Inequality, Demand Composition, and the Transmission of Monetary Policy

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What We Do In This Paper

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- Document three empirical facts about the Eurozone:
  1. *Across countries and households:* Non-tradable consumption increases with income
  2. *Across countries:* Non-tradable consumption shares increase with income inequality
  3. *Monetary Policy:* Weaker effects for economies with higher non-tradable consumption
- Rationalize the empirical findings in a HANK model with non-homothetic preferences

Empirical Findings

Data

- Sample:
  - 2000-2020: Euro area countries (19) ▸ Countries
- Consumption & Income:
  - Household consumption & income (Eurostat, HBS, NSO) ▸ Sources
  - Classify consumption (COICOP) as non-tradable, tradable and housing ▸ 32 sectors
  - Non-tradable consumption share: $\omega_N = \frac{C_N}{C_N + C_T}$
- Inequality:
  - Gini index for disposable income (HFCS, Eurostat)
  - Wealth share by percentile (WID)
  - Share of HtM agents (Almgren, Gallegos, Kramer & Lima, 2022)
- Monetary Policy:
  - Shocks for 2000-2020 from Jarocinski & Karadi (2020)

Non-tradable Consumption across Households

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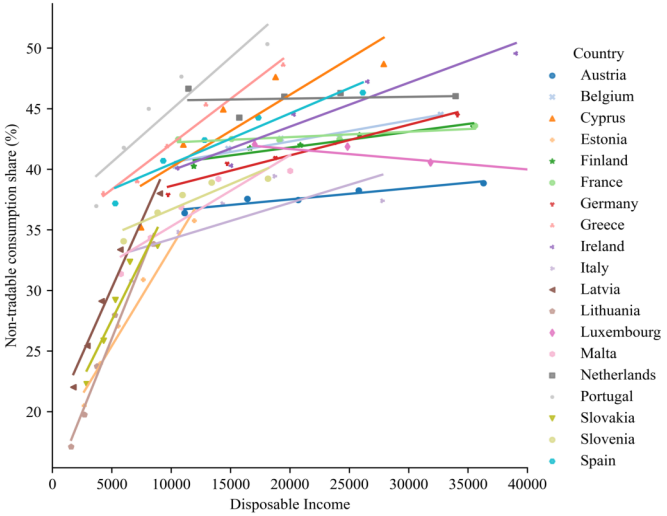

▸ Non-parametric fit ▸ Tradable share

Inequality and Consumption Baskets across Countries

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- Define:
  - n for country
  - Y_n dependent variable
  - $Gini_n$ as average 2000-2020 Gini on net income

$$Y_n = \alpha + \beta Gini_n + \gamma' X_n + \epsilon_n$$

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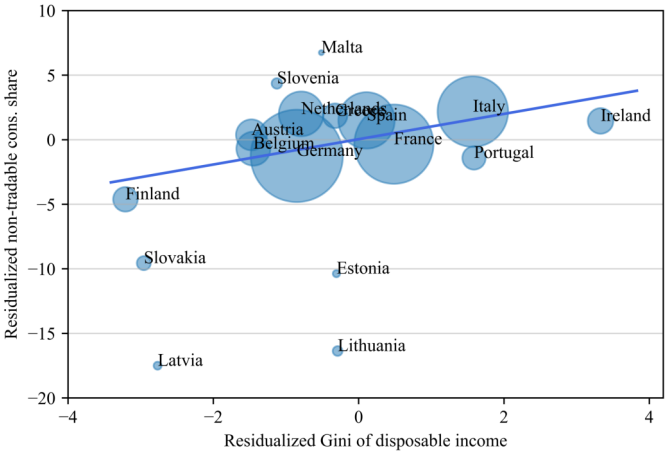
where X_n includes:

  - average 2000-2020 GDP per capita
  - average 2000-2020 old-age dependency ratio
  - average 2000-2020 size of government
  - average 2000-2020 trade balance

Regression weighted with average 2000-2020 GDP.

More Unequal Countries Have Higher Non-tradable Shares



▸ Unweighted ▸ Non-residualized

Monetary Policy and Non-tradable Consumption

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- Study the effect of monetary policy shocks using local projection
  - Control for countries' non-tradable consumption shares

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- Define:
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  - ω_n avrg. 2000-2020 non-tradable consumption share for country n
  - h for horizon in quarters $h = 0, \ldots, 12$
  - p for the number of lags $p = 3$
  - ϕ_n country fixed effects
  - i as JK (2020) monetary policy shocks

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- IRFs for group j are constructed from the sequence $\{\beta_j^h\}_{h=0}^{12}$ and $\{\gamma_j^h\}_{h=0}^{12}$ from the estimated equation

$$y_{t+h,n} - y_{t-1,n} = \alpha^h + \beta^h i_t + \gamma^h (i_t * \bar{\omega}_n) + \sum_{s=1}^{p} \Gamma_s^h y_{t-s,n} + \phi_n + u_{t+h,n}$$

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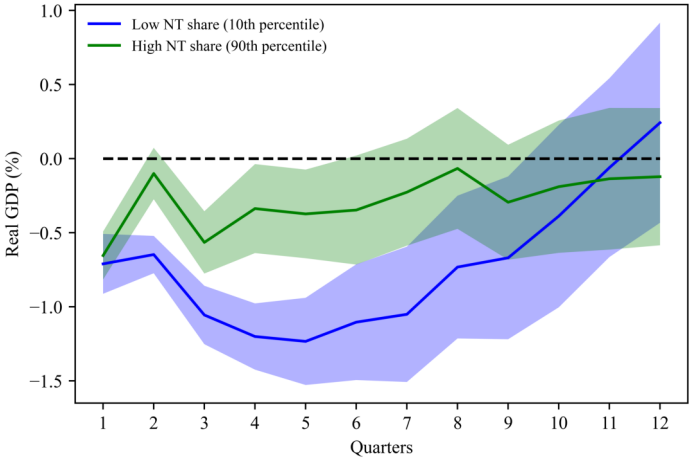

Note: IRF to a one standard deviation contractionary Monetary Policy shock.

