The Regional Keynesian Cross

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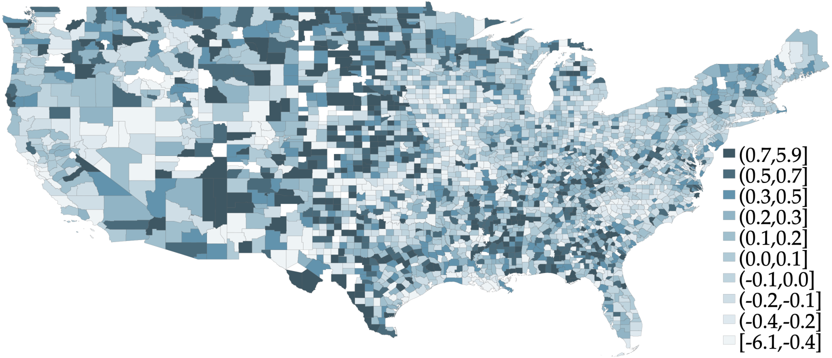
MONETARY POLICY HAS HETEROGENEOUS EFFECTS ACROSS US REGIONS



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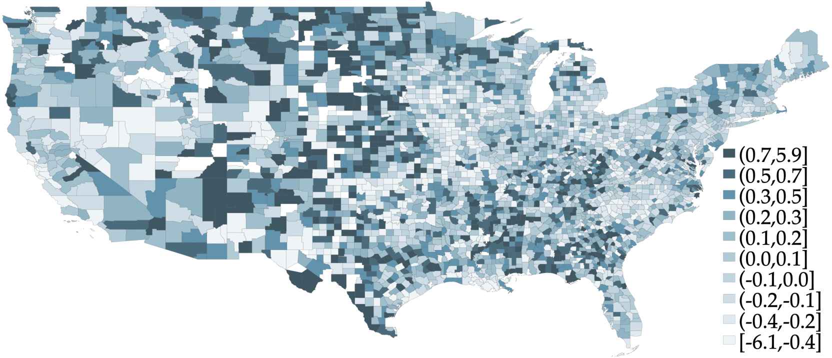

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  - Why is there regional heterogeneity in the employment response to MP?

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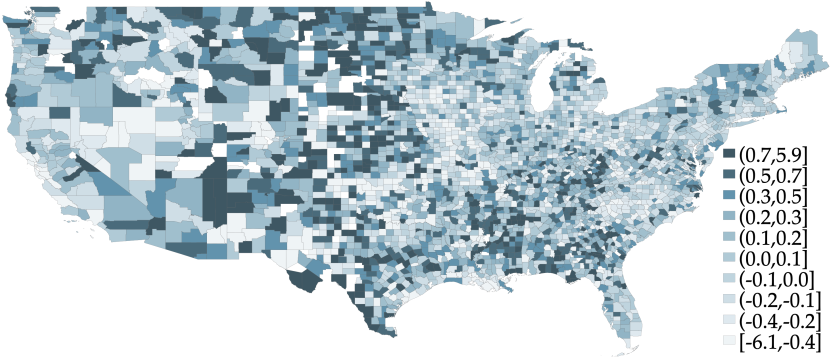

- This paper:
  - I Why is there regional heterogeneity in the employment response to MP?
  - II Does it matter for the aggregate transmission of monetary policy?

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- Match empirical IRFs
- State dependency $\rightarrow$ regional heterogeneity neutral in US, 30% amplification in ITA

TODAY

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LITERATURE

I **Heterogeneous Agents New Keynesian models** (Campbell and Mankiw, 1989; Bilbiie, 2008; Werning, 2015; Challe et al., 2017; Debortoli and Galí, 2018; Kaplan et al., 2018; Auclert, 2019; Hagedorn et al., 2019; de Ferra et al., 2020; Auclert et al., 2020, 2021a,b, 2023; Ravn and Sterk, 2020; Dupor et al., 2023; Acharya et al., 2023; Patterson, 2023)

- ◇ Heterogeneity & MPCs shape the transmission of MP
- ◇ Our contribution: regional setting, heterogeneity both within & across regions matters

