

Inequality, Demand Composition, and the Transmission of Monetary Policy

Lukas Boehnert ¹ Sergio de Ferra ¹ Kurt Mitman ² Federica Romei ¹

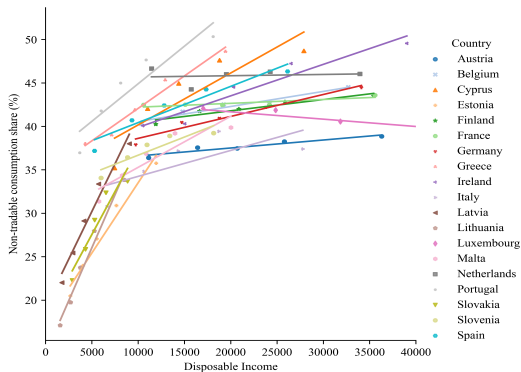
¹University of Oxford

²CEMFI

13th Research Workshop - Banco de España-CEMFI ,
7 November 2023

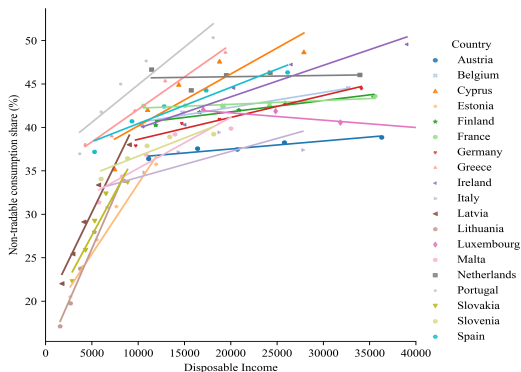
Introduction

- ▶ Across-countries and within-countries, inequality affects composition of demand



Introduction

- ▶ Across-countries and within-countries, inequality affects composition of demand



- ▶ We ask: does the composition of demand change the effect of monetary policy across countries?

Demand composition and the transmission of monetary policy

- ▶ Document that demand composition affects transmission of monetary policy.

Demand composition and the transmission of monetary policy

- ▶ Document that demand composition affects transmission of monetary policy.
- ▶ Countries with **high** non-tradable consumption expenditure react by **less** to a monetary policy shock.

Demand composition and the transmission of monetary policy

- ▶ Document that demand composition affects transmission of monetary policy.
- ▶ Countries with **high** non-tradable consumption expenditure react by **less** to a monetary policy shock.
- ▶ Surprising results!
 - * Non-tradable sector is more subject to nominal rigidity
 - * Greater exposure of output to local demand when non-tradable share is high

Non-homotheticity, heterogeneity, and market incompleteness

Key model elements to explain the results:

- ▶ non-homothetic preferences
- ▶ household heterogeneity
- ▶ market incompleteness

1%

Hand-to-Mouth
Households

Tradables
(Flexible Prices)

99%

Ricardian
Households

Non-tradables
(Nominal Rigidities)

Non-homotheticity, heterogeneity, and market incompleteness

Key model elements to explain the results:

- ▶ non-homothetic preferences
- ▶ household heterogeneity
- ▶ market incompleteness

1%

Hand-to-Mouth
Households

Tradables
(Flexible Prices)

Monetary
shock

99%

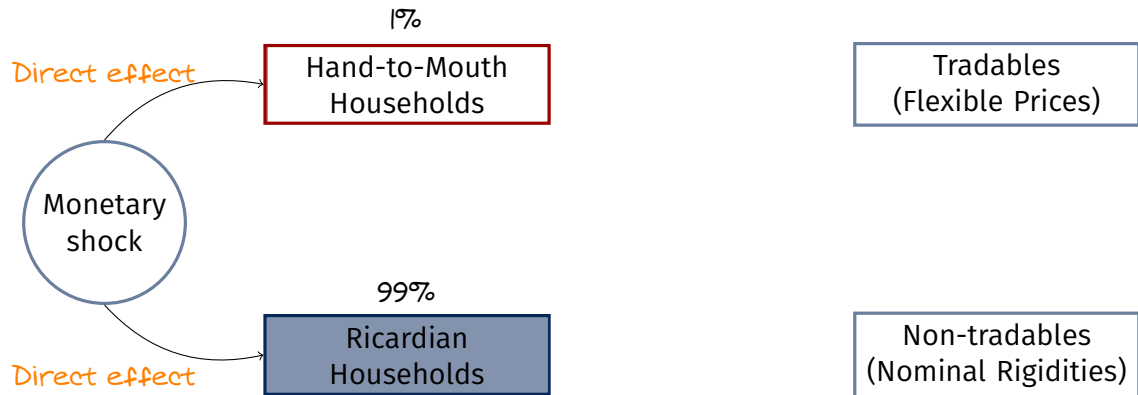
Ricardian
Households

Non-tradables
(Nominal Rigidities)

Non-homotheticity, heterogeneity, and market incompleteness

Key model elements to explain the results:

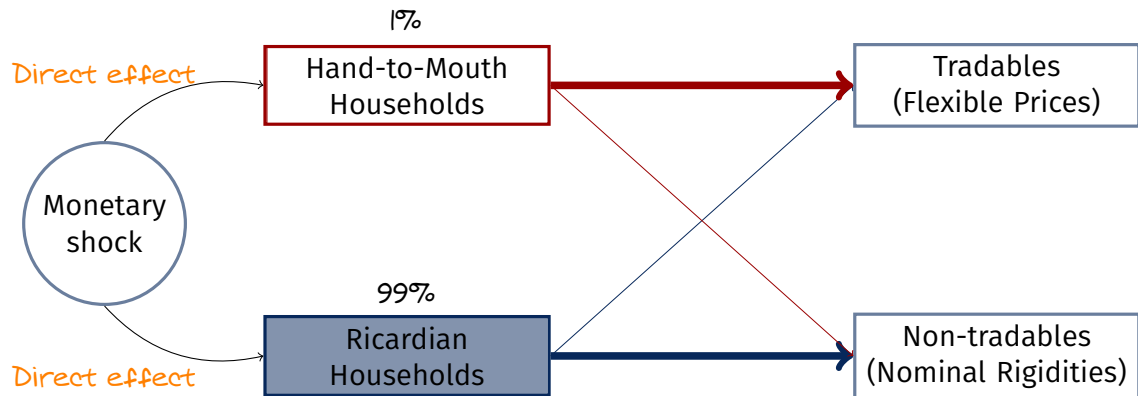
- ▶ non-homothetic preferences
- ▶ household heterogeneity
- ▶ market incompleteness



