Inflation and Capital Flows

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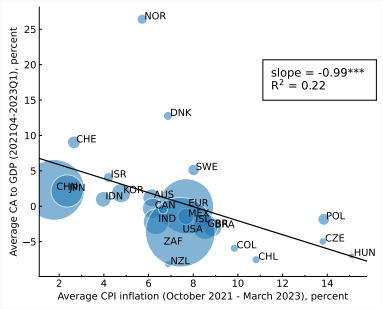
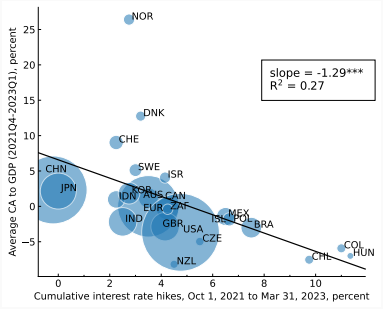
NBER Emerging Markets Conference

Motivation

Cross-sectional fact: capital has been flowing from low inflation to high inflation countries



Current accounts and inflation



Current accounts and policy tightening

What We Do

Questions:

- Are capital flows from low to high inflation countries stabilizing or de-stabilizing?

This paper:

- Two-country open economy with nominal rigidities and cost-push shocks
- Capital flows dynamics under free capital mobility and optimal capital flow management
- Macro stabilization and welfare implications of capital flow management policies

Preview of Results

- **Topsy-Turvy capital flows**
  - free capital flows: low inflation $\longrightarrow$ high inflation countries
  - optimal capital flows: high inflation $\longrightarrow$ low inflation countries
- **Policy implications**
  - less aggressive monetary tightening in most severely hit countries
  - delivers stabilization and welfare gains

- **General logic:** inflows raise marginal costs of firms by reducing supply of non-tradable factors of production and/or increasing demand for non-tradable goods

$$\frac{dmc(\theta_t)}{d\theta_t} > 0$$

Main Elements of the Model

- Deterministic, infinite horizon
- Two countries
  - each country populated by continuum of households & produces single tradable good
  - households consume goods produce in both countries
  - law of one price for tradables
- Nominal rigidities
  - sticky prices à la Calvo
  - inflationary cost-push shocks
- International capital market
  - international bonds pays i_{Bt} in units Home country currency
  - global planner can alter effective return on international bonds faced by each country

Households

- Preferences of households in Home country

$$\int_0^{\infty} e^{-\rho t}\left[\log C_t - \frac{N_t^{1+\phi}}{1+\phi}\right] dt$$

$$C_t \equiv \left[(1-\alpha)^{\frac{1}{\eta}} \left(C_{H,t}\right)^{\frac{\eta-1}{\eta}} + (\alpha)^{\frac{1}{\eta}} \left(C_{F,t}\right)^{\frac{\eta-1}{\eta}}\right]^{\frac{\eta}{\eta-1}}$$

- Budget constraint

$$\dot{D}_t + \dot{B}_t = i_t D_t + i_{B,t} B_t + W_t N_t + \Pi_t - P_{H,t} C_{H,t} - P_{F,t} C_{F,t}$$

- Foreign households face an environment symmetric
  - variables are indexed by asterisks
  - return differential: $\tau_t^D \equiv \frac{1}{2}(i_{Bt}^* - i_{B,t})$ [under free capital flow $\tau_t^D = 0$]

- For baseline, assume no home bias $\alpha = \frac{1}{2}$.