II **Optimal Currency Areas** (Mundell, 1961; McKinnon, 1963; Kenen, 1969; Alesina et al., 2002; Kenen and Meade, 2008; Farhi and Werning, 2016, 2017)

- ◇ Openness to trade determines potency of monetary and fiscal stabilization tools
- ◇ Our contribution: heterogeneity between union members

Integrate I & II $\rightarrow$ framework for MP transmission across regions + empirically testable insights

- ▶ MP across space (Carlino and Defina, 1998; De Ridder and Pfajfar, 2017; Hauptmeier et al., 2023; Corsetti et al., 2021; Herreño and Pedemonte, 2022; Almgren et al., 2022; Costain et al., 2022)
- ▶ Sequence space methods (Mankiw and Reis, 2006; Boppart et al., 2018; Auclert et al., 2023)
- ▶ Open-economy macroeconomics (Obstfeld and Rogoff, 1995; Galí and Monacelli, 2005, 2008; Rey, 2013; Miranda-Agrippino and Rey, 2020)
- ▶ Cross-sectional identification (Nakamura and Steinsson, 2014, 2018; Beraja et al., 2018; Chodorow-Reich et al., 2021; Hazell et al., 2022; Wolf, 2021a,b)

Model

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$$\max_{\{c_{jit}, b_{jit+1}\}} \mathbb{E}_0 \sum_{t \geq 0} \beta_j{}^t \{u(c_{jit}) - v(\ell_{jit})\} \quad \text{s.t.} \quad c_{jit} + b_{jit+1} = \frac{W_{jt}}{P_{jt}} e_{jit} \ell_{jit} + (1 + r_t) b_{jit}, \quad b_{jit+1} \geq \underline{b}_j$$

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- Two sectors: $\ell_{jit} = \left[\alpha_j{}^{-\frac{1}{\eta}} (\ell^{NT}_{jit})^{\frac{\eta+1}{\eta}} + (1 - \alpha_j)^{-\frac{1}{\eta}} (\ell^T_{jit})^{\frac{\eta+1}{\eta}} \right]^{\frac{\eta}{\eta+1}}, \quad y^s_{jt} = \ell^s_{jt},$ unions + rigid wages

TWO IMPORTANT STATISTICS

- Non-tradable labor income share: $\rho_j \equiv \frac{\ell_j^{NT} W_j^{NT}}{\ell_j W_j} \in [0, 1]$

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- Intertemporal MPCs (Auclert et al., 2023)
  - Regional aggregate consumption function captures all the heterogeneity:

$$\mathcal{C}_{jt}\left(\left\{Z_{js}\right\}_{s\geq 0}, \left\{r_s\right\}_{s\geq 0}\right), \qquad Z_{js} \equiv \frac{W_{js}}{P_{js}} L_{js}$$

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  - Define Jacobian matrices + stack in vector notation:

$$(\boldsymbol{M}_j)_{ts} = \frac{\partial \log \mathcal{C}_{jt}(\cdot)}{\partial \log Z_{js}}, \qquad (\boldsymbol{M}_j^r)_{ts} = \frac{\partial \log \mathcal{C}_{jt}(\cdot)}{\partial \log(1+r_s)}, \qquad d\boldsymbol{L}_j \equiv (d\log L_{j1}, d\log L_{j2}, \cdots)'$$

PROPOSITION

The 1st-order response $d\boldsymbol{L}_j$ to a monetary shock $d\boldsymbol{r}$ & tradable demand shock $d\boldsymbol{C}^T$ solves:

$$d\boldsymbol{L}_j = \underbrace{\rho_j \left(\boldsymbol{M}_j^r d\boldsymbol{r} + \boldsymbol{M}_j d\boldsymbol{L}_j \right)}_{\text{Regional exposure}} + \underbrace{(1-\rho_j) d\boldsymbol{C}^T}_{\text{National exposure}}$$