Non-homotheticity, heterogeneity, and market incompleteness

Key model elements to explain the results:

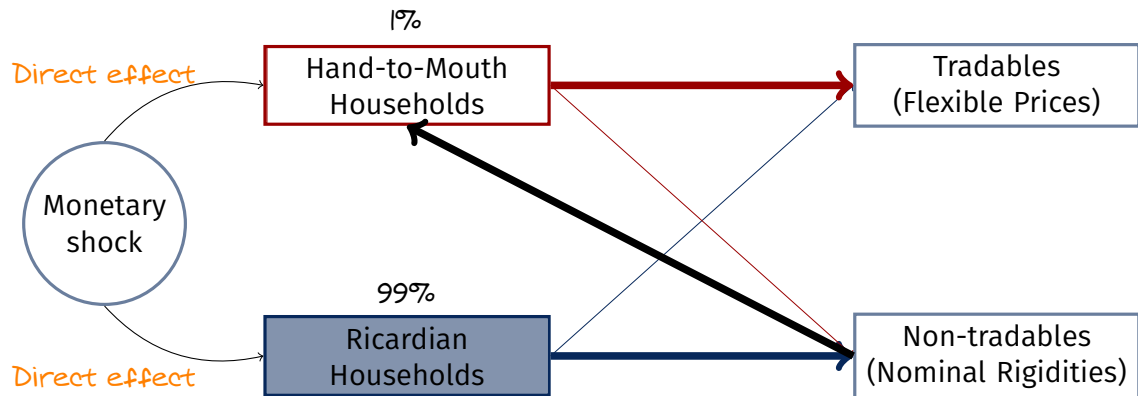
- ▶ non-homothetic preferences
- ▶ household heterogeneity
- ▶ market incompleteness



Non-homotheticity, heterogeneity, and market incompleteness

Key model elements to explain the results:

- ▶ non-homothetic preferences
- ▶ household heterogeneity
- ▶ market incompleteness



Empirical Findings

▶ Sample:

- * 2000-2020: Euro area countries (19) ▶ Countries

▶ Consumption and Income:

- * Household consumption and income (Eurostat, HBS, NSO) ▶ Sources
- * Income per household quintile (Eurostat)
- * Classify consumption (COICOP) as non-tradable, tradable and housing ▶ 32 sectors
- * Non-tradable expenditure share: $\omega_{NT} = \frac{e_{NT}}{e_{NT} + e_T}$

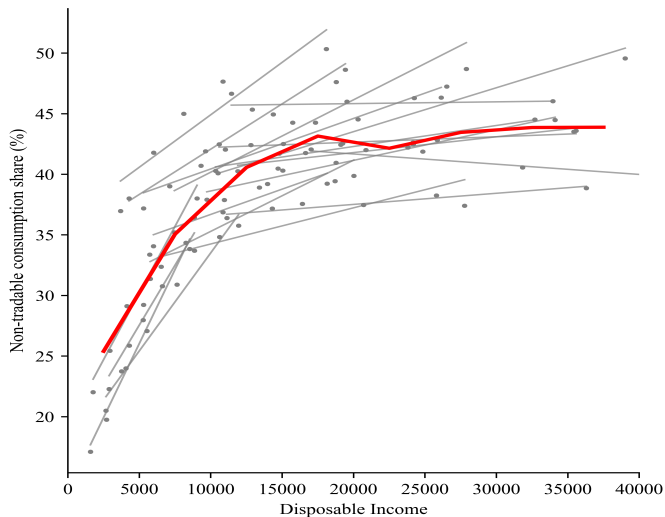
▶ Inequality:

- * Gini index for disposable income (HFCS, Eurostat)
- * Wealth share by percentile (WID)

▶ Monetary Policy:

- * Shocks for 2000-2020 from Jarocinski & Karadi (2020)

Non-tradable Consumption across Households



▶ Non-parametric fit ▶ Tradable share

Inequality and Consumption Baskets across Countries

► Define:

- * n for country
- * Y_n dependent variable, non-tradable expenditure share
- * $Gini_j$ as average 2000-2020 Gini on net income

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

Inequality and Consumption Baskets across Countries

► Define:

- * n for country
- * Y_n dependent variable, non-tradable expenditure share
- * $Gini_j$ as average 2000-2020 Gini on net income

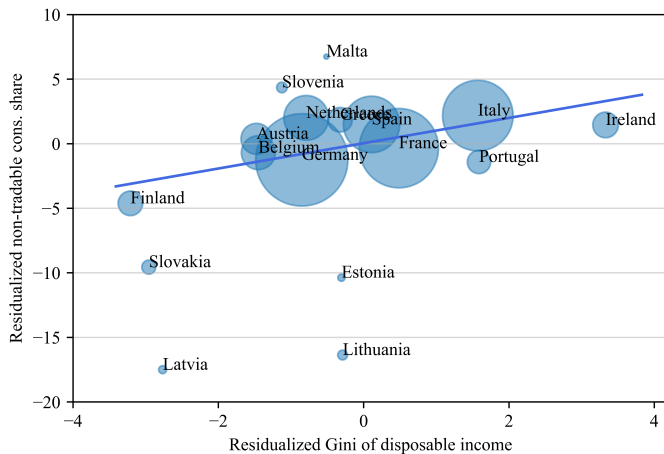
$$Y_n = \alpha + \beta Gini_n + \gamma' X_n + \epsilon_n$$

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

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

Monetary Policy and Non-tradable Consumption

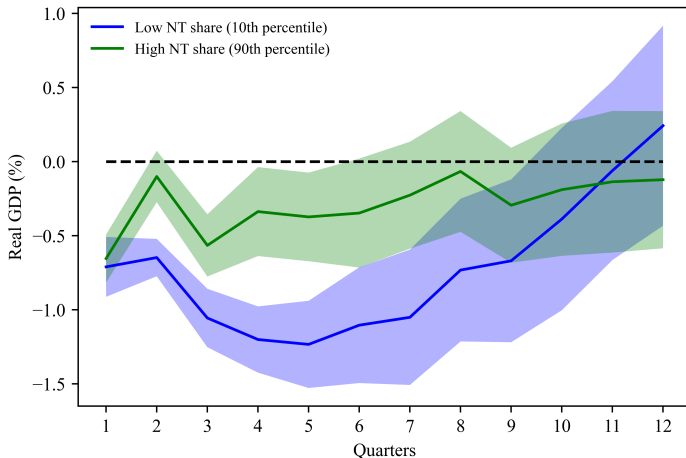
- ▶ Study the effect of monetary policy shocks using local projection
 - * Control for countries' non-tradable consumption shares
- ▶ Define:
 - * y dependent variable
 - * ω_n avrg. 2000-2020 non-tradable consumption share for country n
 - * h for horizon in quarters $h = 0, \dots, 12$
 - * p for the number of lags $p = 3$
 - * ϕ_n country fixed effects
 - * i as JK (2020) monetary policy shocks

