The Network Origins of Inflation Stances in a Currency Union

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Research Questions

- **Questions**
  - What structural forces shape cross-country divergence in inflation preferences in a currency union?
  - What's the welfare implication of this divergence?
- **This paper**: proposes a production-network explanation.
  - Studies optimal policy in a heterogeneous–agent input–output (HAIO) economy.
  - Defines *unilateral inflation stance* and *policy-alignment loss* (PAL).
  - Quantitatively: a country's inflation stance operates mainly through its *input–output multiplier*, and hence, relates to its position in the union's network.

Related Literature

- New Open Economy Macroeconomics (NOEM) literature on **currency-union policy design**: e.g., Benigno, 2004; Galí, 2008; Ferrero, 2009; Farhi and Werning, 2017.
- HANK literature on the **redistribution motive of monetary policy**: e.g., Bhandari et al., 2021; Acharya et al., 2023; Dávila and Schaab, 2023; Le Grand et al., 2022; La'O and Morrison, 2024; Nuño and Thomas, 2022.
- Production network literature on **optimal monetary policy**: e.g. La'O and Tahbaz-Salehi, 2022; Rubbo, 2023; Xu and Yu, 2025; Qiu et al., 2026.

Environment

- The framework of this paper sits at the intersection of Baqaee and Farhi (2024) and La'O and Tahbaz-Salehi (2022).
- Static New Keynesian economy with C countries and N industries.
- Each country has a representative household that supplies a **distinct type of labor**.
- Countries differ in labor supply elasticities, sectoral labor input shares, ownership structures, and consumption baskets.

Firms

- A unit mass of monopolistically competitive firms $k \in [0,1]$ in sector i

$$y_{ik} = z_i F_i(\{x_{ij,k}\}_{j=1}^{N}, \{L_{ic}\}_{c=1}^{C}) = z_i \varsigma_i \prod_{j=1}^{N} x_{ij,k}^{\omega_{ij}} \prod_{c=1}^{C} L_{ic,k}^{\alpha_{ic}}$$

  - In the calibration (geographic segmentation), α_{ic} equals the value-added share of industry i if it is located in country c and zero otherwise.
- Differentiated varieties within an industry i aggregated via a CES aggregator

$$y_i = \left(\int_0^1 y_{ik}^{\frac{\theta_i - 1}{\theta_i}} dk \right)^{\frac{\theta_i}{\theta_i - 1}}$$

- All firms in industry i minimize

$$mc_i = \min_{\{x_{ij,k}\},\{L_{ic,k}\}} \sum_{c=1}^{C} w_c L_{ic,k} + \sum_{j=1}^{N} p_j x_{ij,k}, \quad s.t.\ y_{ik} = 1$$

Nominal Rigidities

- Firm k in industry i can reset price with probability $\delta_i \in (0, 1]$. The optimal reset price maximizes the profit

$$\Pi_{ik} = \max_{p_{ik}} [p_{ik} - (1 - \tau_i)mc_i] \left(\frac{p_{ik}}{p_i}\right)^{-\theta_i} y_i$$

- To a first-order approximation,

$$\log \boldsymbol{p} = \boldsymbol{\delta} \log \boldsymbol{mc}, \qquad \log \boldsymbol{\mu} = -(\boldsymbol{\delta}^{-1} - I) \log \boldsymbol{p}$$

where $\boldsymbol{\delta} = \mathrm{diag}(\delta_1, ..., \delta_N)$.

Households

- Utility function of household c

$$U_c(C_c, L_c) = \log(C_c) - \psi_c \frac{L_c^{1+1/\eta_c}}{1 + 1/\eta_c}$$

where C_c is a utility-relevant aggregator of sectoral goods consumed by household c

$$C_c = \prod_{i=1}^{N} (c_{ci}/\beta_{ci})^{\beta_{ci}}.$$

- Budget constraint

$$\mathrm{GNE}_c \equiv \sum_{i=1}^{N} p_i c_{ci} \leq w_c L_c + \sum_{i=1}^{N} \Phi_{ic} \Pi_i - T_c$$

where Φ is the ownership matrix (geographic segmentation: $\Phi_{ic} = \mathbf{1}\{i \in N_c\}$).