▸ Interaction term ▸ NT output ▸ ZLB ▸ Extensions

Check point: Empirics

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- Three facts:
  1. High-income households consume more non-tradable goods
  2. Higher income inequality leads to higher aggregate non-tradable consumption share
  3. Countries with higher non-tradable consumption shares react less to the MP shock

Check point: Empirics

- Three facts:
  1. High-income households consume more non-tradable goods
  2. Higher income inequality leads to higher aggregate non-tradable consumption share
  3. Countries with higher non-tradable consumption shares react less to the MP shock

- Fact 3 is at odds with standard HANK models
  - Introduce non-homotheticity (Facts 1+2) to rationalize Fact 3

- Today: Simple model + mechanism
  - Full quantitative model in the paper

The Model

Environment

- Small open economy in a monetary union, $P_t^T = 1$
- Two households: (R)icardian and Hand-to-Mouth (H)
- Two goods: Tradable (T) and Non-tradable (N)
  - Tradable price rigidity < Non-tradable price rigidity
- Perfect labor mobility across sectors

Households

- Indirect utility function (Boppart (2014))

$$E_0 \sum_{t=0}^{\infty} \beta^t \left(\frac{1}{\varepsilon} \left[\left(\frac{e_{j,t}}{P_t^N} \right)^{\varepsilon} - 1 \right] - \frac{\nu}{\gamma} \left[\left(\frac{P_t^T}{P_t^N} \right)^{\gamma} - 1 \right] \right)$$

  where
  - $e_{j,t}$ is the nominal expenditure
  - P_t^N is the price of Non-tradable good (Luxury good)
  - P_t^T is the price of Tradable good

- Inelastic labor supply

Household Budget Constraint

- Budget constraint:

$$\begin{aligned} e_{j,t} &= P_t^T c_{j,t}^T + P_t^N c_{j,t}^N \\ &= W_{j,t} l_{j,t} + \Pi_{j,t} + \mathbb{1}_R(P_t^T R_{t-1} B_{j,t} + R_{t-1}^n B_{j,t}^n) - \mathbb{1}_R(P_t^T B_{j,t+1} + B_{j,t+1}^n) \end{aligned}$$

- We engineer the model so that: Detail
  - Ricardian household gets $\kappa\%$ of total output $(P_t^T Y_t^T + P_t^N Y_t^N)$
  - Hand-to-mouth household gets $(1-\kappa)\%$ of total output $(P_t^T Y_t^T + P_t^N Y_t^N)$

First-Order Conditions

$$c_{j,t}^N = \frac{\left(1 - \nu\varpi(P_t^N, P_t^T, e_{j,t})\right)}{\nu\varpi(P_t^N, P_t^T, e_{j,t})} \frac{P_t^T c_{j,t}^T}{P_t^N} \qquad \text{(NT Demand)}$$

$$\varpi(P_t^N, P_t^T, e_{j,t}) \equiv \left(\frac{P_t^N}{e_{j,t}}\right)^{\varepsilon} \left(\frac{P_t^T}{P_t^N}\right)^{\gamma} \qquad \text{(Expenditure shares)}$$

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$$\left(\frac{e_{R,t+1}}{e_{R,t}}\right)^{1-\varepsilon} = \beta R_t^n \left(\frac{P_t^N}{P_{t+1}^N}\right)^{\varepsilon} \qquad \text{(Euler equation)}$$

$$R_t^n = R_t \frac{P_{t+1}^T}{P_t^T} \qquad \text{(No arbitrage condition)}$$

Production

- Firms compete under perfect competition
- Production function:

$$Y_t^h = (L_t^h)^{\alpha_h} \quad h = \{T, NT\}$$

- Profits:

$$P_t^h Y_t^h - W_t L_t^h \quad h = \{T, NT\}$$

- Labor demand:

$$W_t^h = \alpha^h P_t^h Y_t^h$$

Monetary Policy and Equilibrium

- Monetary union, fixed exchange rate, $P_t^T = 1$
- Non-tradable and tradable good markets clear

$$c_{HtM,t}^N + c_{R,t}^N = Y_t^N, \qquad c_{HtM,t}^T + c_{R,t}^T = Y_t^T - B_{R,t} + B_{R,t-1} R_{t-1}$$

- Central bank supply zero bonds

$$B_t^N = 0$$

- Labor market clears:

$$L_{HtM,t}^T + L_{HtM,t}^{NT} = L_{HtM,t} \quad , \quad L_{R,t}^T + L_{R,t}^{NT} = L_{R,t}$$

Income Inequality and Non-tradable Consumption Shares

- We want to statically match:
  - Fact 1: High-income households consume more non-tradable goods
  - Fact 2: Higher income inequality leads to high non-tradable consumption shares

