Stagflation and Topsy-Turvy Capital Flows

Julien Bengui[1] Louphou Coulibaly[2]

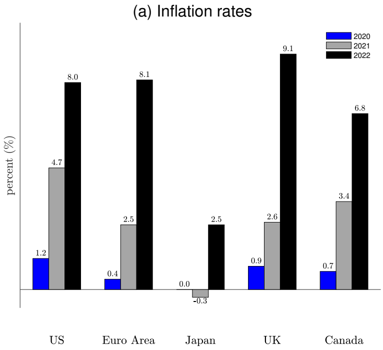
[1] Bank of Canada and CEPR

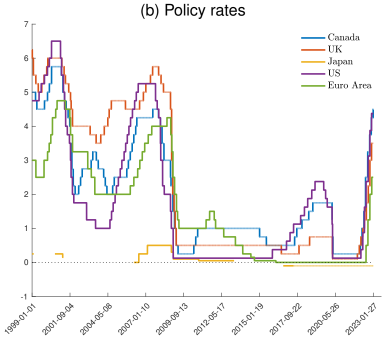
[2] Federal Reserve Bank of Minneapolis, University of Wisconsin-Madison and NBER

March 24, 2023

NBER IFM 2023 Spring Meeting

Motivation: Surge in inflation and aggressive policy tightening





- Surge in inflation has pushed central banks to engage in their most aggressive tightening cycle in decades.
- Raised spectre of new "taper tantrum," large capital outflows from some EMEs.
- Could such capital outflows be excessive or inefficient?

Question: Are capital flows excessive/inefficient?

- Large literature argues that capital flows may be excessive/inefficient.
- This paper: Role of stagflation and output-inflation trade-off?
- Main insight: In stagflationary context, macroeconomic externality operating through economy's supply side generates excessive capital flows.

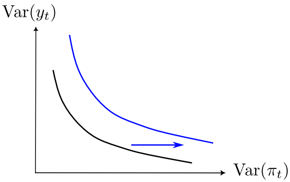
  - Capital inflows raise absorption and push up costs of inputs.

  → In mids of stagflation, rise in domestic costs worsens policy trade-off.

Question: Are capital flows excessive/inefficient?

- ◇ Large literature argues that capital flows may be excessive/inefficient.
- ◇ This paper: Role of stagflation and output-inflation trade-off?
- ◇ Main insight: In stagflationary context, macroeconomic externality operating through economy's supply side generates excessive capital flows.

- ◇ Capital inflows raise absorption and push up costs of inputs.
- → In mids of stagflation, rise in domestic costs worsens policy trade-off.



Related literature

1. Pecuniary externalities under incomplete financial markets Caballero and Krishnamurthy (2001), Korinek (2007, 2018), Bianchi (2011), Jeanne and Korinek (2010, 2019, 2020), Benigno et al. (2013, 2016), etc.
    - Key friction: incomplete markets or borrowing constraints.
    - Externality transmits via prices.
2. AD externality under nominal rigidities Farhi and Werning (2012, 2014, 2016, 2017), Korinek and Simsek (2016), Schmitt-Grohe and Uribe (2016), etc.
    - Key friction: sticky prices/wages.
    - Externality transmits via quantities.

Related literature

1. Pecuniary externalities under incomplete financial markets Caballero and Krishnamurthy (2001), Korinek (2007, 2018), Bianchi (2011), Jeanne and Korinek (2010, 2019, 2020), Benigno et al. (2013, 2016), etc.
   - Key friction: incomplete markets or borrowing constraints.
   - Externality transmits via prices.

2. AD externality under nominal rigidities Farhi and Werning (2012, 2014, 2016, 2017), Korinek and Simsek (2016), Schmitt-Grohe and Uribe (2016), etc.
   - Key friction: sticky prices/wages.
   - Externality transmits via quantities.

Related literature

1. Pecuniary externalities under incomplete financial markets Caballero and Krishnamurthy (2001), Korinek (2007, 2018), Bianchi (2011), Jeanne and Korinek (2010, 2019, 2020), Benigno et al. (2013, 2016), etc.
   - Key friction: incomplete markets or borrowing constraints.
   - Externality transmits via prices.
2. AD externality under nominal rigidities Farhi and Werning (2012, 2014, 2016, 2017), Korinek and Simsek (2016), Schmitt-Grohe and Uribe (2016), etc.
   - Key friction: sticky prices/wages.
   - Externality transmits via quantities.