Policy Instruments

- **Fiscal policy**: industry subsidies $1 - \tau_i = (\theta_i - 1)/\theta_i$ eliminate CES distortions; financed by lump-sum taxes proportional to ownership shares,

$$T_c = \sum_{i \in N} \Phi_{ic} \tau_i mc_i \int_0^1 y_{ik} dk.$$

- **Monetary policy**: controls nominal aggregate demand

$$\text{GNE} = \sum_{c=1}^{C} \sum_{i=1}^{N} p_i c_{ci} = m.$$

Equilibrium Definition

Definition

A *sticky-price equilibrium* is a set of allocations, prices, and policies such that:

(i) firms optimally choose inputs and reset prices when allowed;
(ii) each household maximizes utility subject to its budget constraint;
(iii) the government budget constraint is satisfied;
(iv) all markets clear.

Definition

The *flexible-price equilibrium* is defined by the same conditions, except that all firms reset their prices optimally.

- Log deviation from the flexible-price equilibrium: $\hat{x} = \log x - \log x^*$.

Minimum Notations

	Country c	**Union**
Income share	$\chi_c = \frac{\text{GNE}_c}{\text{GNE}}$	$\sum_c \chi_c = 1$
Consumption share	β_{ci}	$b_i = \sum_c \chi_c \beta_{ci}$
Domar weight	$\lambda_i^c = \sum_j \beta_{cj} \Psi_{ji}$	$\lambda_i = \sum_c \chi_c \lambda_i^c$

- $\Psi = (I - \Omega)^{-1}$ is the Leontief inverse, where $\Omega = [\omega_{ij}]$ is the input–output matrix.
- β_{ci} is **direct** exposure of country c to industry i.
- λ_i^c is **direct** and **indirect** exposure of country c to industry i.

Allocative Efficiency

Proposition

To a first-order approximation,

$$\hat{c}_c - \hat{l}_c = \underbrace{\mathcal{J}_c^{\mathrm{DI}\prime} \log \boldsymbol{\mu}}_{\textbf{\textit{direct incidence}}} + \underbrace{\mathcal{J}_c^{\mathrm{FToT}\prime} \log \boldsymbol{\mu}}_{\textbf{\textit{factoral terms of trade}}} \equiv \mathcal{J}_c' \log \boldsymbol{\mu}.$$

- **Direct incidence** reflects a country's dual role as both a consumer and a profit owner (supplier):
$$\Delta \mathrm{DI}_c = \mathcal{J}_c^{\mathrm{DI}\prime} \log \boldsymbol{\mu} = \sum_i \left(\frac{\lambda_i \Phi_{ic}}{\chi_c} - \lambda_i^c \right) \log \mu_i$$
- **Factor terms of trade** measures the relative value of the labor a country supplies to the labor costs it faces:
$$\Delta \mathrm{FToT}_c = \mathcal{J}_c^{\mathrm{FToT}\prime} \log \boldsymbol{\mu} = d \log w_c - \sum_f \Lambda_f^c d \log w_f$$

Allocative Efficiency as Overall Terms of Trade

- In a horizontal economy (without input–output linkages), and assuming ownership segmentation,

$$\Delta\mathrm{DI}_c = \mathcal{J}_c^{\mathrm{DI}\prime} \log \boldsymbol{\mu} = \underbrace{\sum_{i \in N_c} \sum_{f \neq c} \chi_f \beta_{fi} / \chi_c \log \mu_i}_{\textbf{change in export prices}} - \underbrace{\sum_{i \notin N_c} \beta_{ci} \log \mu_i}_{\textbf{change in import prices}} \quad .$$

- **The direct incidence effect** maps to the commodity terms of trade effect.
- **Allocative efficiency** = overall (commodity + factoral) terms of trade effect.

The Role of Production Networks

Input–Output Multiplier

$$\xi_c \equiv \sum_{i \in N_c} \frac{\lambda_i}{\chi_c} = \frac{\sum_{i \in N_c} p_i y_i}{\mathrm{GNE}_c}$$

measures total domestic sales relative to domestic final demand.