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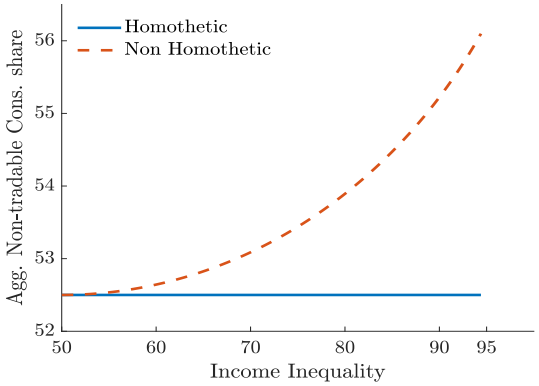

Monetary Policy and Non-tradable Consumption Shares

- We want to dynamically match:
  - Fact 3: Countries with high non-tradable consumption shares react less to the monetary policy shock.

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- Define period 1 as short run and period 2+ as long run.

- In period 1:
  - R_1 increases (monetary policy shock)
  - Non-tradable prices cannot adjust (extreme nominal rigidity)
  - Unemployment in the non-tradable sector

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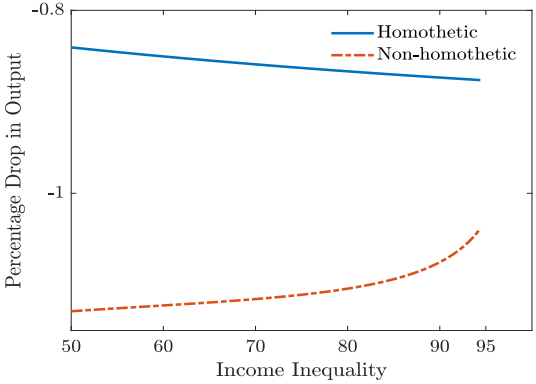

Two-sector TANK

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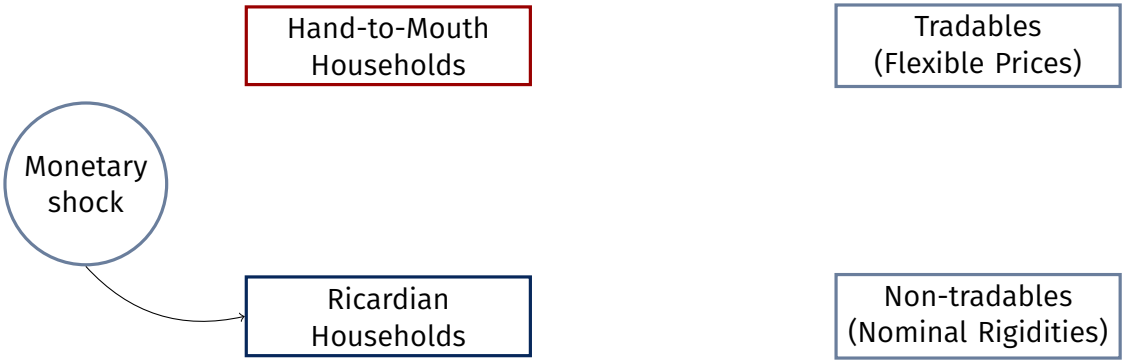

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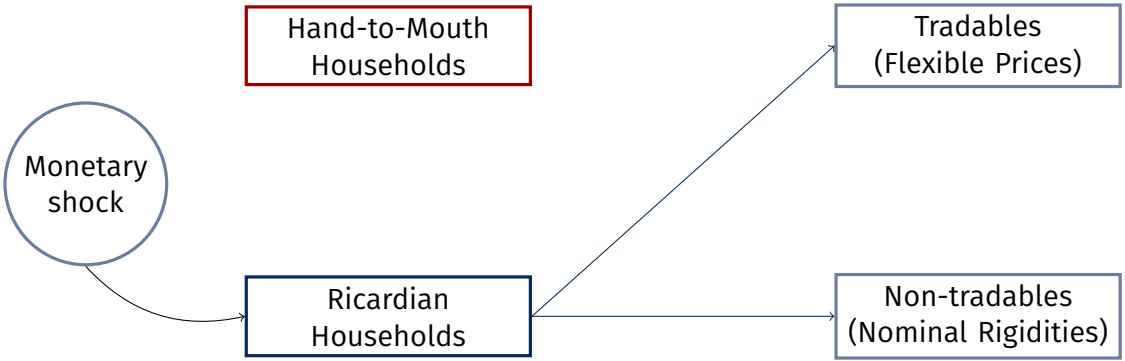

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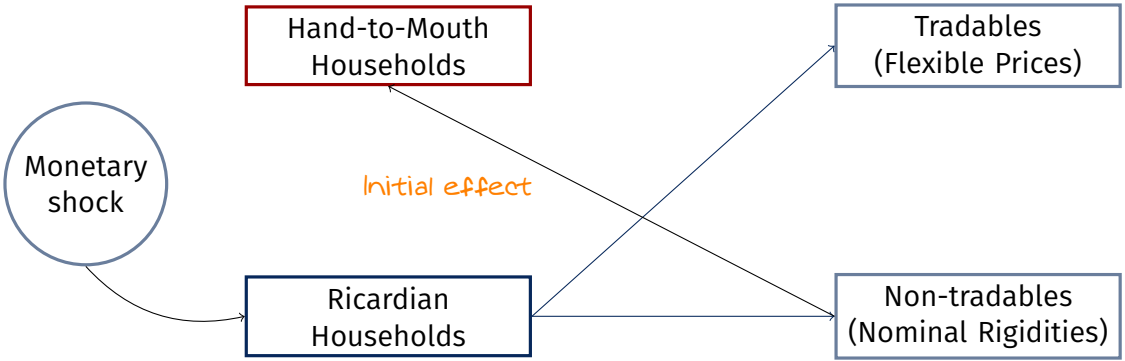
- Monetary Policy affects Hand-to-Mouth households in two ways:
  - Initial effect: Lower income from non-tradable sector