- Substantive differences with AD externality literature:
  - Externality operates via supply rather than demand side.
  - Key objects: Heterogeneity in GE elasticity of firm costs wrt spending and/or stringency of output/inflation trade-off (rather than heterogeneity in MPC and measure of slack).

Model

Baseline two-country sticky-price model with cost-push shocks

- ◇ Log utility, standard disutility from labor supply, Armington preferences (no home bias for presentation)
- ◇ CRS production, monopolistic competition and Calvo pricing.
- ◇ Output-inflation trade-off generated by wage markup shocks.
- ◇ No other frictions or constraints on policy (complete markets, PCP & LOOP, optimal cooperative policy under commitment).

Key equations

- ◇ International risk-sharing condition: $c_t = c_t^*$
- ◇ NKPC: $\rho \pi_{H,t} = \dot{\pi}_{H,t} + \kappa mc_t,$ with $mc_t = \overbrace{(1+\phi)y_t - \frac{\eta}{2}s_t + u_t}^{\text{real wage}} + \frac{1}{2}s_t$

Model

Baseline two-country sticky-price model with cost-push shocks

- ◇ Log utility, standard disutility from labor supply, Armington preferences (no home bias for presentation)
- ◇ CRS production, monopolistic competition and Calvo pricing.
- ◇ Output-inflation trade-off generated by wage markup shocks.
- ◇ No other frictions or constraints on policy (complete markets, PCP & LOOP, optimal cooperative policy under commitment).

Key equations

- ◇ International risk-sharing condition: $c_t = c_t^*$
- ◇ NKPC: $\rho \pi_{H,t} = \dot{\pi}_{H,t} + \kappa mc_t,$ with $mc_t = \overbrace{(1+\phi)y_t - \frac{\eta}{2}s_t + u_t}^{\text{real wage}} + \frac{1}{2}s_t$

Approach and key insights

Approach

- Allow capital flow management (CFM) policy to open a wedge in international risk-sharing condition: $c_t = c_t^* + \theta_t$.
- Marginal costs now given by $mc_t = \overbrace{(1+\phi)y_t - \frac{\eta}{2}s_t + u_t + \frac{1}{2}\theta_t}^{\text{real wage}} + \frac{1}{2}s_t$.
- Solve for optimal monetary and CFM policy, leading to targeting rules

$$\dot{y}_t^D + \varepsilon\pi_t^D = 0 \qquad \text{and} \qquad \theta_t = 2y_t^D$$

Insights

- **Free capital mobility regime is (constrained) inefficient**, country with most stringent output-inflation trade-off consumes too much.
- If Marshall-Lerner condition is satisfied, **capital flows are *topsy-turvy*** (i.e., flow one way under free capital mobility and the other way under optimal CFM).

Approach and key insights

Approach

- Allow capital flow management (CFM) policy to open a wedge in international risk-sharing condition: $c_t = c_t^* + \theta_t$.
- Marginal costs now given by $mc_t = \overbrace{(1+\phi)y_t - \frac{\eta}{2}s_t + u_t + \frac{1}{2}\theta_t}^{\text{real wage}} + \frac{1}{2}s_t$.
- Solve for optimal monetary and CFM policy, leading to targeting rules

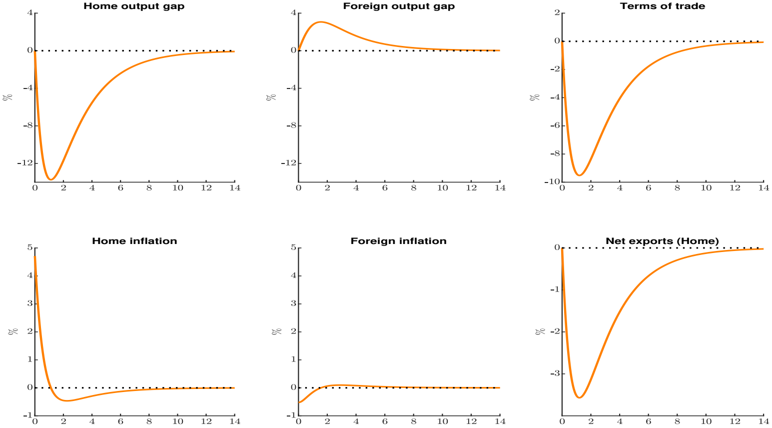
$$\dot{y}_t^D + \varepsilon\pi_t^D = 0 \qquad \text{and} \qquad \theta_t = 2y_t^D$$

Insights

- **Free capital mobility regime is (constrained) inefficient**, country with most stringent output-inflation trade-off consumes too much.
- If Marshall-Lerner condition is satisfied, **capital flows are *topsy-turvy*** (i.e., flow one way under free capital mobility and the other way under optimal CFM).