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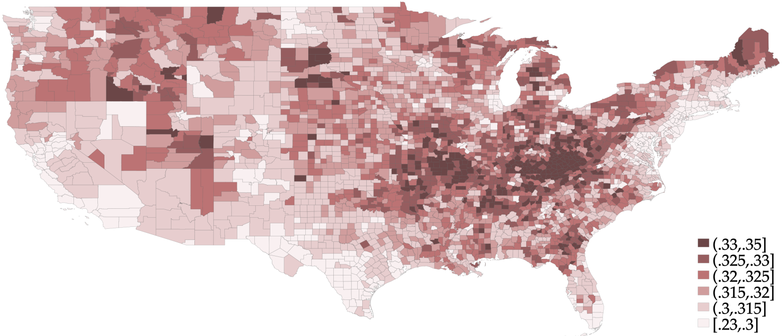
$$d\boldsymbol{L} = \underbrace{\left(\boldsymbol{M} + \mathbb{C}\mathrm{ov}(\rho_j, \boldsymbol{M}_j)\right)d\boldsymbol{L}}_{\text{national multiplier}} + \underbrace{\left(\boldsymbol{M}^r + \mathbb{C}\mathrm{ov}(\rho_j, \boldsymbol{M}_j^r)\right)d\boldsymbol{r}}_{\text{national interest rate channel}} + \mathbb{C}\mathrm{ov}((1+\rho_j-\rho)\boldsymbol{M}_j, d\boldsymbol{L}_j)$$

- Joint distribution of MPCs and non-tradability across regions matters

Model Meets Data

THE GEOGRAPHY OF MPCS



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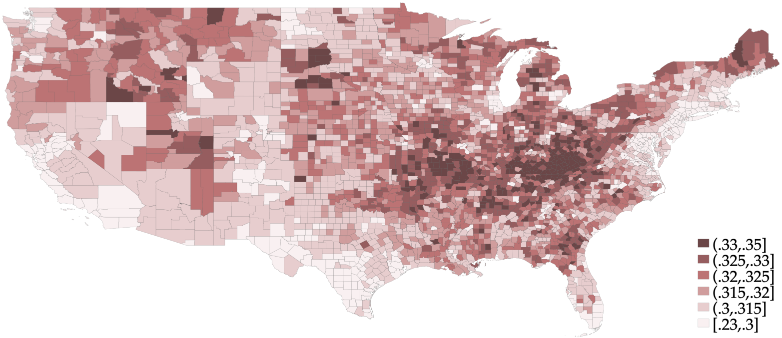

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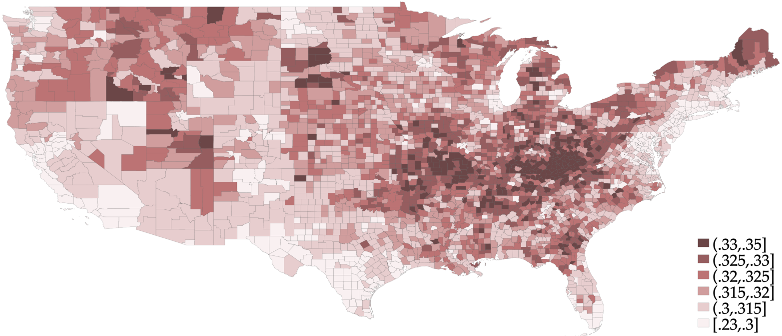

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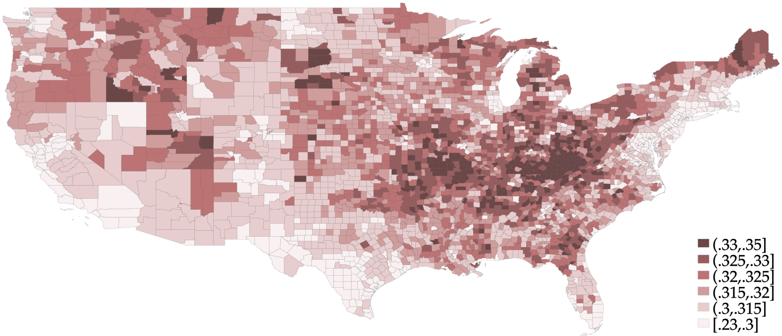