Labor Supply and Production

Labor supply

- Each household h is a monopolistically competitive supplier of its labor service
- Aggregate demand is a CES of labor varieties with elasticity of ε_t^w
- Optimal wage setting

$$\frac{W_t(h)}{P_t} = \underbrace{\frac{\varepsilon_t^w}{\varepsilon_t^w - 1}}_{\text{wage markup: } \mu_t^w} C_t(h) N_t(h)^{\phi}$$

Production and nominal rigidities

- Monopolistically competitive firms with linear production technology $Y_t(\ell) = N_t(\ell)$
- Price setting
  - Calvo: reset price $P_{Ht}(\ell)$ when receives (with probability ρ_δ) a price-change signal
  - Currency of invoicing: PCP $\longrightarrow$ LOP holds

Equilibrium in the Global Economy

Given sequence of interest rates $\{i_t, i_t^*\}$ and taxes on international financial transactions $\{\tau_t^D\}$, an equilibrium is a sequence allocations $\{c_t, c_t^*, y_t, y_t^*\}$ and prices $\{\pi_{Ht}, \pi_{Ft}^*, w_t, w_t^*, s_t, s_t^*\}$ (where $s_t \equiv p_{Ft} - p_{Ht}$ and $s_t^* \equiv p_{Ht}^* - p_{Ft}^*$) such that

- In each country:
  - (i) households and firms optimize
  - (ii) market clears local currency bonds $D_t = 0$ and for goods $y_t = \frac{1}{2}(c_t + c_t^* + \eta s_t)$
- Law of one price holds: $s_t = -s_t^*$
- International bonds market clears ($\rightarrow$ international "risk" sharing): $c_t - c_t^* = \underbrace{\int_0^t 2\tau_s^D ds}_{\theta_t}$

We are interested in the optimal path of θ_t

Analysis of Optimal Capital Flows

Overview of Steps

- Consider the model in "World" and "Difference" format
  - World variables: $x_t^W \equiv \frac{1}{2}(x_t + x_t^*)$ and $\pi_t^W \equiv \frac{1}{2}(\pi_{H,t} + \pi_{F,t}^*)$
  - Difference variables: $x_t^D \equiv \frac{1}{2}(x_t - x_t^*)$ and $\pi_t^D \equiv \frac{1}{2}(\pi_{H,t} - \pi_{F,t}^*)$
- Solve for θ_t that minimize the loss function
  - Loss function: 2^{nd} order approx. of welfare around non-distorted steady state
  - Compare with free capital flows: $\theta_t = 0$

Assumption. $\eta > 1$

- Empirically relevant case
- Implies Marshall-Lerner condition holds

Loss Function and Equilibrium Dynamics

- Loss function

$$\mathcal{L}_t = (1+\phi)(y_t^W)^2 + \frac{\varepsilon}{\kappa}(\pi_t^W)^2 + (\eta^{-1}+\phi)(y_t^D)^2 + \frac{\varepsilon}{\kappa}(\pi_t^D)^2 + \frac{1}{4}(\theta_t)^2.$$

- Four equilibrium conditions

IS curve W: $\dot{y}_t^W = i_t^W - \pi_t^W - \rho$

Phillips curve W: $\dot{\pi}_t^W = \rho\pi_t^W - \kappa(1+\phi)y_t^W - \kappa u_t^W$

IS curve D: $\dot{y}_t^D = \eta\left[i_t^D - \pi_t^D - \frac{1}{2}\dot{\theta}_t\right]$

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

Lemma. The paths of the world output gap and inflation $\{y_t^W, \pi_t^W\}$ are independent of the capital flow regime (i.e., the path of θ_t)

- Focus (for now) on optimal monetary policy: $\dot{y}_t^D + \varepsilon\pi_t^D = 0$ and $\dot{y}_t^W + \varepsilon\pi_t^W = 0$

Inefficiency of Free Capital Mobility

- Optimal targeting rule for capital flow management

$$\boxed{\theta_t = 2y_t^D}$$

  excessive inflows in country with most depressed output (higher inflation)

- **Macro externality view**: formally, from envelope theorem

$$\frac{d\mathcal{L}_t}{d\theta_t} = \underbrace{\varphi_t^D}_{\text{multiplier on (PC in D)}} \times \underbrace{\frac{\partial mc^D(y_t^D, \theta_t)}{\partial \theta_t}}_{+}$$

  - inflows ↑ domestic marginal costs through wealth effect on supply of labor services
  - externality operates in context of demand imbalance [AD externality], but transmit through relative price of non-tradable goods and services [pecuniary externality]