- Under ownership segmentation,

$$\Delta \mathrm{DI}_c = \underbrace{(\xi_c - \mathbb{E}_\chi[\xi])\,\overline{\log \mu}}_{\text{IO-multiplier channel}} + \underbrace{\left(\mathbb{E}_\chi[\xi] - \sum_i \lambda_i^c\right)\overline{\log \mu}}_{\text{home-bias channel}} + \underbrace{\sum_i \mathcal{J}_{ic}^{\mathrm{DI}}(\log \mu_i - \overline{\log \mu})}_{\text{sectoral-heterogeneity channel}} .$$

- Without production networks,

$$\xi_c = 1, \qquad \sum_i \lambda_i^c = 1,$$

so the first two channels disappear.

- When the IO-multiplier channel dominates, countries with above-average ξ_c experience a deterioration in their terms of trade following a monetary expansion ($\overline{\log \mu} < 0$).

Aggregate Cancellation: A Macro Envelope Theorem

Corollary

Income-share-weighted allocative efficiencies exactly cancel at first order:

$$\sum_{c=1}^{C} \chi_c(\hat{c}_c - \hat{l}_c) = \sum_{c=1}^{C} \chi_c \mathcal{J}_c' \log \boldsymbol{\mu} = 0.$$

- **Intuition:** a closed economy has zero aggregate terms of trade.
- **Implication:** monetary policy has a redistribution motive whenever welfare aggregation departs from income-share weighting.

Bergson–Samuelson Welfare

- Adopt the Bergson–Samuelson welfare aggregator

$$W(\{\kappa_c\}_{c=1}^{C}) = \sum_{c=1}^{C} \kappa_c U_c,$$

where $\{\kappa_c\}$ are Pareto weights satisfying $\sum_c \kappa_c = 1$.

Proposition (Bergson–Samuelson Welfare function)

For arbitrary Pareto weights $\{\kappa_c\}_{c=1}^{C}$,

$$W(\{\kappa_c\}) - W^*(\{\kappa_c\}) = \sum_{c=1}^{C} \kappa_c \mathcal{J}_c' \log \boldsymbol{\mu} - \frac{1}{2} \log \boldsymbol{\mu}' \mathcal{L}(\{\kappa_c\}) \log \boldsymbol{\mu}.$$

- Generalizes Baqaee and Farhi (2024) (income-share weighting) and La'O and Tahbaz-Salehi (2022) (representative agent) to a HAIO economy with arbitrary Pareto weights.
- Under income-share weighting, monetary policy has a purely efficiency objective, $\sum_c \chi_c \mathcal{J}_c' \log \boldsymbol{\mu} = 0$.
- **Takeaway**: monetary policy faces a tradeoff between **aggregate stabilization** and **first-order redistribution** whenever Pareto weights deviate from income shares.

Optimal Policy

Proposition (Optimal Monetary Policy (Second Best))

Given Pareto weights $\{\kappa_c\}_{c=1}^{C}$, the optimal monetary policy targets the sectoral price index

$$\sum_{j=1}^{N} \zeta_j^*(\{\kappa_c\}) \log p_j = \pi^*(\{\kappa_c\})$$

with sectoral weights and optimal inflation bias

$$\zeta_j^*(\{\kappa_c\}) = (\delta_j^{-1} - 1) \sum_{i=1}^{N} (\delta_i^{-1} - 1) \varrho_i^m \, \mathcal{L}(\{\kappa_c\})_{ij},$$

$$\pi^*(\{\kappa_c\}) = \sum_{c=1}^{C} \kappa_c \, \mathcal{J}_c'(I - \boldsymbol{\delta}^{-1}) \varrho^m.$$

Here, $\varrho^m \equiv \frac{d \log \boldsymbol{p}}{d \log m} = \left[I - \varrho^w (\Gamma + \boldsymbol{\ell}^\mu \boldsymbol{\eta}^{-1})' (I - \boldsymbol{\delta}^{-1})\right]^{-1} \varrho^w \mathbf{1}$ denotes sectoral monetary pass-through.