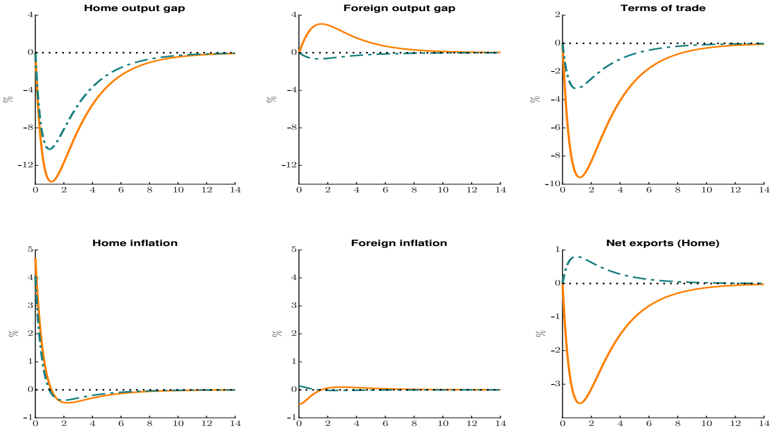
Impulse responses to cost-push shock in calibrated example

How do capital flows influence macro adjustment to Home markup shock generating stagflation episode? (standard calibration, with home bias)



Impulse responses to cost-push shock in calibrated example

How do capital flows influence macro adjustment to Home markup shock generating stagflation episode? (standard calibration, with home bias)



Conclusion

- Draw attention to macroeconomic externality associated with capital flows and operating via firms' marginal costs in standard open-economy sticky price model.
- When policy faces output-inflation trade-off, externality causes excessive capital flows toward countries with most severely hit by stagflationary shock.
- Casts doubts on classical view that free capital mobility promotes macroeconomic adjustment, esp. in stagflation context.

Households

- Can trade two types of nominal bonds, domestic bond D_t and international bond B_t (with international bond denominated in Home currency wlog)

$$\dot{D}_t(h) + \dot{B}_t(h) = i_t D_t(h) + i_{B,t} B_t(h) + W_t(h) N_t(h) + T_t \\ - \int_0^1 P_{H,t}(l) C_{H,t}(h,l) dl - \int_0^1 P_{F,t}(l) C_{F,t}(h,l) dl.$$

- Each household h is a monopolistically competitive supplier of its labor service and faces CES demand $N_t(h) = (W_t(h)/W_t)^{-\varepsilon_t^w} N_t$, leading to optimal wage setting

$$\frac{W_t(h)}{P_t} = \mu_t^w C_t(h) N_t(h)^{\phi},$$

where $\mu_t^w \equiv \varepsilon_t^w / (\varepsilon_t^w - 1)$ is gross wage markup.

back

Firms + International relative prices

Firms

- Produce differentiated goods with technology $Y_t(l) = N_t(l)$.
- $N_t(l)$ is composite of individual household labor, CES aggregator with ES among varieties ε_t^w, to generate cost-push shocks.
- Calvo (1983) price setting with producer currency pricing. details

International relative price

- Terms of trade $S_t \equiv P_{F,t}/P_{H,t} = P^*_{F,t}/P^*_{H,t}$.

back

Details on firms' pricing

◇ Calvo (1983) price setting, opportunity to reset price $P^r_{H,t}(j)$ when receives price-change signal (Poisson process w. intensity $\rho_\delta \geq 0$). Firm maximizes

$$\int_t^\infty \rho_\delta e^{-\rho_\delta (k-t)} \frac{\lambda_k}{\lambda_t} \left[P^r_{H,t}(j) - P_{H,k} MC_k\right] Y_{k|t} dk,$$

subject to demand $Y_{k|t} = \left(P^r_{H,t}/P_{H,k}\right)^{-\varepsilon} Y_k$, with real marginal cost $MC_k \equiv (1-\tau^N) W_k / P_{H,k}$.