Topsy-Turvy Capital Flows

- Trade balance

$$\boxed{nx_t = \left(1 - \frac{1}{\eta}\right) y_t^D} \quad \text{free capital mobility} \qquad \text{vs.} \qquad \boxed{nx_t = -\frac{1}{\eta} y_t^D} \quad \text{optimal CFM}$$

- Given $\eta > 1$ (Marshall-Lerner condition holds):
  - Free capital flows: *inflows* in country with most depressed output (higher inflation)
  - Optimal CFM: *outflows* in country with most depressed output (higher inflation)

  capital flows are topsy-turvy under free flows

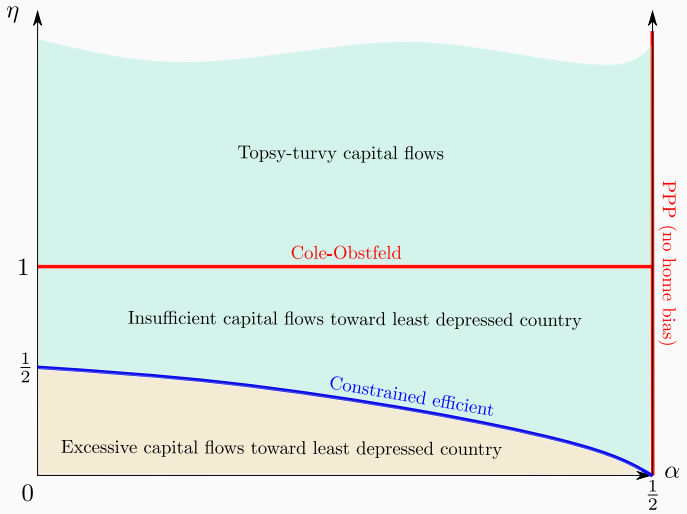
Relaxing no home bias assumption ($\alpha < 1/2$)

- So far, no home bias $\alpha = 1/2$. What if we allow for home bias?
- Optimal CFM calls for outflows in countries with most depressed output if ML holds
  - Trade elasticity as $\chi \equiv 2(1-\alpha)\eta$
  - Macro externality: $\frac{d\mathcal{L}}{d\theta_t} = \varphi_t^D \cdot \frac{\partial mc^D(\theta_t)}{\partial \theta_t}$ with

$$\frac{\partial mc^D(\theta_t)}{\partial \theta_t} = \frac{\alpha\chi}{(1-2\alpha)^2 + 2\alpha\chi}\left[\underbrace{1}_{\substack{\text{wealth}\\ \text{effect}}} - \underbrace{(1-2\alpha)\chi^{-1}}_{\substack{\text{purchasing power}\\ \text{effect}}}\right]$$

  - $\chi > 1$ under Assumption 1 (ML holds) and relative price effect dominates
- Optimal targeting rule: $\boxed{\theta_t = \left[1 - (1-2\alpha)\chi^{-1}\right] 2y_t^D}$

Capital Flow Patterns under Free Flows



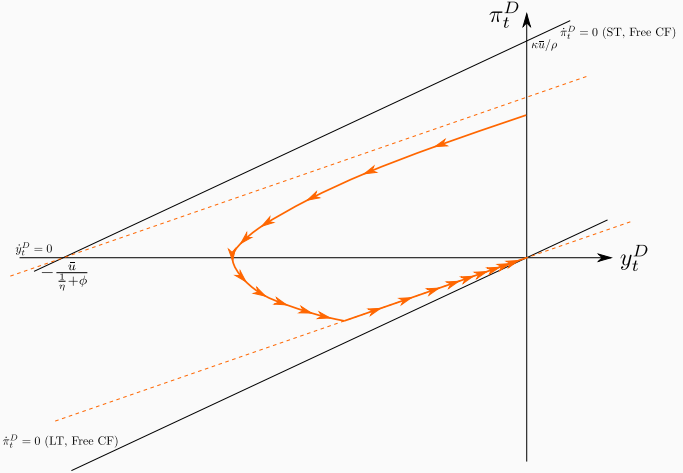
Dynamics of Output and Inflation during Stagflation