Centralized vs. Unilateral Optimal Policy

	Centralized	**Unilateral**
Pareto weights	$\kappa = \chi$	$\kappa = \mathbf{e}_c \ (\kappa_c = 1)$
Objective	Minimize union-wide welfare loss	Minimize country c's welfare loss
Optimal policy	$\sum_j \zeta_j^*(\chi) \log p_j = 0$	$\sum_j \zeta_j^*(\mathbf{e}_c) \log p_j = \pi^*(\mathbf{e}_c)$
Inflation target	Zero	$\pi^*(\mathbf{e}_c) / \sum_j \zeta_j^*(\mathbf{e}_c)$

- $\pi^*(\mathbf{e}_c)$ measures how country c's **terms of trade** respond to a monetary expansion.
- Country c's unilateral optimal policy is inflationary if $\pi^*(\mathbf{e}_c) > 0$, indicating that its terms of trade improve following a monetary expansion.

Unilateral Inflation Stance

- The unilateral optimal policy
$$(\zeta^*(\mathbf{e}_c), \pi^*(\mathbf{e}_c)) = \arg\min_{(\zeta,\pi)} \mathbb{L}_c(\zeta, \pi)$$
assumes country c fully controls monetary policy.
- In a currency union, however, the target price index ζ is determined collectively (e.g., by the ECB Governing Council). Each country can only express its preferred inflation rate.

Definition

Given the union's target price index ζ, country c's **inflation stance** is

$$\pi_c(\zeta) = \arg\min_{\pi\in\mathbb{R}} \mathbb{E}[\mathbb{L}_c(\zeta, \pi)].$$

Proposition

The unilateral inflation stance satisfies

$$\pi_c(\zeta) = \underbrace{\frac{\zeta' \varrho^m}{[\zeta^*(\mathbf{e}_c)]' \varrho^m}}_{\text{price-index adjustment}} \pi^*(\mathbf{e}_c).$$

Interpretation. $\pi_c(\zeta)$ is a rescaled version of $\pi^*(\mathbf{e}_c)$.

Policy-Alignment Loss (PAL)

Definition (Policy-Alignment Loss)

The *policy-alignment loss* for country c under a union-wide policy (ζ, π) is

$$\mathrm{PAL}_c(\zeta, \pi) \;\equiv\; \mathbb{L}_c(\zeta, \pi) - \mathbb{L}_c\Big(\zeta^*(\mathbf{e}_c), \pi^*(\mathbf{e}_c)\Big) \;\geq\; 0.$$

Proposition (PAL Decomposition)

The expected PAL admits the closed-form decomposition

$$\mathbb{E}[\mathrm{PAL}_c(\zeta, \pi)] = \underbrace{\tfrac{1}{2}\,\frac{\zeta^*(\mathbf{e}_c)'\varrho^m}{(\zeta'\varrho^m)^2}[\pi_c(\zeta) - \pi]^2}_{\text{inflation misalignment}} + \underbrace{\mathcal{I}_c(\zeta)}_{\text{price-index misalignment}},$$

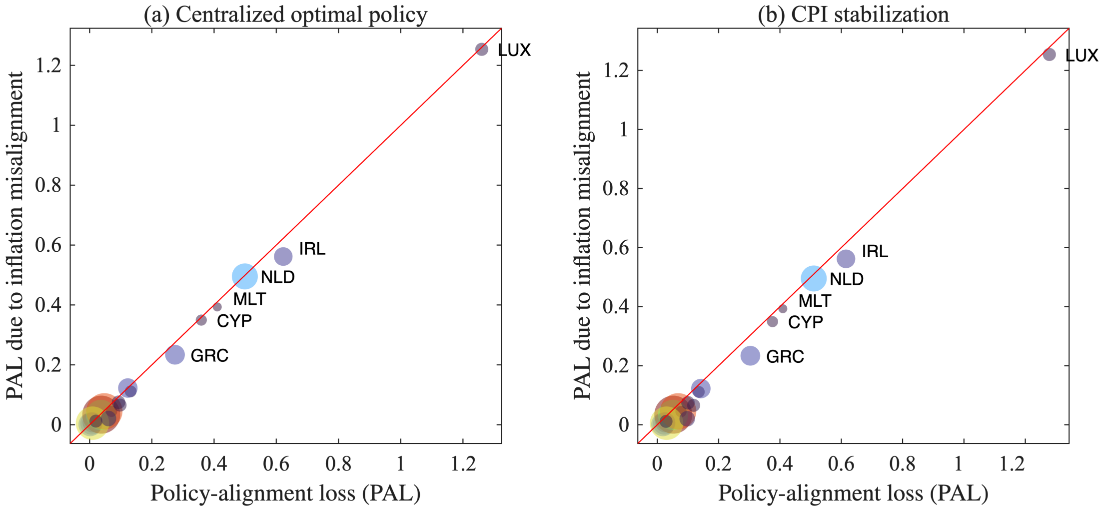
where $\mathcal{I}_c(\zeta) \geq 0$ *vanishes at* $\zeta = \zeta^*(\mathbf{e}_c)$.