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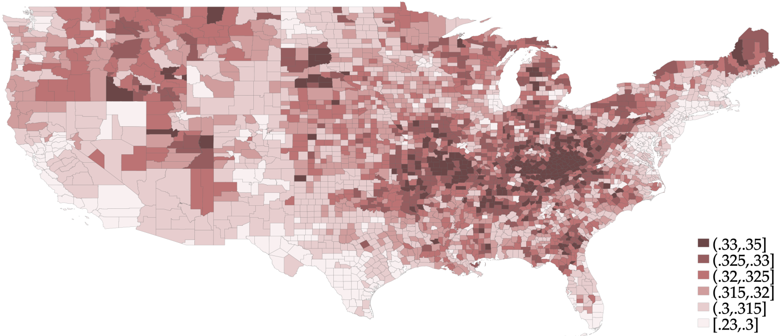

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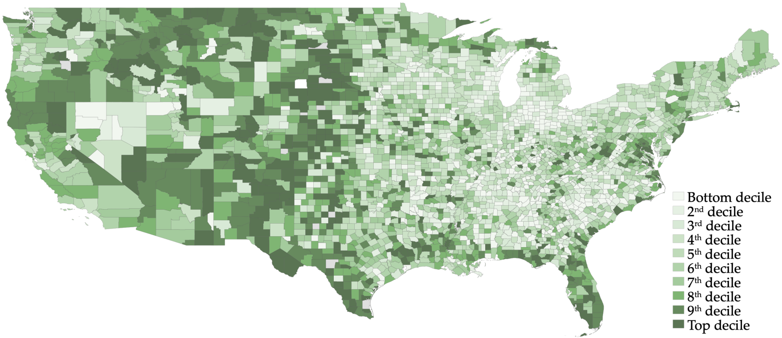
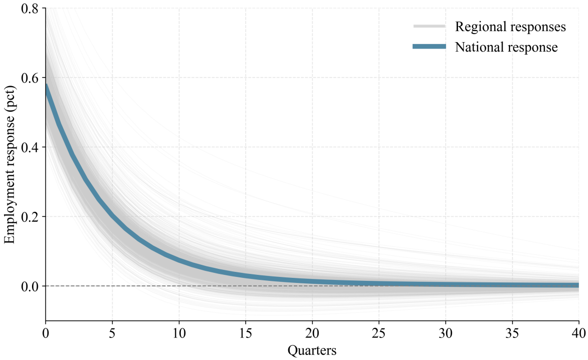
- Account for full distribution of agents along economic & socio-demographic characteristics

THE GEOGRAPHY OF NON-TRADABLE EMPLOYMENT



- Non-tradable sector classification based on Mian & Sufi (2014)
- Annual employment data from US Census County Business Pattern
- Non-tradable employment & MPCs negatively correlated across counties $\approx$ -0.25

REGIONAL HETEROGENEITY IN THE RESPONSE TO MP



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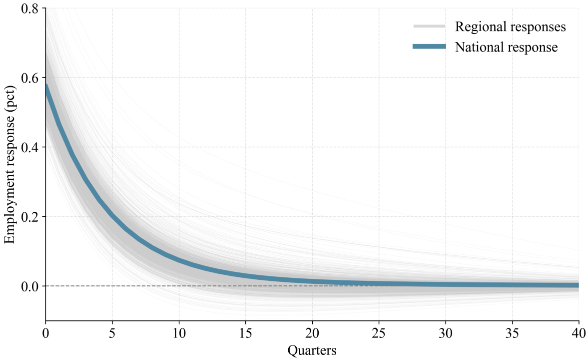

- Large regional heterogeneity in the response to MP
- ... but does it matter for the aggregate?

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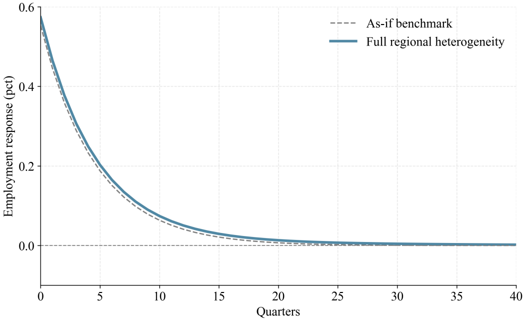

