Financial Integration and Monetary Policy Coordination

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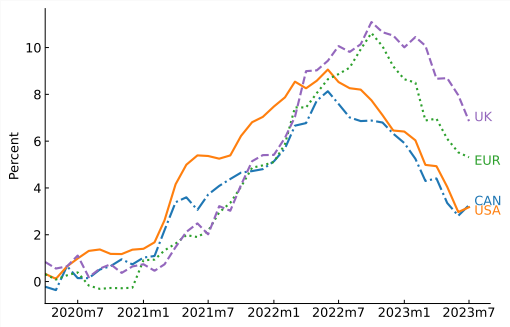
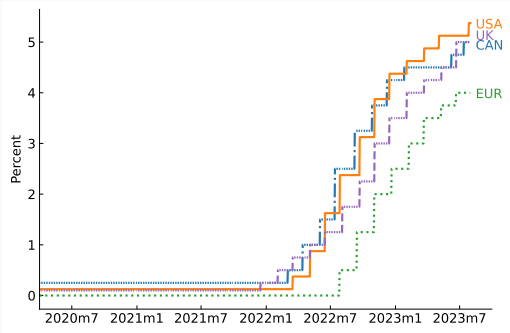
Motivation

- Surge in inflation followed by synchronized tightening of monetary policy

(a) Inflation



(b) Policy rates



Motivation (ctd)

Concerns about synchronized tightening leading to global recession

> *Central banks nearly everywhere feel accused of being on the back foot. The present danger, however, is [...] they collectively go too far and drive the world economy into an unnecessarily harsh contraction...* **By simultaneously all going in the same direction, they risk reinforcing each other's policy impacts without taking that feedback loop into account.**
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Questions:

- What are the benefits from monetary policy cooperation?
- Does cooperation necessarily call for less tightening?

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- Fornaro and Romei (2022):
  - Cooperative monetary policy under inflation-output tradeoff
  - Under-tightening in response to reallocation shock

Preview of Results

- **Cooperation may call for lower or higher nominal rates**
- **Three sufficient statistics**: (i) output gap; (ii) sectoral differences in labor intensity for tradables (T) and non-tradables (N); (iii) the trade balance response to changes in nominal rates

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Signs revert when $dTB/dR > 0$ (or T are more labor intensive) $\Rightarrow$ under-tightening

Main Elements of the Model

- Deterministic, infinite horizon
- Continuum of identical small open economies
  - Each country populated by continuum of households
- Two goods: tradable (T) and non-tradable (N)
  - Law of one price for tradables
- Sticky wages in period 0
  - Flexible wages for $t > 0$
- Perfect capital mobility
  - Global asset pays R^* in units of T

Households

$$\sum_{t=0}^{\infty} \beta^t \left[U(c_t) - \kappa_t h_t - \frac{\chi}{2} \left(\hat{\pi}_t \right)^2 \right]$$

$$c_t = \left[\phi^T (c_t^T)^{\frac{\gamma-1}{\gamma}} + \phi^N (c_t^N)^{\frac{\gamma-1}{\gamma}} \right]^{\frac{\gamma}{\gamma-1}}, \qquad h_t = h_t^T + h_t^N, \quad \hat{\pi}_t \text{ deviation from CPI target}$$

- Budget constraint:

$$P_t^T c_t^T + P_t^N c_t^N + \frac{b_{t+1}}{R_t} + P_t^T \frac{b_{t+1}^*}{R_t^*} = W_t (h_t^T + h_t^N) + \Psi_t + b_t + P_t^T b_t$$

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- Off labor supply at $t = 0$
- For baseline, assume $\gamma = 1$. General IES $1/\sigma$

Firms

- Production for tradables (T) and non-tradables (N)

$$F^T(h_t^T, A_t^T) = A_t^T (h_t^T)^{\alpha^T}, \quad F^N(h_t^N, A_t^N) = A_t^N (h_t^N)^{\alpha^N}$$

- Optimality

$$P_t^T \alpha^T A_t^T (h_t^T)^{\alpha^T - 1} = P_t^N \alpha^N A_t^N (h_t^N)^{\alpha^N - 1} = W_t.$$

Monetary Policy

- For $t > 0$, assume central bank stabilizes price level
- For $t = 0$, optimal choice of $\{R_0\}$

Competitive Equilibrium in the Global Economy

Given b_0^*, a sticky wage W , and a sequence of policies $\{R_t\}$ in each country k, an equilibrium is a sequence of world real rates $\{R_t^*\}$, prices $\{P_t^T, P_t^N, W_t, e_{k,t}^j\}$ and allocations $\{c_t^T, c_t^N, h_t^T, h_t^N, b_{t+1}, b_{t+1}^*\}$ in each country k such that:

- In each country:
  - (i) Households and firms optimize
  - (iii) Market clears for non-tradables $F^N(h_t^N, A_t^N) = c_t^N$, local currency bonds $b_{t+1} = 0$. and labor for $t \geq 1$
- Law of one price holds for tradables: $P_{kt}^T = e_{kt}^j P_{jt}^T$ for any country-pair k, j
- Market for real assets clear globally: $\int b_{kt+1}^* dk = 0$ for $t \geq 0$.