- Inflation misalignment is **quadratic** in the distance $|\pi_c(\zeta) - \pi|$.

Calibration

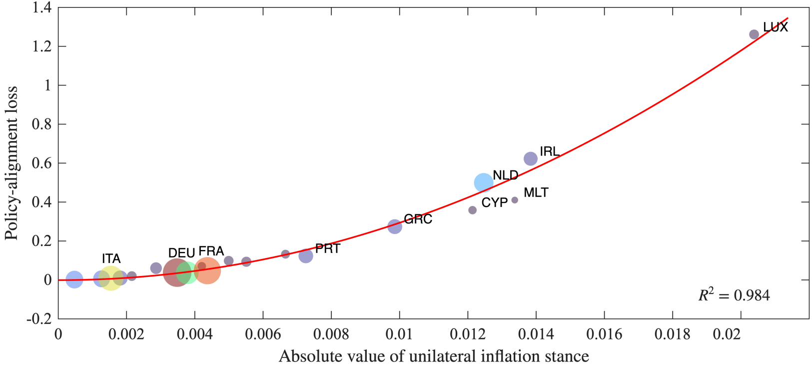
- **Parameters**: $\eta_c = 2$, $\theta_i = 6$, $\Phi_{ic} = \mathbf{1}\{i \in N_c\}$ (geographically segmented ownership).
- **IO matrix**: WIOD 2014 (Timmer et al., 2015); $C = 20$ euro-area countries, each with $N_c = 56$ industries.
- **Price rigidities**: monthly FPA from Pastén et al. (2020), mapped to WIOD industries via NAICS; converted to quarterly.
- **Sectoral productivity shocks**: annual TFP growth from WIOD SEA via Törnqvist index, interpolated to quarterly, linearly detrended, and used to form the variance–covariance matrix.

Decomposition of Policy-Alignment Loss



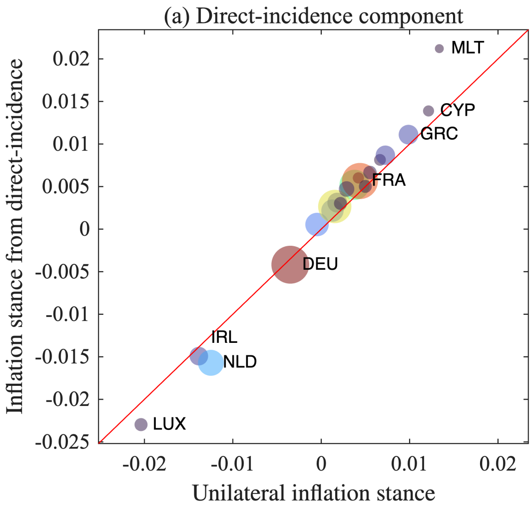
- PAL is mainly driven by inflation misalignment (quadratic in inflation stance deviation).