United States

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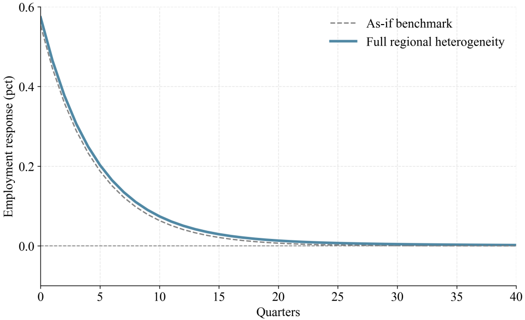

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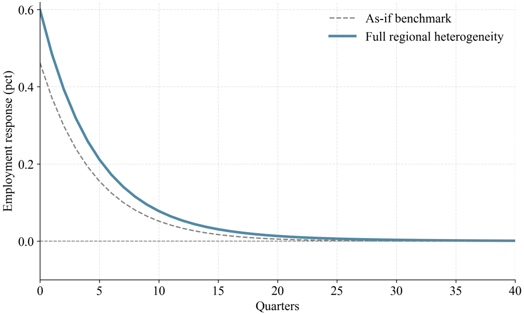

Italy

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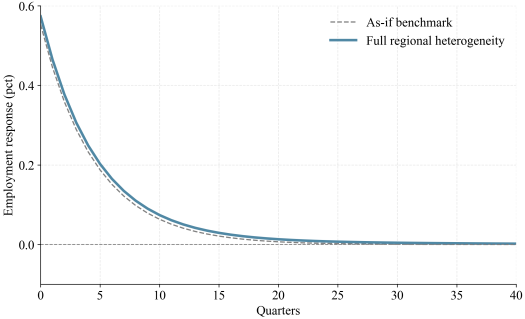
- State dependency $\rightarrow$ potency of MP depends on full regional distribution



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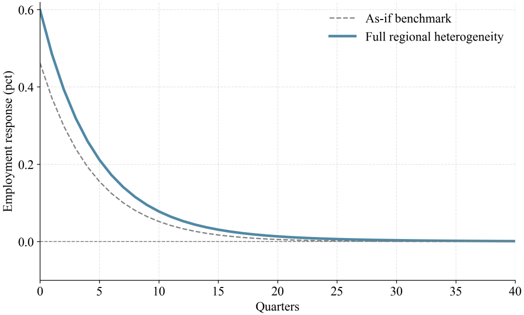

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CONCLUSION AND WAY FORWARD

- Regional heterogeneity in response to MP explained theoretically and empirically by:
  - Local MPC
  - Local share of the non-tradable sector

- Multiplier non-linear in MPC & $\rho_j \longrightarrow$ joint distribution matters for aggregate
  - State dependency: regional heterogeneity amplifies MP in Italy, not in US

- Portable framework: follow-up project on €-zone $\rightarrow$ heterogeneous fiscal policy

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Thanks!

Appendix

Regression Specification

▸ Histogram ▸ Back

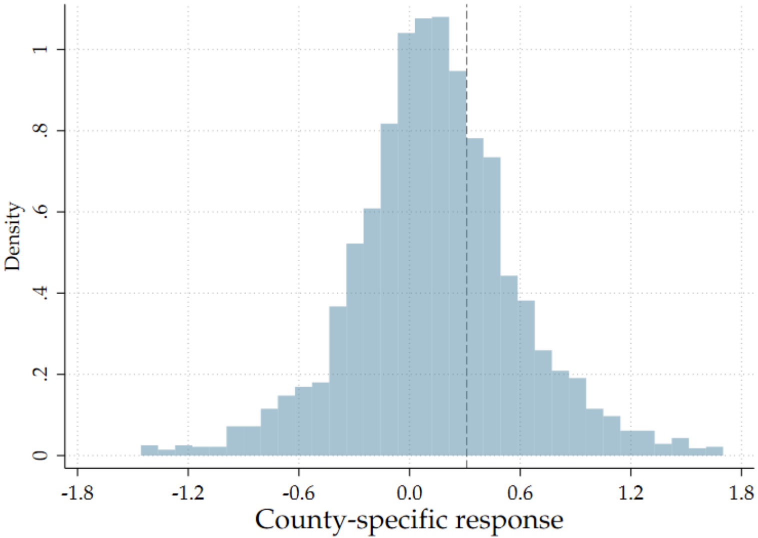
- Panel local-projection (weighted by 2000 population):

$$\Delta \log(L_{jt+h}) = \alpha_{jh} + \delta_{th} + \sum_{j=1}^{J} \beta_{jh} \times D_{jh} \times \varepsilon_t + \sum_{\ell=1}^{12} \gamma_{h\ell} \Delta \log(L_{jt-\ell}) + u_{jht}$$