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In a symmetric equilibrium: $b_{t+1}^* = 0$ for all k, t and $e_{kt}^j = 1$

Individual central bank problem

$$\max_{h_0^T, h_0^N, b_1^*} u\left(F^T(h_0^T, A_0^T) - \frac{b_1^*}{R_0^*}, F^N(h_0^N, A_0^N)\right) - \kappa_0(h_0^T + h_0^N) - \frac{\chi}{2}(\widehat{\pi}_0)^2 + \beta V_1(b_1^*)$$

$$\text{s.t.} \quad \frac{\widehat{\pi}_0}{1+\overline{\pi}} = \frac{W}{W_0^n}\left(\frac{h_0^T}{\overline{h}_0^T}\right)^{(1-\alpha^T)\phi^T}\left(\frac{h_0^N}{\overline{h}_0^N}\right)^{(1-\alpha^N)\phi^N} - 1$$

$$\frac{h_0^N}{h_0^T} = \frac{\overline{h}_0^N}{\overline{h}_0^T}\left(1 - \frac{b_1^*}{R_0^* F(h_0^T, A_0^T)}\right)$$

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- Absent inflation costs, first-best $\overline{h}^T, \overline{h}^N$ can be implemented for any natural wage W_0^n
  - Align real wage consistent that implements $\overline{h}^T, \overline{h}^N$

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Suppose $\widehat{\pi}_0 > 0$ and $\widehat{h}_0 < 0$:

- By $\downarrow b_1^*$, country can raise demand for T and N goods

  $\Rightarrow$ Higher borrowing reallocate employment toward N

- If $\alpha^N > \alpha^T$, this helps $\downarrow \widehat{\pi}_0$
  - Higher intensity means that to achieve $\uparrow h$, less increase in prices needed

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Does cooperative monetary policy call for higher or lower nominal rates?

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- Inflationary pressures through exchange rates can be offset by monetary policy

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All spillovers through R_0^*:

- No terms of trade (single tradable good)
- Inflationary pressures through exchange rates can be offset by monetary policy
- With capital controls, no spillovers (Bianchi and Coulibaly, 2021)

Optimal Monetary Policy under Cooperation

Denote $\mathcal{R}^*$ the real rate as a function of nominal rates $\boldsymbol{R}_0$

$$\max_{\boldsymbol{R}_0} \mathcal{U}_0(\boldsymbol{R}_0, \mathcal{R}^*(\boldsymbol{R}_0)) \quad \Rightarrow \frac{\partial \mathcal{U}_0(\boldsymbol{R}, R^*)}{\partial \boldsymbol{R}} + \frac{d\mathcal{R}^*}{d\boldsymbol{R}} \frac{\partial \mathcal{U}}{\partial R^*} = 0$$

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$$\frac{d\mathcal{R}^*}{d\boldsymbol{R}} > 0 \iff \sigma > \overline{\sigma} \equiv 1 - \frac{\alpha^T}{\alpha^T \phi^T + \alpha^N \phi^N}$$

$\Rightarrow$ Generalized Marshall Lerner: $dTB/dR < 0$ for relatively low IES $1/\sigma$ or high α^T:

Sufficient statistics

Proposition. *Denote h_0^N the output gap in the Nash equilibrium. Then, the Nash equilibrium displays under-tightening $R_0^{NE} < R_0^{GP}$ if and only if $(\alpha^N - \alpha^T)(\sigma - \overline{\sigma})\widehat{h}_0^N > 0$.*

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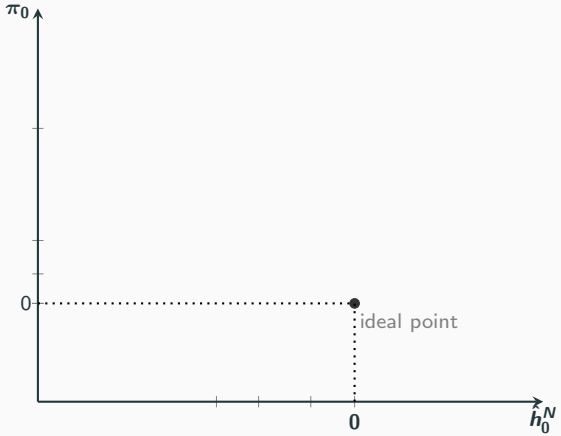
Proposition. *Denote h_0^N the output gap in the Nash equilibrium. Then, the Nash equilibrium displays under-tightening $R_0^{NE} < R_0^{GP}$ if and only if $(\alpha^N - \alpha^T)(\sigma - \overline{\sigma})\widehat{h}_0^N > 0$.*

- Examples w/ under-tightening in Nash-eqm:
  - Overheating, N are more labor intensive & $dTB/dR < 0$
  - Recession, N are more labor intensive & $dTB/dR > 0$
- Examples w/ over-tightening in Nash-eqm:
  - Overheating, N are more labor intensive & $dTB/dR > 0$
  - Recession, N are more labor intensive & $dTB/dR < 0$

