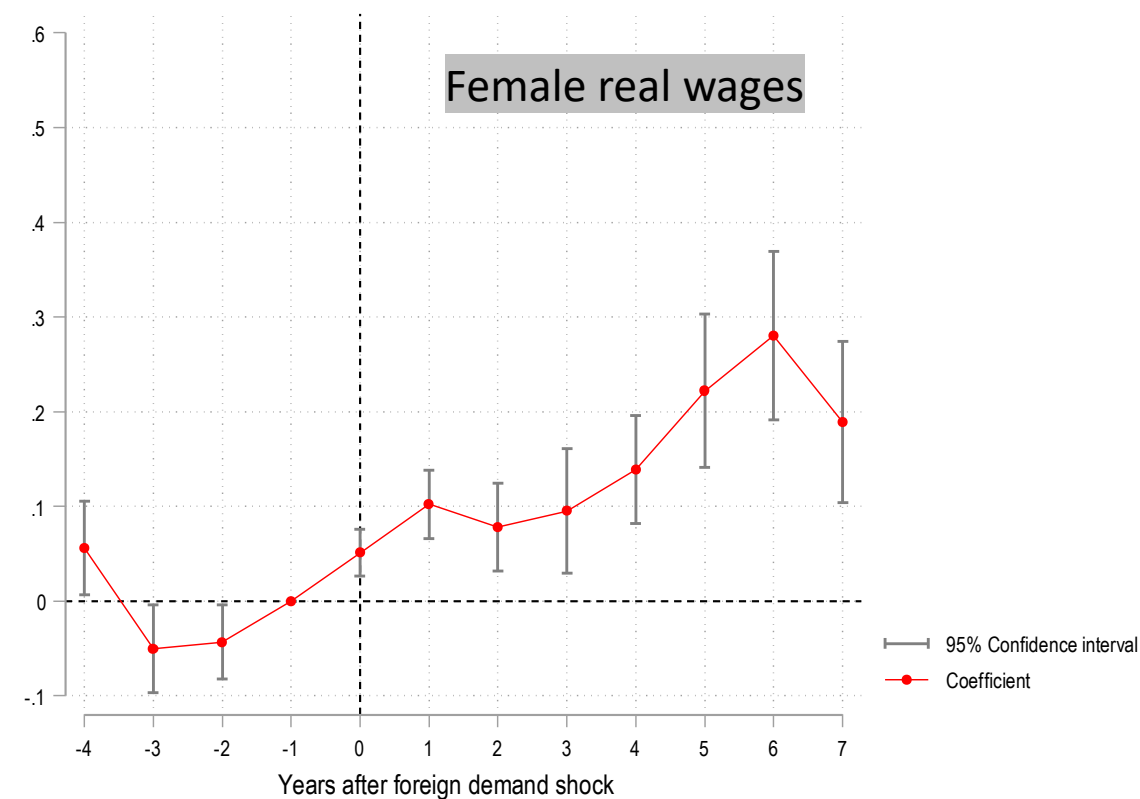 - +0.2% increase in real wages in LR

Real average wages

95% Confidence interval
Coefficient

Years after foreign demand shock

THE WORLD BANK
IBRD • IDA | WORLD BANK GROUP

Preliminary results: heterogeneity by gender

Effects on male wages are positive...

...but smaller than effects on female wages

Next steps

- Run analyses for Other groups of the population (i.e. race)

- Complement analysis with informal LM using two rounds of census

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