▸ back

NKPC for Foreign

- New Keynesian Philips Curve (NKPC) for Foreign country:

$$\rho \pi^*_{F,t} = \dot{\pi}^*_{F,t} + \kappa \underbrace{\left[(1+\phi) y^*_t + \frac{\eta - 1}{2} s_t - \frac{1}{2} \theta_t + u^*_t \right]}_{mc^*_t},$$

back

World and difference formulation

- Define
  - "world" variables $y_t^W \equiv (y_t + y_t^*)/2$, $\pi_t^W \equiv (\pi_{H,t} + \pi_{F,t}^*)/2$,
  - "difference" variables $y_t^D \equiv (y_t - y_t^*)/2$, $\pi_t^D \equiv (\pi_{H,t} - \pi_{F,t}^*)/2$.
- Terms of trade satisfies

$$2y_t^D = \eta s_t. \tag{ToT}$$

- NKPCs

$$\dot{\pi}_t^W = \rho \pi_t^W - \kappa(1+\phi) y_t^W - \kappa u_t^W, \tag{NKPC W}$$

$$\dot{\pi}_t^D = \rho \pi_t^D - \kappa \left[\left(\frac{1}{\eta} + \phi \right) y_t^D + \frac{1}{2} \theta_t \right] - \kappa u_t^D. \tag{NKPC D}$$

back

Welfare criterion

- Assume long-run distortions from monopolistic competition eliminated by labor subsidy.
- 2nd order approximation of (equally weighted) sum of households' utility around efficient allocation:

$$\mathbb{L}_t = \left[(1+\phi)(y_t^W)^2 + \frac{\varepsilon}{\kappa}(\pi_t^W)^2\right] + \left[\left(\frac{1}{\eta}+\phi\right)(y_t^D)^2 + \frac{\varepsilon}{\kappa}(\pi_t^D)^2\right] + \frac{1}{4}(\theta_t)^2 .$$

▸ Loss function with home bias

▸ back ▸ back to IRF

Block recursivity

- Loss function given by

$$\mathbb{L}_t = \left[(1+\phi)(y_t^W)^2 + \frac{\varepsilon}{\kappa}(\pi_t^W)^2\right] + \left[\left(\frac{1}{\eta}+\phi\right)(y_t^D)^2 + \frac{\varepsilon}{\kappa}(\pi_t^D)^2\right] + \frac{1}{4}(\theta_t)^2.$$

- Constraints given by

$$\dot{\pi}_t^W = \rho\pi_t^W - \kappa(1+\phi)y_t^W - \kappa u_t^W, \quad \text{(NKPC W)}$$

$$\dot{\pi}_t^D = \rho\pi_t^D - \kappa\left[\left(\frac{1}{\eta}+\phi\right)y_t^D + \frac{1}{2}\theta_t\right] - \kappa u_t^D, \quad \text{(NKPC D)}$$

$$2y_t^D = \eta s_t. \quad \text{(ToT)}$$

- System is block recursive: “world” variables separated from “difference” variables in both objective function and constraints.

back

Loss function with home bias

- Loss function with $\alpha < 1/2$

$$\mathbb{L}_t = \left[(1+\phi)(y_t^W)^2 + \frac{\varepsilon}{\kappa}(\pi_t^W)^2\right] + \left[(1+\phi)(y_t^D)^2 + \frac{\varepsilon}{\kappa}(\pi_t^D)^2\right]$$
$$+\alpha(1-\alpha)\left[(1-\eta)\eta(s_t)^2 + (\theta_t - (\eta-1)(1-2\alpha)s_t)^2\right].$$

back

Optimal monetary policy

- Optimal monetary policy solves

$$\min_{\{y_t^D,\pi_t^D\}} \int_0^{\infty} e^{-\rho t} \left[\left(\frac{1}{\eta} + \phi \right) (y_t^D)^2 + \frac{\varepsilon}{\kappa} (\pi_t^D)^2 + \frac{1}{4} (\theta_t)^2 \right] dt$$

subject to

$$\rho \pi_t^D = \dot{\pi}_t^D + \kappa \left[\left(\frac{1}{\eta} + \phi \right) y_t^D + \frac{1}{2} \theta_t \right] + \kappa u_t^D. \qquad \text{(NKPC D)}$$

- Optimal plan characterized by targeting rule

$$\dot{y}_t^D + \varepsilon \pi_t^D = 0.$$

- Remark:
  - Monetary policy is "inward looking" regardless of assumption on $\{\theta_t\}$.