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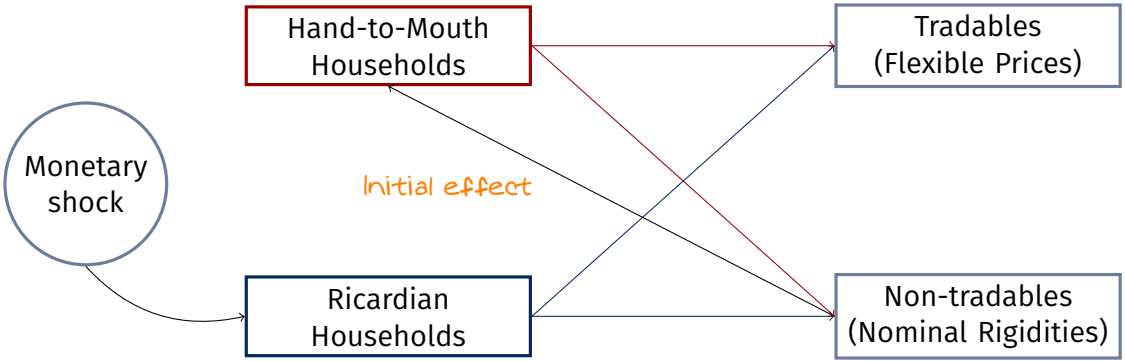

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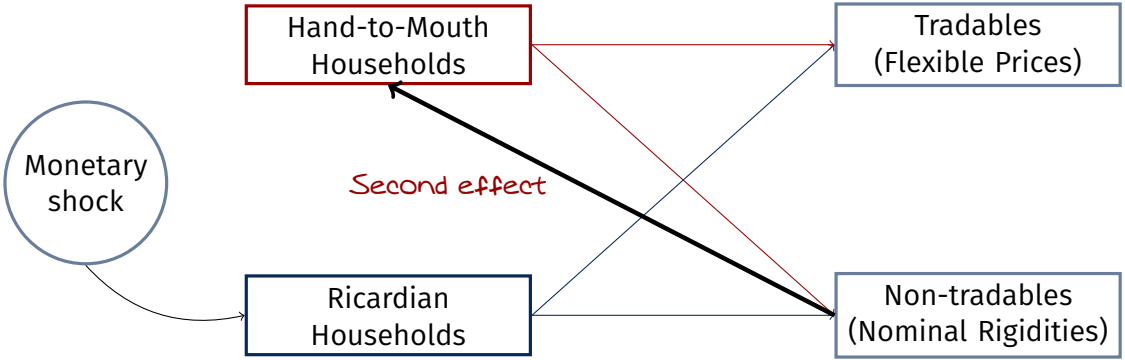

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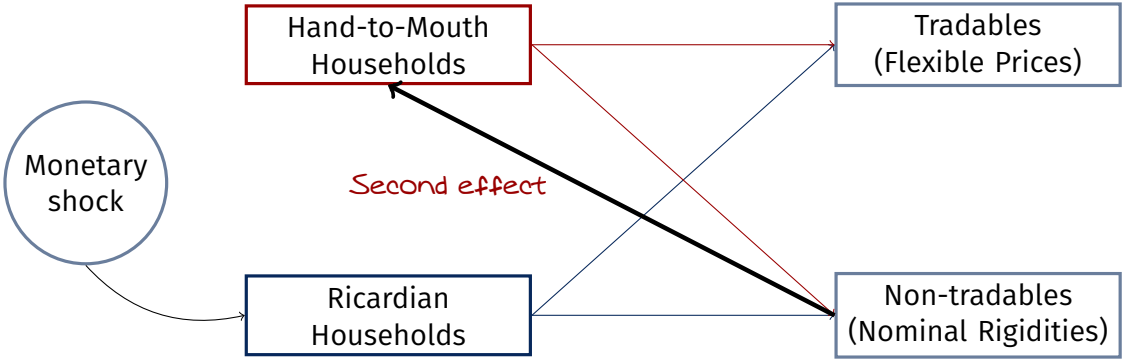
  - **Aggregate effect:** Increasing in the non-tradable sector size