Monetary Policy and Non-tradable Consumption

- ▶ Study the effect of monetary policy shocks using local projection
 - * Control for countries' non-tradable consumption shares
- ▶ Define:
 - * y dependent variable
 - * ω_n avrg. 2000-2020 non-tradable consumption share for country n
 - * h for horizon in quarters $h = 0, \dots, 12$
 - * p for the number of lags $p = 3$
 - * ϕ_n country fixed effects
 - * i as JK (2020) monetary policy shocks
- ▶ IRFs are constructed from the sequence $\{\beta_j^h\}_{h=0}^{12}$ and $\{\gamma_j^h\}_{h=0}^{12}$ from the estimated equation

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

Monetary Policy and Non-tradable Consumption



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

▸ Interaction term ▸ NT output ▸ ZLB ▸ Extensions

The Model

Environment

- ▶ Small open economy in a monetary union, $P_t^T = 1$
- ▶ Two households: (R)icardian and Hand-to-mouth (*HtM*)
- ▶ Two goods: Tradable (*T*) and Non-tradable (*N*)
- ▶ Perfect labor mobility across sectors

Households

- ▶ Non-homothetic preferences are described by Boppart (2014) indirect utility function

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

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
- ▶ Budget constraint:

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

- ▶ Inelastic labor supply

Non-homotheticity and Demand for Non-tradables

$$c_{j,t}^N = \frac{(1 - \nu \varpi(p_t^N, p_t^T, e_{j,t})) p_t^T c_{j,t}^T}{\nu \varpi(p_t^N, p_t^T, e_{j,t}) p_t^N} \quad (\text{NT Demand})$$

$$\varpi(p_t^N, p_t^T, e_{j,t}) \equiv \left(\frac{p_t^N}{e_{j,t}} \right)^\varepsilon \left(\frac{p_t^T}{p_t^N} \right)^\gamma \quad (\text{T expenditure share wedge})$$

Non-homotheticity and Demand for Non-tradables

$$c_{j,t}^N = \frac{(1 - \nu \varpi(p_t^N, p_t^T, e_{j,t})) p_t^T c_{j,t}^T}{\nu \varpi(p_t^N, p_t^T, e_{j,t}) p_t^N} \quad (\text{NT Demand})$$

$$\varpi(p_t^N, p_t^T, e_{j,t}) \equiv \left(\frac{p_t^N}{e_{j,t}} \right)^\varepsilon \left(\frac{p_t^T}{p_t^N} \right)^\gamma \quad (\text{T expenditure share wedge})$$

Non-homotheticity and Demand for Non-tradables

$$c_{j,t}^N = \frac{(1 - \nu \varpi(p_t^N, p_t^T, e_{j,t}))}{\nu \varpi(p_t^N, p_t^T, e_{j,t})} \frac{p_t^T c_{j,t}^T}{p_t^N} \quad (\text{NT Demand})$$

$$\varpi(p_t^N, p_t^T, e_{j,t}) \equiv \left(\frac{p_t^N}{e_{j,t}} \right)^\epsilon \left(\frac{p_t^T}{p_t^N} \right)^\gamma \quad (\text{T expenditure share wedge})$$

→ If $\epsilon = \gamma = 0$, then $c_{j,t}^N = (1 - \nu) / \nu \frac{p_t^T c_{j,t}^T}{p_t^N}$.

Non-homotheticity and Demand for Non-tradables

$$c_{j,t}^N = \frac{(1 - \nu \varpi(p_t^N, p_t^T, e_{j,t}))}{\nu \varpi(p_t^N, p_t^T, e_{j,t})} \frac{p_t^T c_{j,t}^T}{p_t^N} \quad (\text{NT Demand})$$

$$\varpi(p_t^N, p_t^T, e_{j,t}) \equiv \left(\frac{p_t^N}{e_{j,t}} \right)^\varepsilon \left(\frac{p_t^T}{p_t^N} \right)^\gamma \quad (\text{T expenditure share wedge})$$

→ If $\varepsilon = \gamma = 0$, then $c_{j,t}^N = (1 - \nu) / \nu \frac{p_t^T c_{j,t}^T}{p_t^N}$.

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

$$R_t^n = R_t \frac{p_{t+1}^T}{p_t^T} \quad (\text{No arbitrage condition})$$

Production

- ▶ Firms compete under perfect competition

- ▶ Production function:

$$Y_t^s = (L_t^s)^{\alpha_s} \quad s = \{T, NT\}$$

where

$$L_t^s \equiv (L_{HtM,t}^s)^{1-K} (L_{R,t}^s)^K \quad s = \{T, NT\}$$

- ▶ Profits:

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

Production

- ▶ Labor demand:

$$W_t^R l_{R,t} = \alpha_s \kappa P_t^S Y_t^S \quad W_t^{HtM} l_{HtM,t} = \alpha_s (1 - \kappa) P_t^S Y_t^S$$

- ▶ κ share of profits goes to R and $(1 - \kappa)$ to HtM

- ▶ Hence κ shapes income inequality since:

- * Ricardian household gets $\kappa(P_t^T Y_t^T + P_t^N Y_t^N)$
- * Hand-to-mouth household gets $(1 - \kappa)(P_t^T Y_t^T + P_t^N Y_t^N)$

Monetary policy and equilibrium

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

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

- ▶ Central bank supplies zero bonds

$$B_t^N = 0$$

- ▶ Labor market clears:

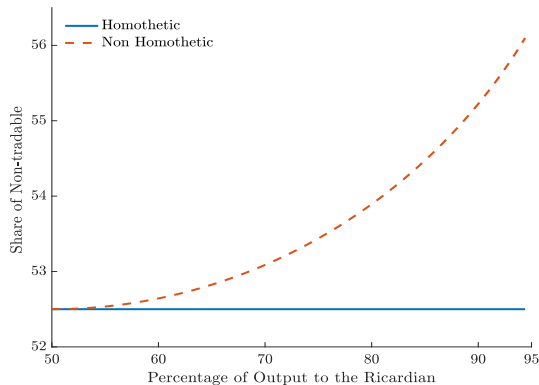
$$L_{HtM,t}^T + L_{HtM,t}^{NT} = L_{HtM,t} \quad L_{R,t}^T + L_{R,t}^{NT} = L_{R,t}$$

Income inequality and non tradable consumption share

► We want to match:

- * Fact 1: High-income households consume more non-tradable good
- * Fact 2: Higher income inequality leads to high non-tradable consumption share

Income inequality and non tradable consumption share



► We want to match:

- * Fact 1: High-income households consume more non-tradable good ✓
- * Fact 2: Higher income inequality leads to high non-tradable consumption share ✓

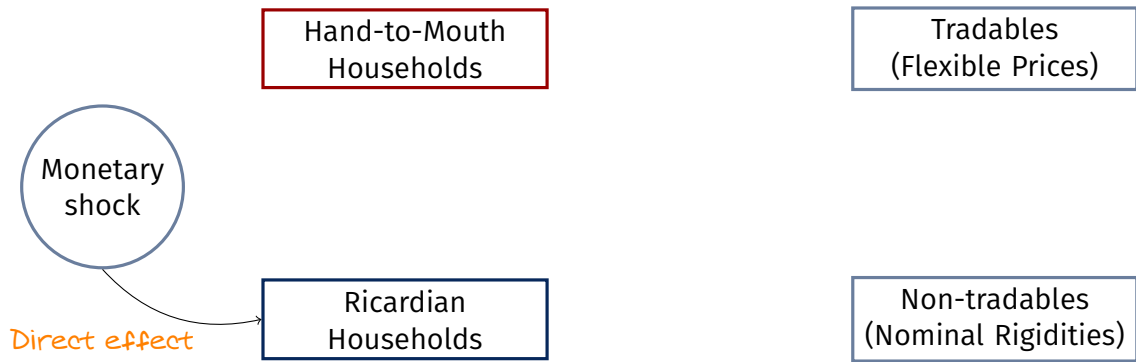
Monetary Policy Shock

Fact 3: Countries with high non-tradable expenditure share react by less to monetary policy shocks

- ▶ We define period 1 as short run and period 2 onwards as long run.
- ▶ In period 1, R_1 increases (monetary policy shock)
- ▶ In period 1 price of non-tradable cannot adjust (extreme nominal rigidity)
- ▶ In period 1, unemployment in the non-tradable sector

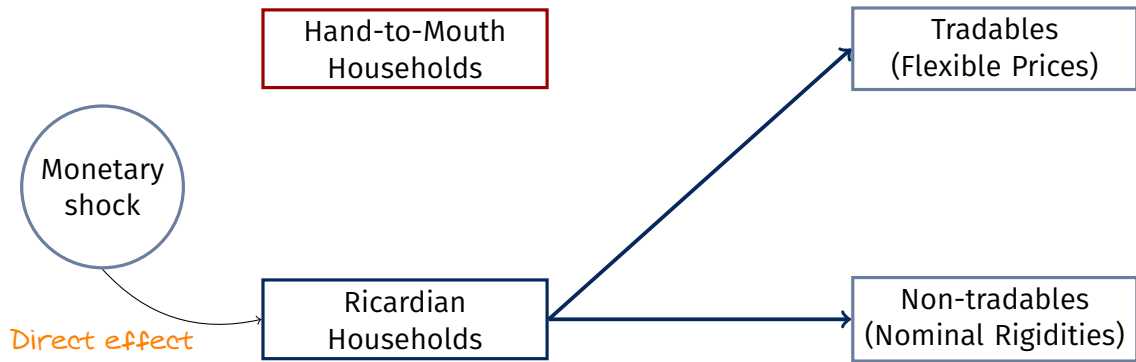
Two-sector TANK

- ▶ Monetary Policy affects Hand-to-Mouth households in two ways:
 - * **Direct effect**: Ricardian consume less because of higher interest rate



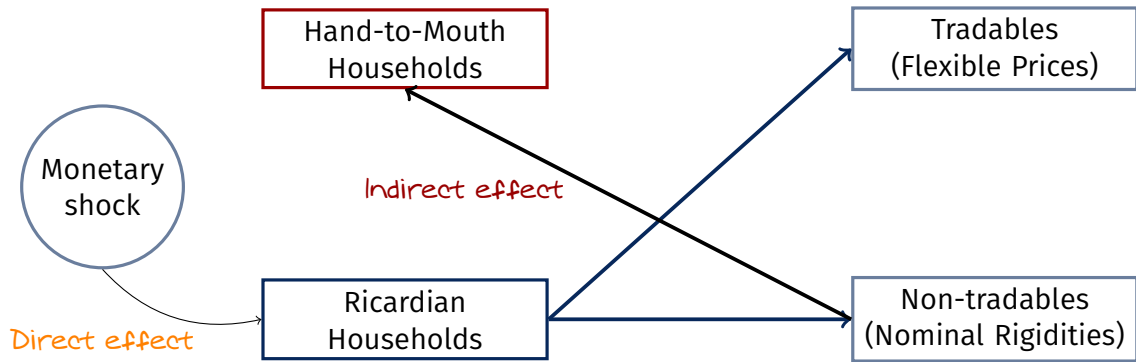
Two-sector TANK

- ▶ Monetary Policy affects Hand-to-Mouth households in two ways:
 - * **Direct effect**: Ricardian consume less because of higher interest rate



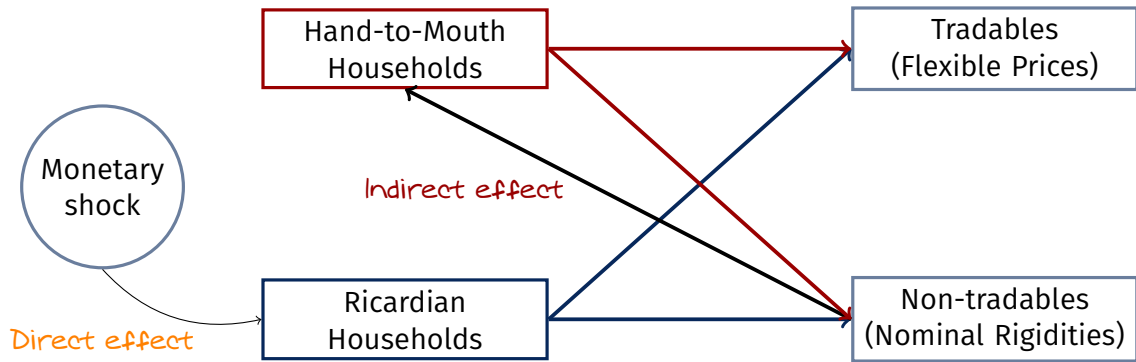
Two-sector TANK

- ▶ Monetary Policy affects Hand-to-Mouth households in two ways:
 - * **Direct effect:** Ricardian consume less because of higher interest rate
 - * **Indirect effect:** Lower demand for non-tradable good