Fornaro and Romei (2022): $\alpha^N = 1, \sigma = 1, \kappa = 0, \Rightarrow b_1/dR < 0, \widehat{h} < 0$

Inflation-Output Tradeoff

Under-tightening for $\sigma < \overline{\sigma}$ and $\alpha^N > \alpha^T$



Inflation-Output Tradeoff

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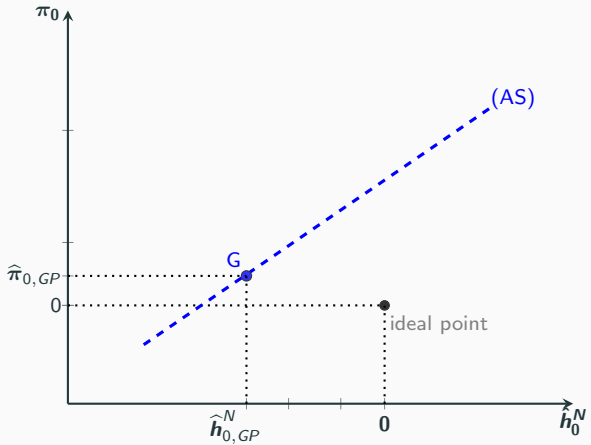

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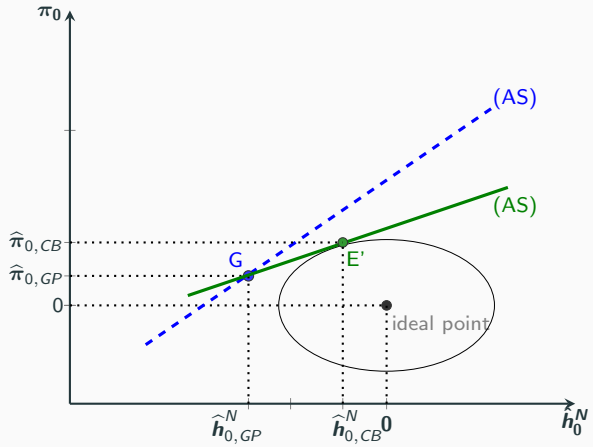

Lower nominal interest rates for a SOE expand output and lower inflation

Inflation-Output Tradeoff

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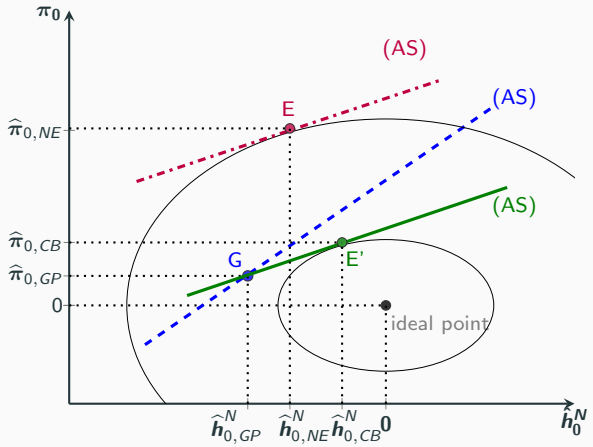
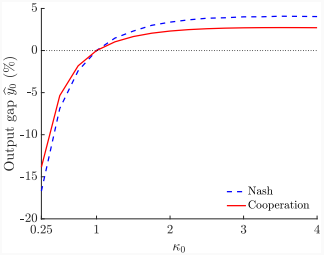


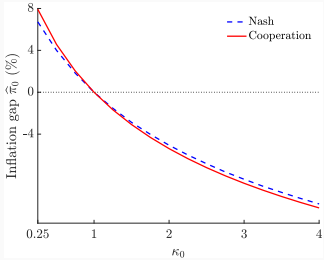
Low nominal rates raise R^* and generate even higher inflation

Quantitative Gains from Coordination

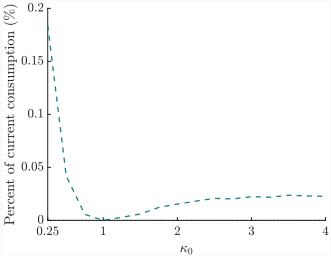
Output gap



Inflation gap



Welfare



Extensions/Other considerations

- Anticipated shocks can generate inflation and overheating
  - Under cooperation, $\widehat{\pi} = \widehat{h} = 0$ (Bianchi and Coulibaly, 2021)
- Sufficient statistics generalize with CES aggregator and imperfect labor mobility
- Other factors of production (e.g. oil)
  - Intensity of other factors of production irrelevant as long as their price is flexible

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- Anticipated shocks can generate inflation and overheating
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- Other factors of production (e.g. oil)
  - Intensity of other factors of production irrelevant as long as their price is flexible
  - Role of labor intensity for inflation

Conclusion

- Theory of monetary policy coordination under financial integration
- Nash equilibrium features over- or under-tightening depending on
  - the sign of output gap
  - differences in labor intensity
  - response of trade balance to exchange rate depreciations
- Quantitative gains can be significant for large shocks