Two-sector TANK with Non-homothetic Preferences

- Monetary Policy changes with income inequality:
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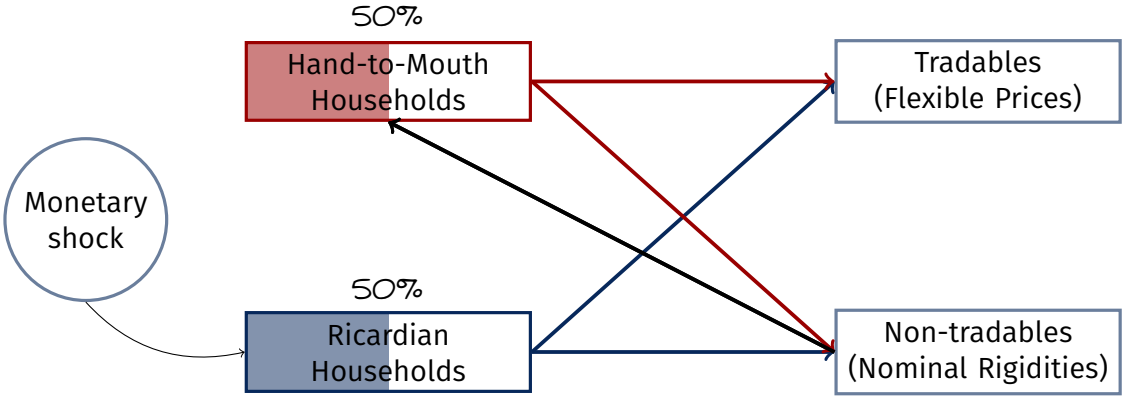

Two-sector TANK with Non-homothetic Preferences

- Monetary Policy changes with income inequality:
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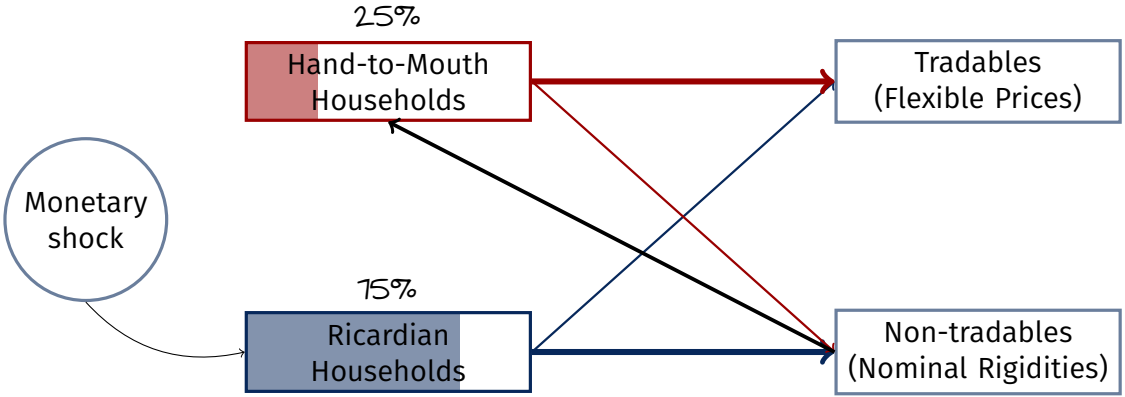
  - Income inequality: Larger initial effect, smaller second effect



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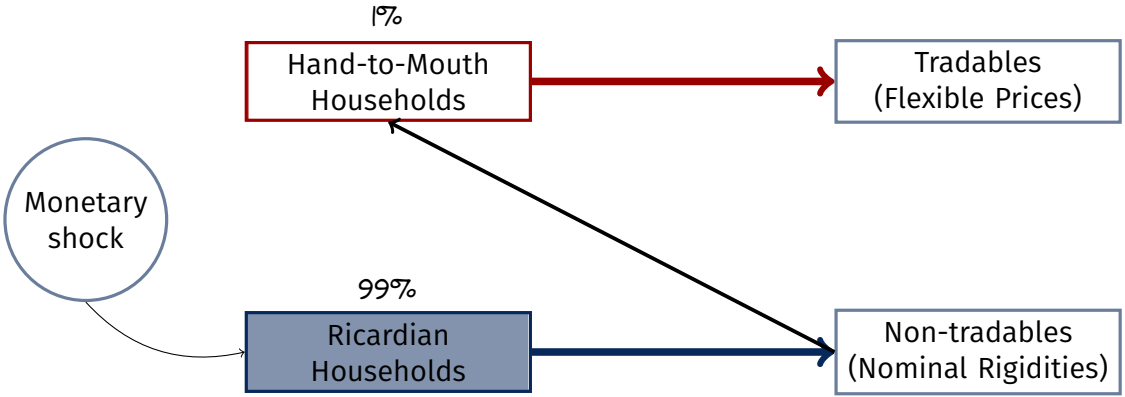

Two-sector TANK with Non-homothetic Preferences

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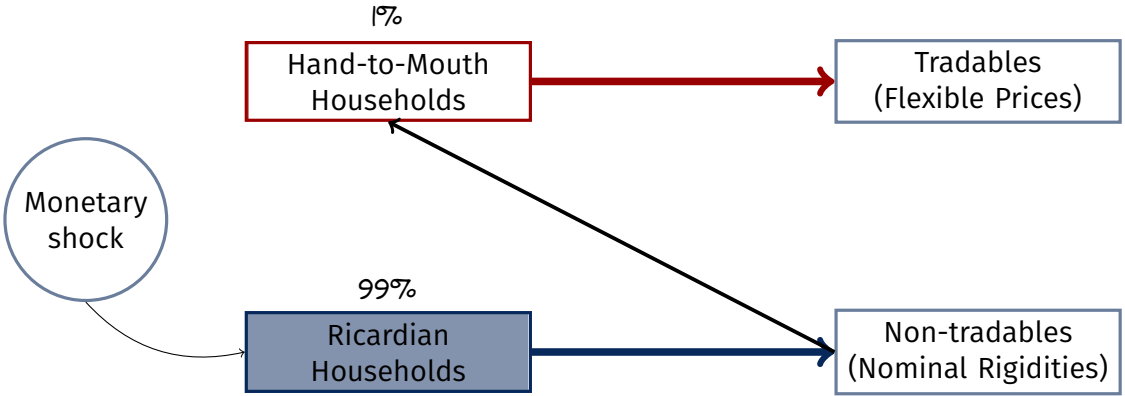
  - Income inequality: Larger initial effect, smaller second effect
  - **Aggregate effect:** Decreasing in the non-tradable sector size