  - D_{jh}: Dummy for county j
  - α_{jh}: county fixed effect
  - δ_{th}: time fixed effect $\Rightarrow$ absorbs the shock
  - β_{jh}: county-specific slope $\Rightarrow$ unexplained heterogeneity

The Distribution of County-Specific Responses

▸ Back



Model Parametrization

Back

Parameter	Description	Value	Comment
σ	Inverse IES	1	Standard
φ	Frisch Elasticity	1	Chetty et al. (2011)
ψ	Labor disutility	1	Normalization
ν	Elasticity of substitution between the two goods	1.5	Hazell et al. (2022)
η	Elasticity of substitution between the two sectors	0.45	Berger et al. (2022)
ω	Preference for non-tradables	0.66	Hazell et al. (2022)
ρ_e	Persistence of the log-productivity process	0.966	McKay et al. (2016)
σ_e	Cross-sectional std of log-productivity process	0.017	McKay et al. (2016)
$\underline{b}$	Borrowing limit	-1	Target $r = 4\%$ annually

Details on Regional MPCs

Back

- Use self-reported MPC out of capital losses from Fuster et al. (2020)

$$MPC_{it} = \alpha + \delta_t + \underbrace{\sum_{s=1}^{5} \beta_s^R D_{sit}^R}_{\text{Race bins}} + \underbrace{\sum_{s=1}^{4} \beta_s^A D_{sit}^A}_{\text{Age bins}} + \underbrace{\sum_{s=1}^{9} \beta_s^Y D_{sit}^Y}_{\text{Income bins}} + \underbrace{\sum_{s=1}^{5} \beta_s^E D_{sit}^E}_{\text{Educ. bins}} + \underbrace{\sum_{s=1}^{4} \beta_s^W D_{sit}^W}_{\text{Wealth bins}} + u_{it}$$

- Use ACS to bin households in groups g. Group-specific MPC:

$$\widehat{MPC}_g = \hat{\alpha} + \sum_{s=1}^{5} \hat{\beta}_s^R D_{gs}^R + \sum_{s=1}^{4} \hat{\beta}_s^A D_{gs}^A + \sum_{s=1}^{9} \hat{\beta}_s^Y D_{gs}^Y + \sum_{s=1}^{5} \hat{\beta}_s^E D_{sit}^E + \sum_{s=1}^{4} \hat{\beta}_s^W D_{sit}^W$$

- County-level MPC: avg. of group-specific MPCs, weighted by share of hhs in each group:

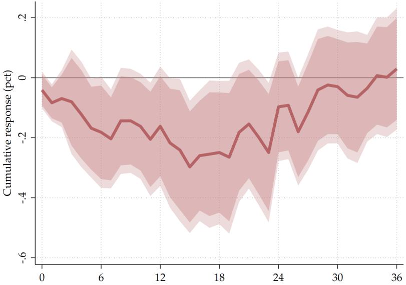
$$MPC_{jt} = \sum_{g} s_{jtg} \widehat{MPC}_g$$

LP FULL SPECIFICATION

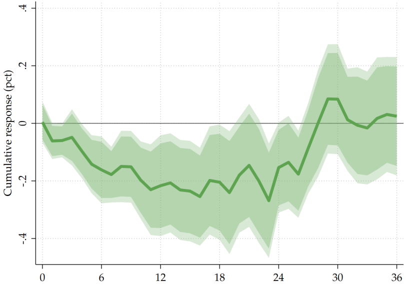
BACK

$$\Delta \ln(L_{jt+h}) = \underbrace{\alpha_{jh} + \delta_{th}}_{\text{Fixed effects}} + \underbrace{\beta_h^{NT} \times D_{jt}^{NT} \times \varepsilon_t}_{\text{Openness interaction}} + \underbrace{\beta_h^{M} \times D_{j}^{M} \times \varepsilon_t}_{\text{MPC interaction}} + \underbrace{\cdots}_{\text{Interaction \& lagged controls}} + u_{jht}$$