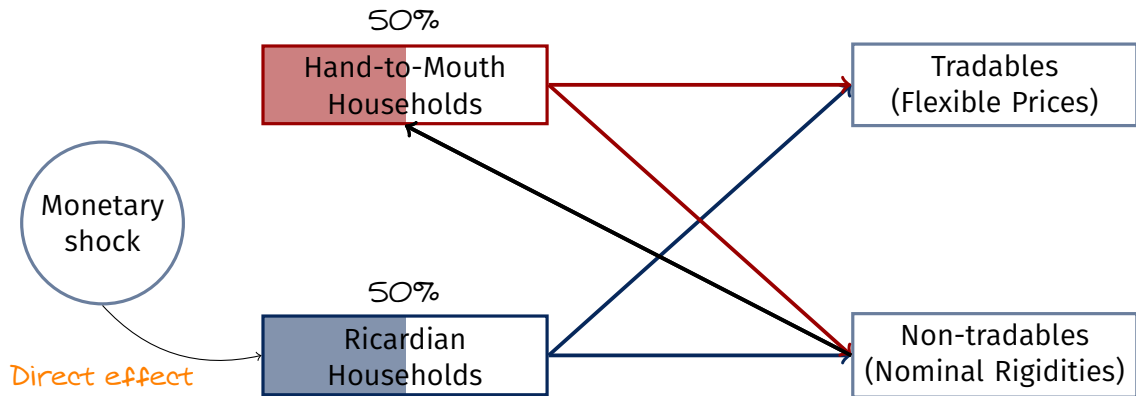
Two-sector TANK

- ▶ Monetary Policy affects Hand-to-Mouth households in two ways:
 - * **Direct effect:** Ricardian consume less because of higher interest rate
 - * **Indirect effect:** Lower demand for non-tradable good
 - * **Aggregate effect:** Increasing in the non-tradable sector size



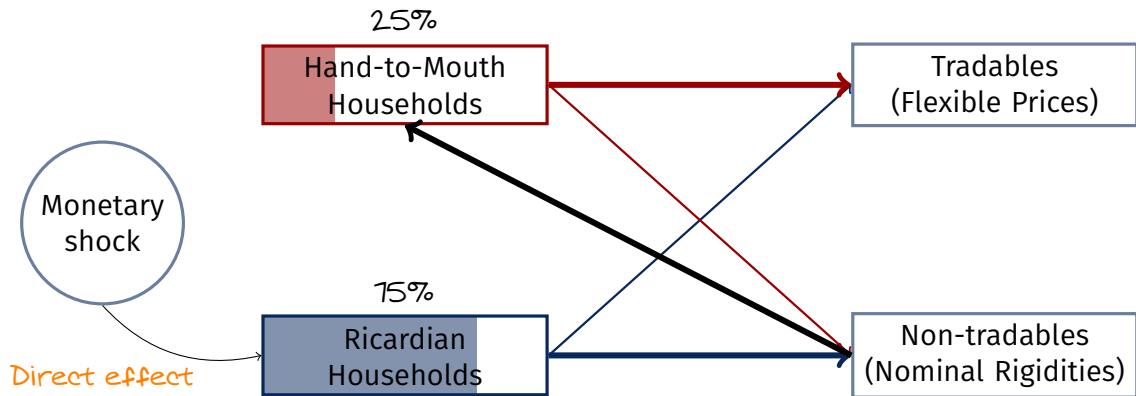
Two-sector TANK with Non-homothetic Preferences

- ▶ Monetary Policy changes with income inequality:



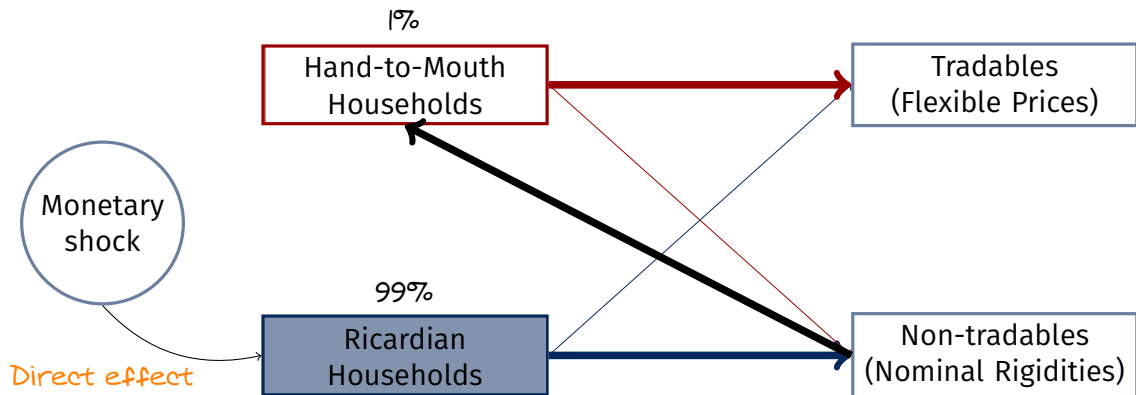
Two-sector TANK with Non-homothetic Preferences

- ▶ Monetary Policy changes with income inequality:



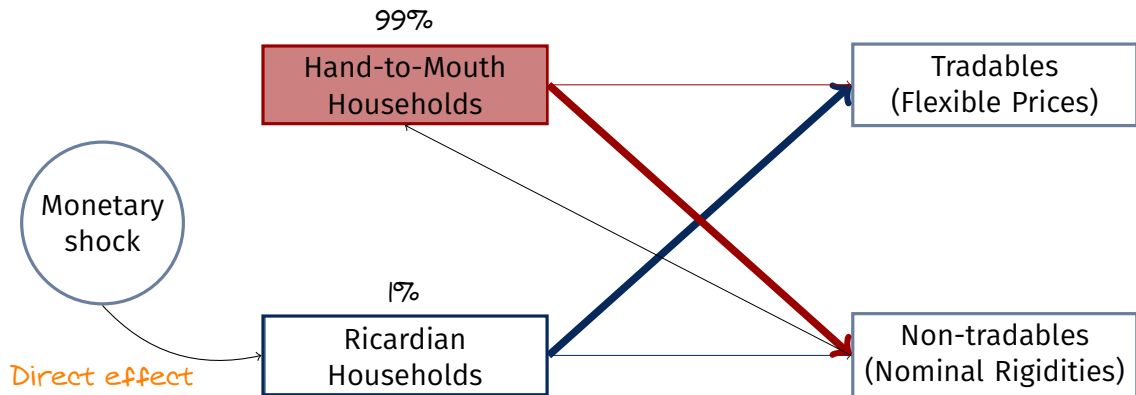
Two-sector TANK with Non-homothetic Preferences

- ▶ Monetary Policy changes with income inequality:
 - * When has the shock the minimum effect?



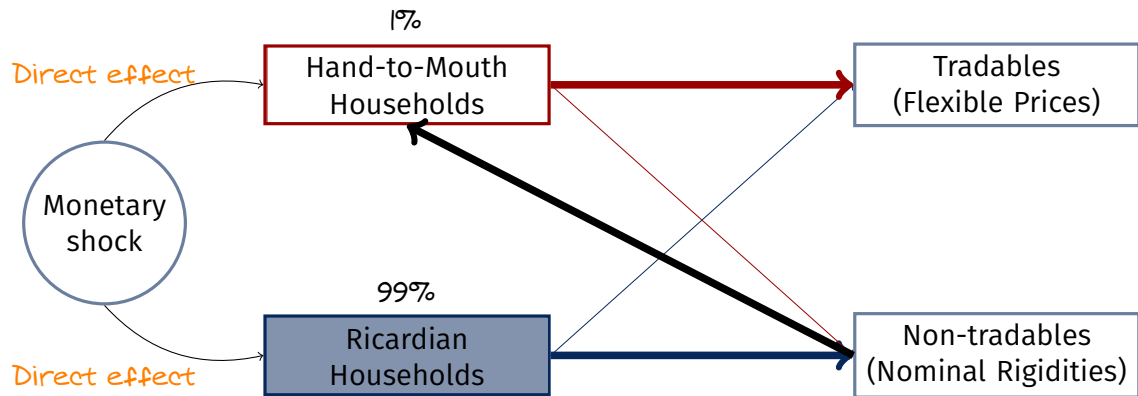
Two-sector TANK with Non-homothetic Preferences

- ▶ Monetary Policy changes with income inequality:
 - * When has the shock the minimum effect?
 - + All income to Hand-to-mouth



Two-sector TANK with Non-homothetic Preferences

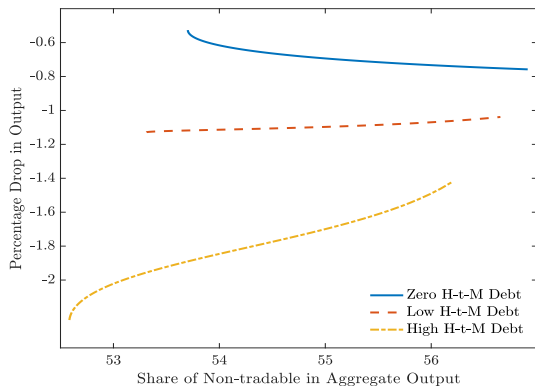
- ▶ Monetary Policy changes with income inequality:
 - * When has the shock the minimum effect?
 - + All income to Hand-to-mouth
 - + Some debt to the Hand-to-mouth and all income to the Ricardian



Non-tradable consumption and monetary policy response

- ▶ We want to match:
 - * Fact 3: Countries with high non-tradable consumption share react less to the monetary policy shock

Non-tradable consumption and monetary policy response



► We want to match:

- * Fact 3: Countries with high non-tradable consumption share react less to the monetary policy shock ✓

The Quantitative Model

Households

- ▶ Relative to TANK version:
 - * No HtM/Ricardian distinction
 - * Income process:
 - + Permanent income differences
 - + Ex-ante identical households within types, facing idiosyncratic income risk
 - * Financial markets
 - + Incomplete markets
 - + Standard Aiyagari, all households can trade one-period, risk-free nominal bonds, subject to borrowing constraint
 - + Borrowing constraint equal to a fraction of permanent income
 - + Profits equal to a fraction of permanent income
- ▶ We retain non-homothetic preferences

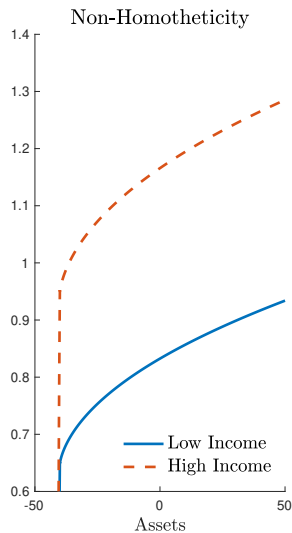
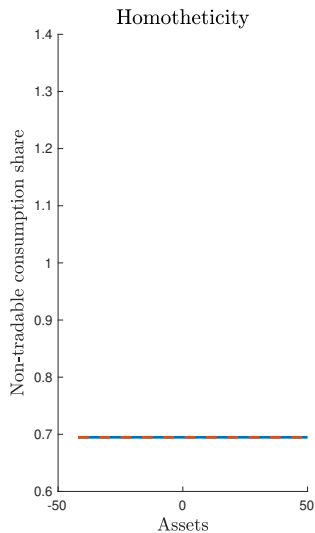
Calibration and shock