Details on optimal monetary policy

- Optimal monetary policy solves

$$\min_{\{y_t^W,\pi_t^W,y_t^D,\pi_t^D,s_t\}} \int_0^\infty e^{-\rho t}\Big\{\Big[(1+\phi)(y_t^W)^2+\frac{\varepsilon}{\kappa}(\pi_t^W)^2\Big]+\Big[(1+\phi)(y_t^D)^2+\frac{\varepsilon}{\kappa}(\pi_t^D)^2\Big]$$
$$+\alpha(1-\alpha)\Big[(1-\eta)\eta(s_t)^2+(\theta_t-(\eta-1)(1-2\alpha)s_t)^2\Big]\Big\}dt.$$

subject to

$$\dot{\pi}_t^W=\rho\pi_t^W-\kappa(1+\phi)y_t^W-\kappa u_t^W, \qquad \text{(NKPC W)}$$
$$\dot{\pi}_t^D=\rho\pi_t^D-\kappa\Big[(1+\phi)y_t^D-\frac{\omega-1}{2}s_t+\alpha\theta_t\Big]-\kappa u_t^D, \qquad \text{(NKPC D)}$$
$$2y_t^D=\omega s_t+(1-2\alpha)\theta_t. \qquad \text{(ToT)}$$

- Optimal plan characterized by targeting rules

$$\dot{y}_t^W+\varepsilon\pi_t^W = 0,$$
$$\dot{y}_t^D+\varepsilon\pi_t^D = 0.$$

back

Remark on relaxing no home bias assumption ($\alpha < 1/2$)

- So far, assumed $\alpha = 1/2$ in $C \equiv \left[(1-\alpha)^{\frac{1}{\eta}} (C_H)^{\frac{\eta-1}{\eta}} + \alpha^{\frac{1}{\eta}} (C_F)^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}$

- What if we allow for home bias ($\alpha < 1/2$)?

$$\frac{\partial mc^D(y_t^D, \theta_t)}{\partial \theta_t} = \frac{\alpha\chi}{\eta - (\eta-1)(1-2\alpha)^2} \left[\underbrace{1}_{\text{real wage effect}} - \underbrace{(1-2\alpha)/\chi}_{\text{purchasing power effect}} \right]$$

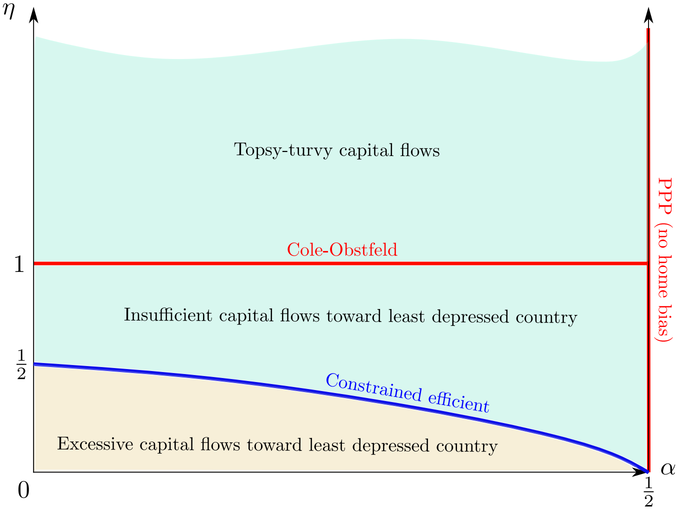
where $\chi \equiv 2(1-\alpha)\eta$ is trade elasticity.

- Targeting rule becomes: $$\boxed{\theta_t = \frac{\chi - (1-2\alpha)}{\chi} 2y_t^D}$$

- Under condition that $\chi > 1 - 2\alpha$, real wage effect dominates, so same capital flow inefficiency as in baseline.

graphical representation

Capital flow patterns allowing for home bias ($\alpha < 1/2$)



back

Calibration

For numerical analysis, use model calibration compatible with Groll and Monacelli (2020).

Table: Calibration

Parameter	Description	Value/Target
ρ	Discount factor	0.04
ϕ	Frisch elasticity	0
α	Degree of trade openness	0.25
ε	Elasticity of substitution btw. differentiated goods	7.66
η	Elasticity of substitution btw. Home and Foreign goods	2
χ	Trade elasticity	3
ρ_δ	Probability of being able to reset price	$1-0.75^4$
ρ_μ	Persistence of markup shocks	0.65