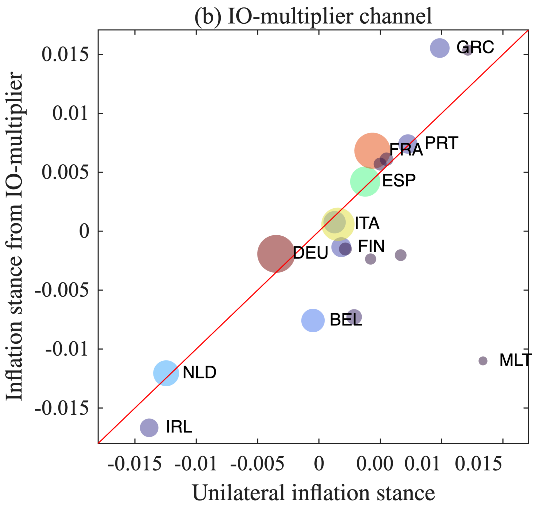
Inflation-Stance Deviation and PAL: Quadratic Fit



- Union-wide inflation consensus is zero under the centralized optimal policy.
- Quadratic fit (no linear term) gives $R^2 = 0.98$.
- A one-percentage-point inflation deviation predicts a loss of about 0.29 pp of steady-state consumption.
- Tail countries (LUX, IRL, NLD, GRC) bear disproportionate welfare costs.

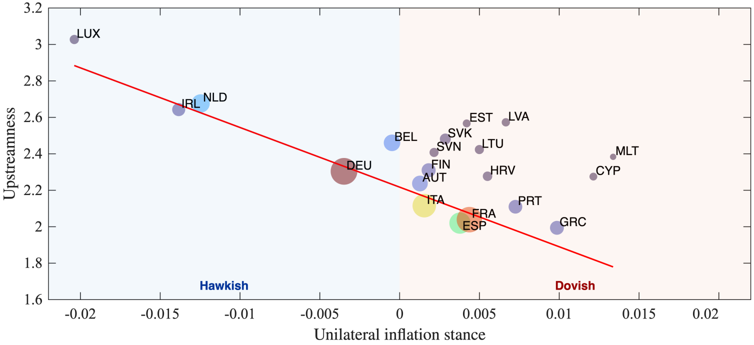
Decomposition of the Inflation Stance





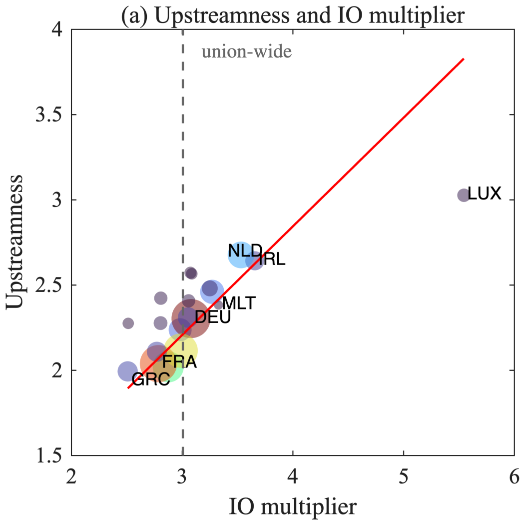
- Panel (a): The direct-incidence component reproduces almost the entire unilateral inflation stance.
- Panel (b): the *IO-multiplier channel alone* reproduces most cross-country variation.

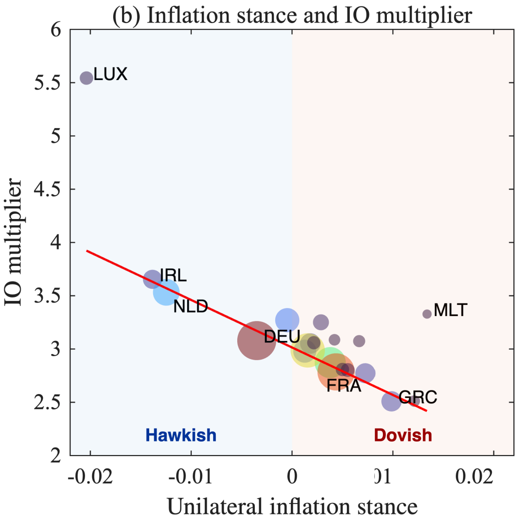
Inflation Stance and Upstreamness



- **Upstreamness** (Antràs et al., 2012): value-added-weighted distance from final consumption.
- Strong negative relationship: WLS slope ≈ -32.7, $R^2 = 0.77$.
- More upstream countries prefer lower inflation; downstream prefer higher.
- Mirrors the familiar North–South divide in the euro area.