- ▶ We compare 4 economies

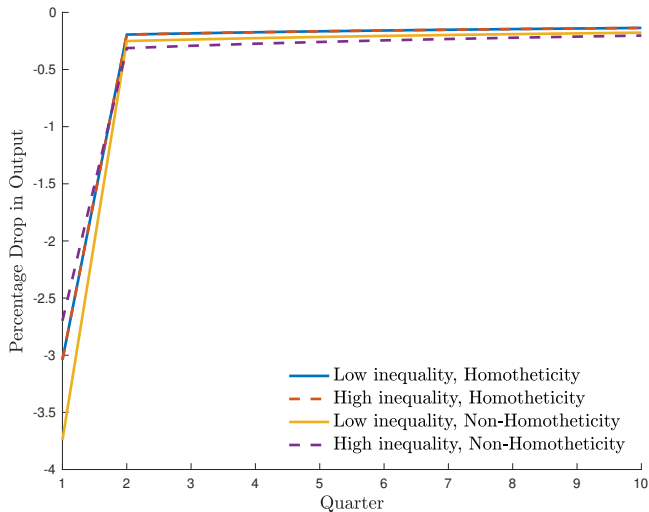
	hom. pref	non-hom. pref
1 perm type		
2 perm types		

- ▶ Income risk to match Gini on income in countries with low inequality (25th percentile of the inequality distribution)
- ▶ Add differences in permanent income to match Gini on income in high-inequality countries (75th percentile of the inequality distribution)
- ▶ The parameter of non-tradable preference to match the low inequality non-tradable consumption share
- ▶ Borrowing constraint implies 10% of borrowing constrained agents

Non-tradable consumption share



Monetary Policy Transmission



Conclusions

- ▶ 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

Thank you very much!

Appendix

Data sources

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

Classification of sectors

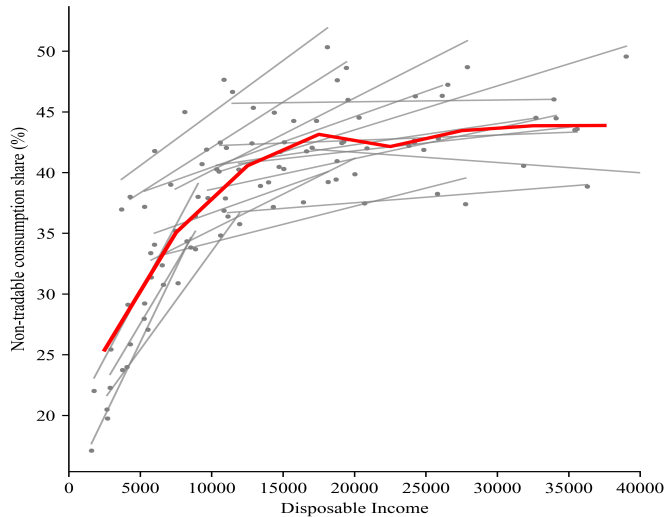
Non-tradables	Tradables	Housing
Education	Alcoholic beverages, tobacco and narcotics	Actual rentals for housing
Good and services for routine household maintenance	Audio-visual, photographic and information processing equipment	Imputed rentals for housing
Hospital services	Clothing and footwear	Maintenance 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	

Countries sorted by their Average Non-tradable share

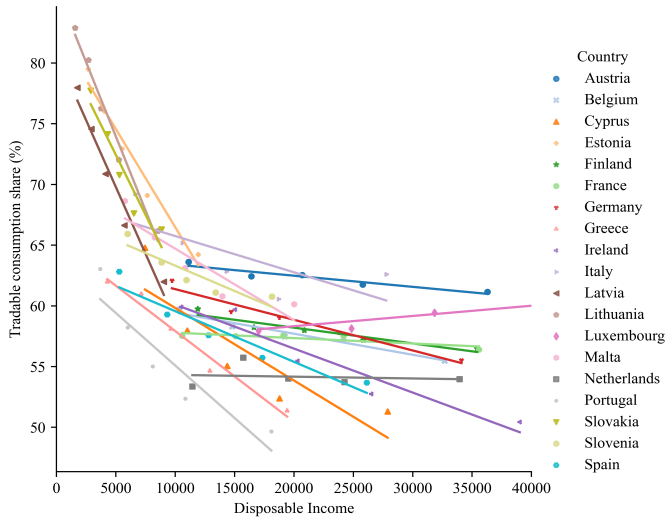
Country	Non-tradable share (%)	Country	Non-tradable share (%)
Lithuania	35	Luxembourg	49
Slovakia	38	Portugal	50
Estonia	38	Netherlands	51
Latvia	40	Austria	51
Slovenia	44	Malta	52
Finland	45	Ireland	53
Germany	45	Greece	54
Belgium	48	Spain	55
Italy	48	Cyprus	57
France	48		

▶ Return

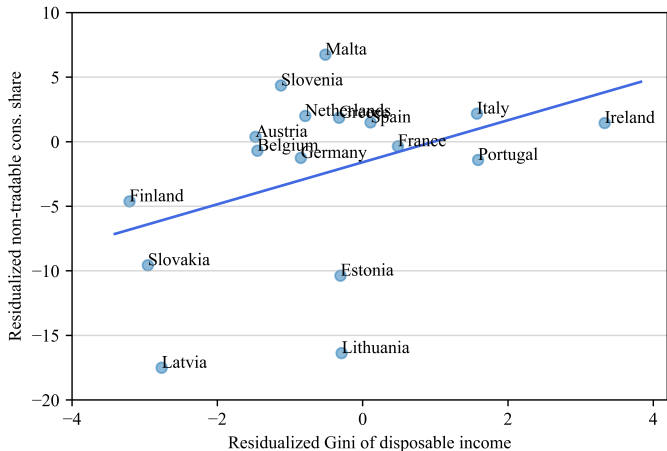
How does consumption change with income?



How does consumption change with income?