Conclusion

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- Document three empirical facts:
  1. *Across countries and households:* High-income households consume more non-tradable good
  2. *Across countries:* Higher income inequality leads to high non-tradable consumption share
  3. *Monetary Policy:* Weaker effects for economies with higher non-tradable consumption
     - At odds with standard HANK models
- Rationalize the empirical findings in a HANK model with non-homothetic preferences

Thank you very much!

Appendix

Data sources

- Consumption by sector per household (Eurostat, Household Budget survey, National Statistical Offices)
- Income per household by quintile (Eurostat)
- Gini index for disposable income (Eurostat)
- Wealth share by percentile (WID)
- HtM share by country from Almgren, Gallegos, Kramer & Lima, 2022
- Shocks from 2000-2020 from Jarocinski & Karadi (2020)

Return

Classification of sectors

Non-tradables	Tradables	Housing
Education	Alcoholic beverages, tobacco and narcotics	Actual rentals for housing
Good and services for routine household maintenance	Audio-visual, photographic and information processing equipment	Imputed rentals for housing
Hospital services	Clothing and footwear	Maintenance and repair of the dwelling
Miscellaneous goods and services	Electricity, gas and other fuels	Water supply and miscellaneous services
Operation of personal transport equipment	Food and non-alcoholic beverages	
Out-patient services	Furniture and furnishings, carpets and other floor coverings	
Postal services	Glassware, tableware and household utensils	
Recreational and cultural services	Household appliances	
Restaurants and hotels	Household textiles	
Telephone and telefax services	Medical products, appliances and equipment	
Transport services	Newspapers, books and stationery	
	Other major durables for recreation and culture	
	Other recreational items and equipment, gardens and pets	
	Package holidays	
	Purchase of vehicles	
	Telephone and telefax equipment	
	Tools and equipment for house and garden	

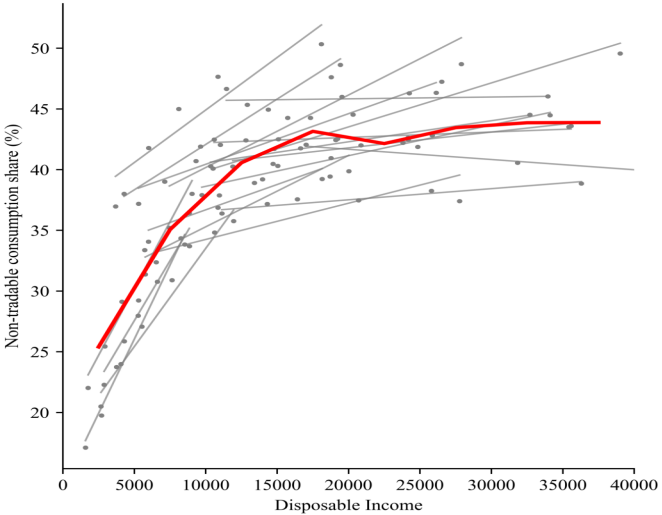
Return

Countries sorted by their Average Non-tradable share

Country	Non-tradable share (%)	Country	Non-tradable share (%)
Lithuania	35	Luxembourg	49
Slovakia	38	Portugal	50
Estonia	38	Netherlands	51
Latvia	40	Austria	51
Slovenia	44	Malta	52
Finland	45	Ireland	53
Germany	45	Greece	54
Belgium	48	Spain	55
Italy	48	Cyprus	57
France	48		

Return

How does consumption change with income?



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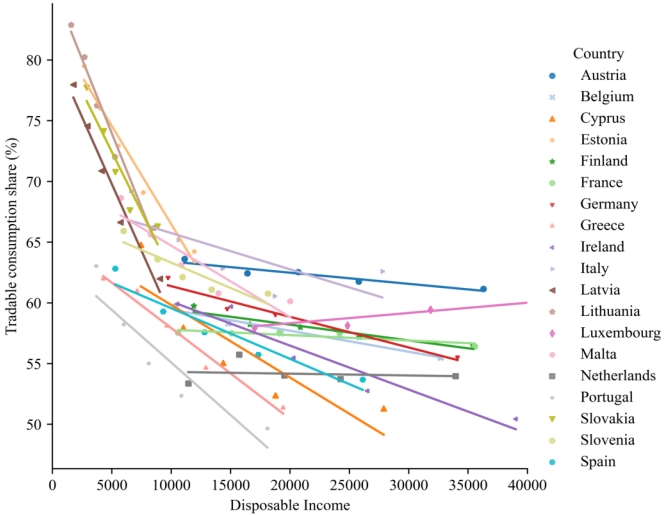
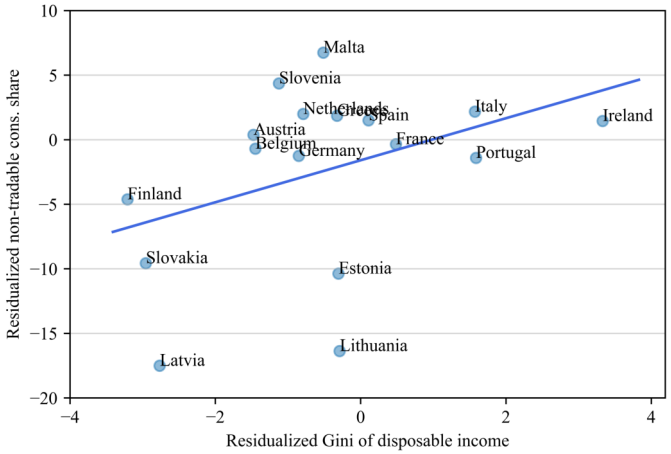