- Baseline group: high MPC, high non-tradables counties
  - I β_h^{NT}: high MPC, low non-tradables counties less responsive than baseline
  - II β_h^{M}: low MPC, high non-tradables counties less responsive than baseline



β_h^{NT}



β_h^{M}

HORSE-RACE : MPCs & NON-TRADABLES WIN

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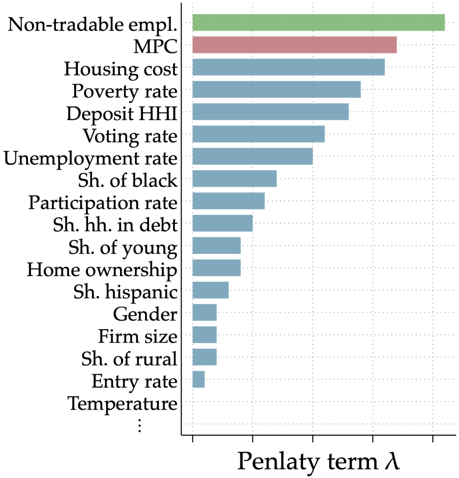
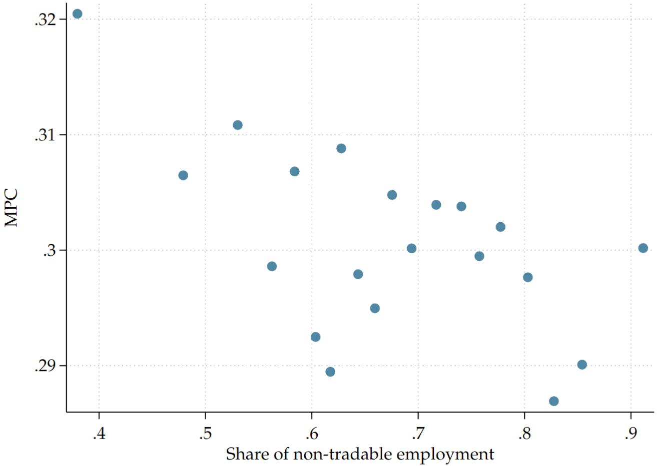
- Increase λ and plot "survival function"
- Local MPCs & non-tradable empl. important



Correlation between MPCs and ρ

▸ Back

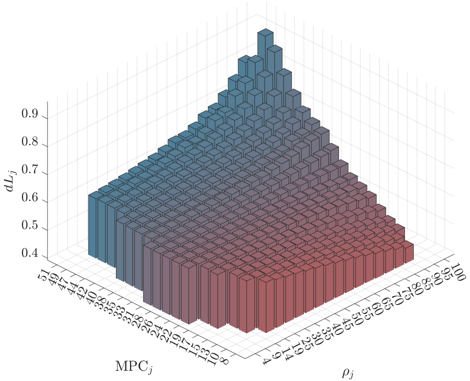


MATCHING THE REGIONAL STRUCTURE

- Calibration computationally intensive with 3000+ counties
- Draw samples of $N = 10$ representative counties from empirical distribution
- Pick the sample closest to moments of interest
- Calibrate β_j and α_j to match the $\{\widehat{MPC}_j, \widehat{\rho}_j\}_{j=1}^N$ in the model's steady state
  - Match the empirical MPC to the first entry in $\boldsymbol{M}_j$

MATCHING THE REGIONAL HETEROGENEITY IN THE RESPONSE

▸ BACK



- Plot on-impact response for 3,000 calibrated counties in the (ρ_j, MPC_j) space
  - I Response increasing in MPC
  - II Effect of MPC on the response increasing in ρ $\leftarrow$ MPC-ρ complementarity in the multiplier
  - III Response decreasing in ρ for low MPC and increasing in ρ for high MPC
    - ◇ Opposite channels: multiplier vs trade exposure

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