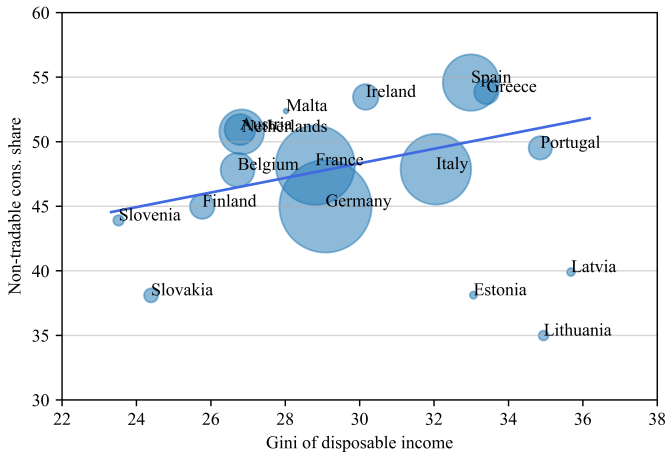


Inequality and the consumption basket



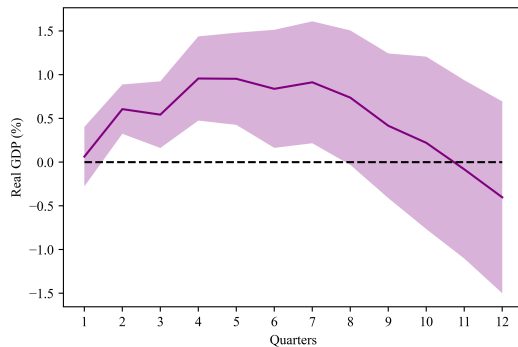
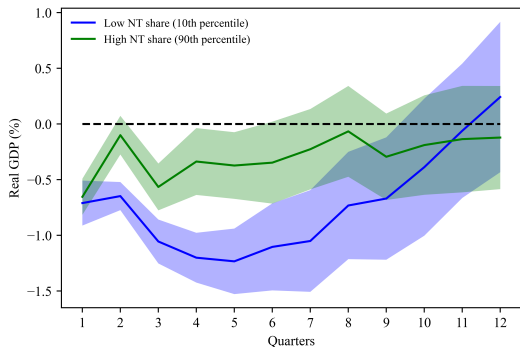
▶ Return

Inequality and the consumption basket



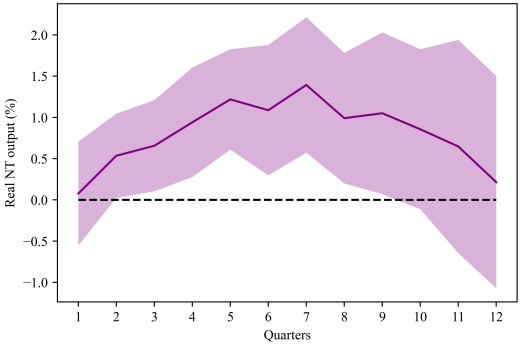
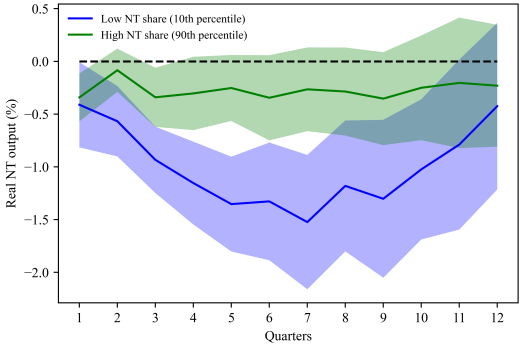
▶ Return

Does the national consumption basket matter for Monetary Policy?



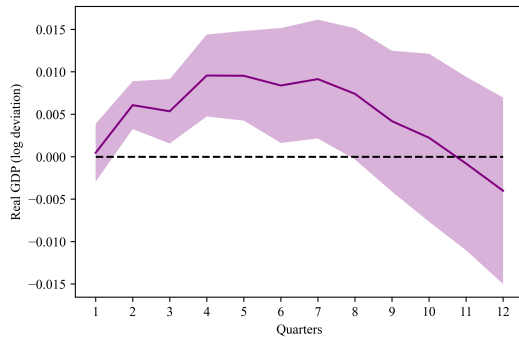
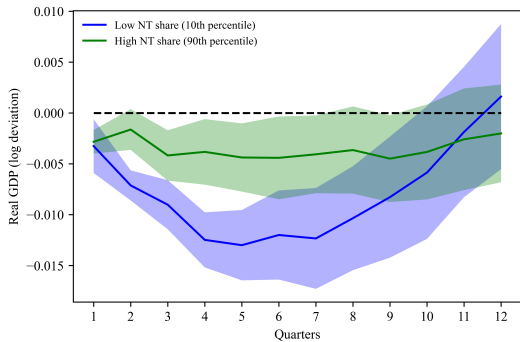
▶ Return

Non-tradable output response



▶ Return

Output response when controlling for the ZLB



▶ Return

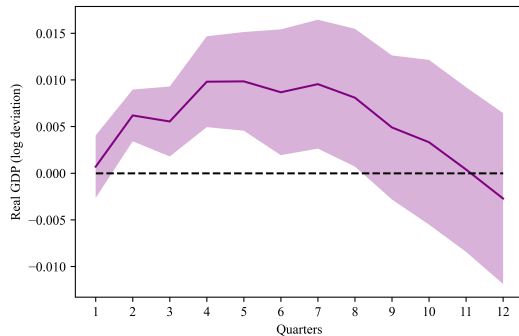
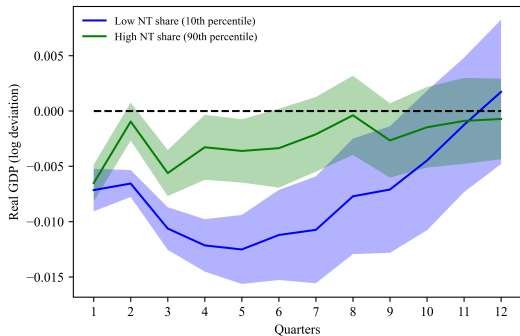
Local Projection extensions

▶ Controlling for Gini

▶ Controlling for wealth inequality

▶ Return

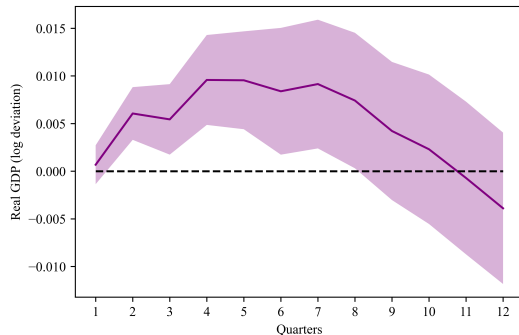
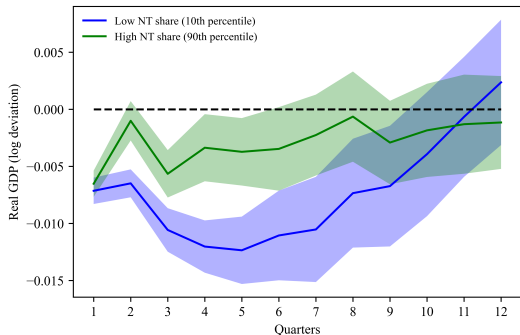
GDP response when controlling for Gini



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](#)