Inequality and the consumption basket



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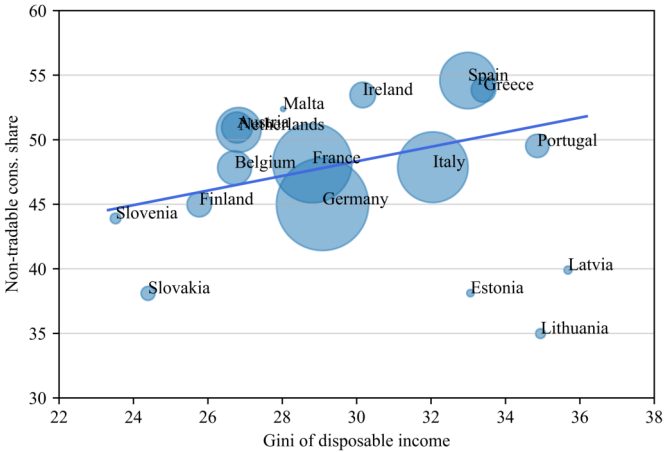

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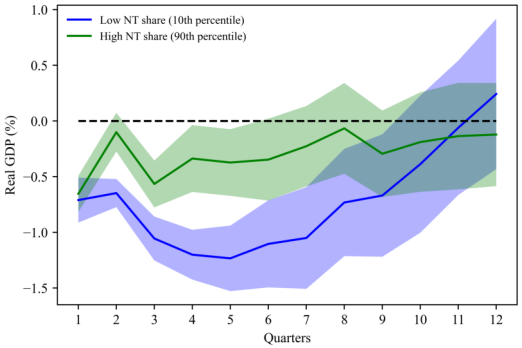
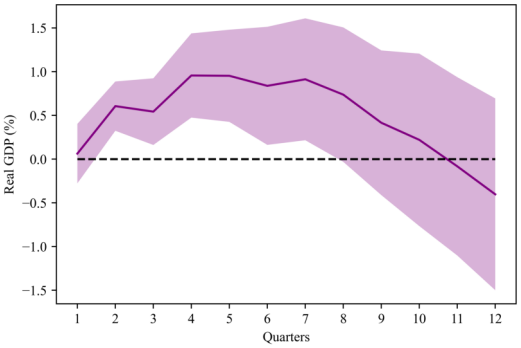
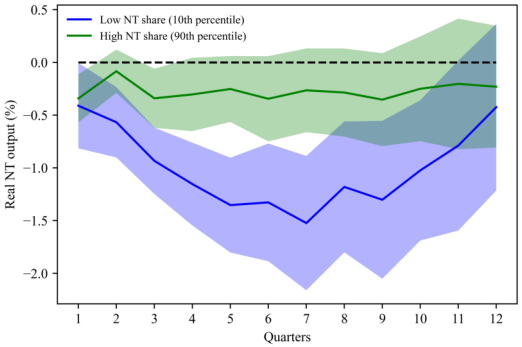
Does the national consumption basket matter for Monetary Policy?

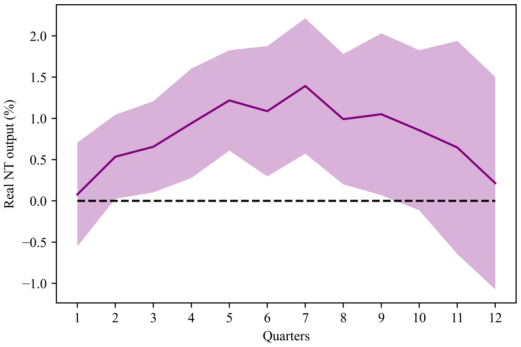




Return

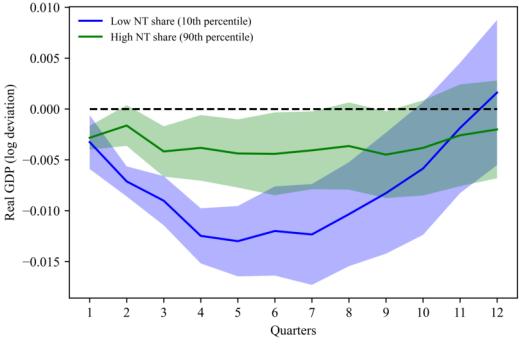
Non-tradable output response

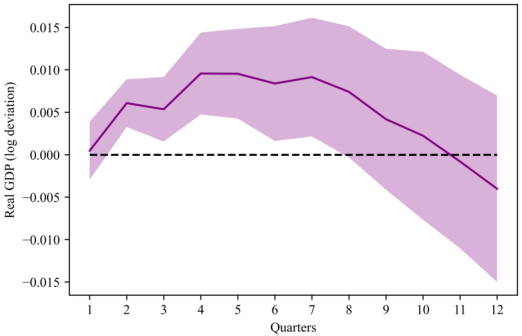




Return

Output response when controlling for the ZLB





Return

Local Projection extensions

- Controlling for HtM share
- Controlling for Gini
- Controlling for wealth inequality
- Return