IO Multiplier as Mediating Network Statistic





- Panel (a): upstreamness ↔ local IO multiplier ($R^2 = 0.77$).
- Panel (b): IO multiplier ↔ unilateral inflation stance ($R^2 = 0.75$).
- Mechanism: network position ⇒ IO multiplier ⇒ terms of trade ⇒ inflation preference.

Conclusion

- This paper develops a HAIO model and provides microfoundations for divergent inflation preferences across member states in a currency union.
- Bringing the model to the euro area, I find that a country's inflation stance negatively relates to it upstreamness, and the deviation from the union-wide consensus predicts welfare costs.
- Therefore, countries at either extreme of the production network, whether highly upstream or highly downstream, incur the largest welfare costs.

References

Acharya, Sushant, Edouard Challe, and Keshav Dogra (2023) 'Optimal monetary policy according to HANK.' *American Economic Review* 113(7), 1741–1782

Antràs, Pol, Davin Chor, Thibault Fally, and Russell Hillberry (2012) 'Measuring the upstreamness of production and trade flows.' *American Economic Review* 102(3), 412–416

Baqaee, David R., and Emmanuel Farhi (2024) 'Networks, Barriers, and Trade.' *Econometrica* 92(2), 505–541

Benigno, Pierpaolo (2004) 'Optimal monetary policy in a currency area.' *Journal of International Economics* 63(2), 293–320

Bhandari, Anmol, David Evans, Mikhail Golosov, and Thomas J Sargent (2021) 'Inequality, Business Cycles, and Monetary-Fiscal Policy.' *Econometrica* 89(6), 2559–2599

Dávila, Eduardo, and Andreas Schaab (2023) 'Optimal monetary policy with heterogeneous agents: Discretion, commitment, and timeless policy.' Technical Report, National Bureau of Economic Research

Farhi, Emmanuel, and Iván Werning (2017) 'Fiscal unions.' *American Economic Review* 107(12), 3788–3834

Ferrero, Andrea (2009) 'Fiscal and monetary rules for a currency union.' *Journal of International Economics* 77(1), 1–10

Galí, Jordi (2008) *Monetary policy, inflation, and the business cycle: an introduction to the new Keynesian framework* (Princeton University Press)

La'O, Jennifer, and Alireza Tahbaz-Salehi (2022) 'Optimal monetary policy in production networks.' *Econometrica* 90(3), 1295–1336

La'O, Jennifer, and Wendy A Morrison (2024) 'Optimal monetary policy with redistribution.' Technical Report, National Bureau of Economic Research

Le Grand, François, Alaïs Martin-Baillon, and Xavier Ragot (2022) 'Should monetary policy care about redistribution? Optimal monetary and fiscal policy with heterogeneous agents'

Nuño, Galo, and Carlos Thomas (2022) 'Optimal redistributive inflation.' *Annals of Economics and Statistics* (146), 3–64

Pastén, Ernesto, Raphael Schoenle, and Michael Weber (2020) 'The propagation of monetary policy shocks in a heterogeneous production economy.' *Journal of Monetary Economics* 116(C), 1–22

Qiu, Zhesheng, Yicheng Wang, Le Xu, and Francesco Zanetti (2026) 'Monetary policy in open economies with production networks.' *Journal of Monetary Economics* 159, 103918

Rubbo, Elisa (2023) 'Networks, phillips curves, and monetary policy.' *Econometrica* 91(4), 1417–1455

Timmer, Marcel P., Erik Dietzenbacher, Bart Los, Robert Stehrer, and Gaaitzen J. Vries (2015) 'An illustrated user guide to the world input–output database: The case of global automotive production.' *Review of International Economics* 23(3), 575–605

Xu, Zhihao, and Changhua Yu (2025) 'Optimal monetary policy in production networks with distortions.' *Journal of Economic Theory* 225, 105979