GDP response when controlling for Gini

$$y_{t+h,n} - y_{t-1,n} = \alpha + \beta^h i_t + \gamma^h (i_t * \bar{\omega}_n) + \lambda^h (i_t * \bar{Gini}_c) + \sum_{s=1}^{p} \Gamma_s^h y_{t-s,n} + \phi_n + u_{t+h,n} \quad (1)$$

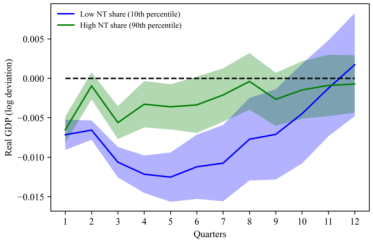


Figure NT share

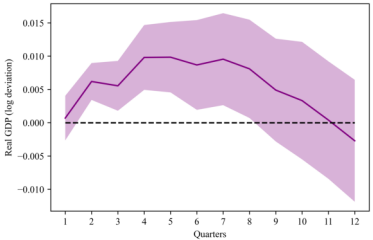


Figure Gamma Difference

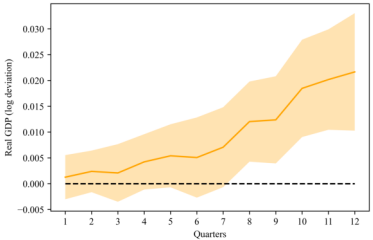
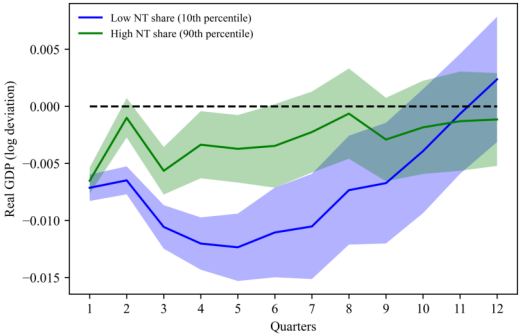


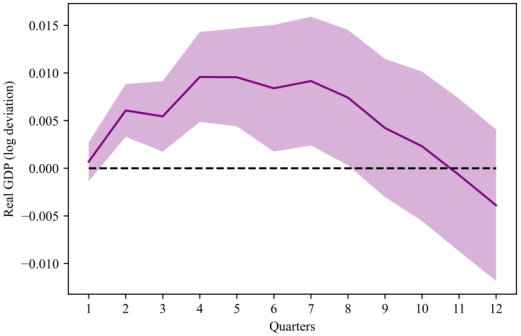
Figure Lambda Difference

Notes: The IRF shows the response controlling for average net income inequality.

▸ Return

GDP response when controlling for wealth inequality





Notes: The IRF shows the response controlling for the average wealth share of the top 10 percent.

▸ Return

GDP response when controlling for HtM share

$$y_{t+h,n} - y_{t-1,n} = \alpha + \beta^h i_t + \gamma^h (i_t * \bar{\omega}_n) + \lambda^h (i_t * H\bar{t}M_c) + \sum_{s=1}^{p} \Gamma_s^h y_{t-s,n} + \phi_n + u_{t+h,n} \quad (2)$$

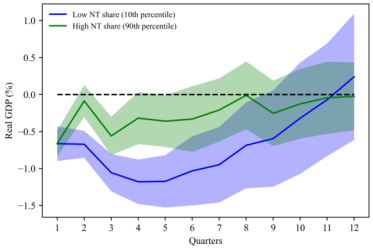


Figure NT share

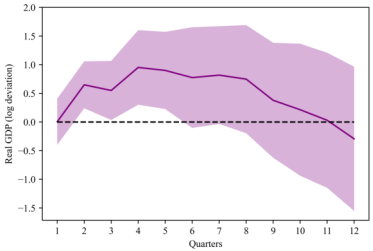


Figure Gamma Difference

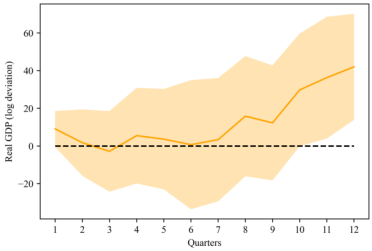


Figure Lambda Difference

Notes: The IRF shows the response controlling for the share of HtM agents.

▸ Return

Production continued

- Optimal condition:

$$W_t^R l_{R,t} = \alpha_h \kappa P_t^h Y_t^h \qquad W_t^{HtM} l_{HtM,t} = \alpha_h (1-\kappa) P_t^h Y_t^h$$

- κ profits goes to R and $(1-\kappa)$ to HtM
- Hence κ shapes the income inequality since:
  - Ricardian household gets $\kappa(P_t^T Y_t^T + P_t^N Y_t^N)$
  - Hand-to-mouth household gets $(1-\kappa)(P_t^T Y_t^T + P_t^N Y_t^N)$

Return