- Consider unanticipated inflationary cost-push shock in Home, starting from steady-state
  - [Home] $u_t = 2\bar{u} > 0$ for $t \in [0, T)$ and $u_t = 0$ for $t \geq T$
  - [Foreign] $u_t^* = 0$ for $t \geq 0$

$$u_t^W = u_t^D = \begin{cases} \bar{u} > 0 & \text{for} \quad t \in [0, T) \\ 0 & \text{for} \quad t \geq T. \end{cases}$$

- Adjustment of world economy under free capital mobility and optimal CFM

Dynamics of Output and Inflation during Stagflation



Quantitative Analysis

So far, we consider optimal monetary policy from global welfare perspective

- Consider now standard Taylor rules

$$i_t = \rho + \phi_y y_t + \phi_\pi \pi_t$$
$$i_t^* = \rho + \phi_y^* y_t^* + \phi_\pi^* \pi_t^*$$

  - $\phi_\pi = \phi_\pi^* = 1.5$, $\phi_y = \phi_y^* = 0.25$

- Mean-reverting cost-push shock in Home with $\rho_u = 0.65$

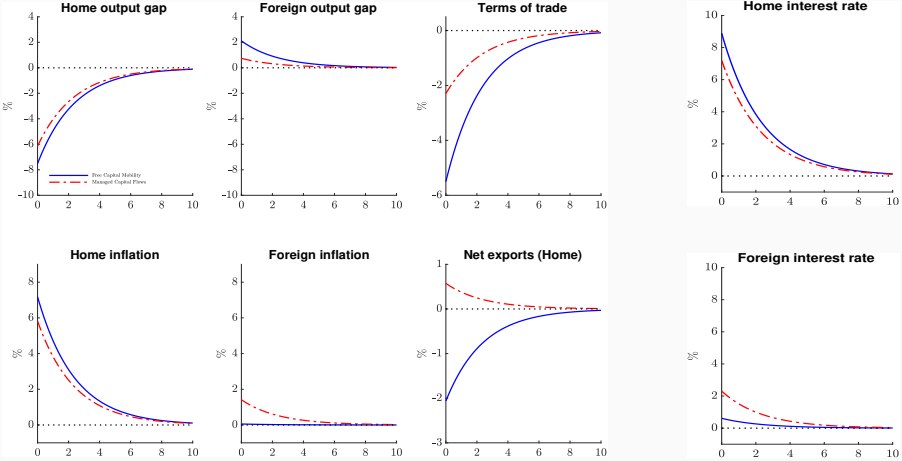
- Calibration of parameters

  - $\rho = 0.64$, $\alpha = 0.25$, $\eta = 2$, $\varepsilon = 7.7$, $\rho_\delta = 1 - 0.75^4$

- Compare two capital flows regimes

  - [free capital mobility]: $\theta_t = 0$
  - [targeting rule for CFM]: $\theta_t = \frac{5}{3} y_t^D$

Quantitative Analysis



- Reverse pattern of capital flows leads to (i) less aggressive monetary tightening in most severely hit countries and (ii) delivers welfare gains of about 0.04% of permanent cons.

Implications and Extensions

Policy Implications

If stagflation scenario materializes in AEs, capital outflows from EMEs might be inefficient from perspective of macro stabilization at world level $\rightarrow$ need active CFM or macropru policies

Extensions

- Extension with non-tradable goods (NT)
  - Macro externality through wealth effect on demand for NT (vs. supply of labor)
  - Results continue to hold with GHH preferences and/or wage rigidity
- Other extensions
  - Alternative goods pricing specifications (LCP, DCP, etc...)
  - Additional constraints on monetary policy (lack of commitment, peg, etc...)

Conclusion

- Capital flows from low-inflation to high-inflation countries may be destabilizing
- Reversing pattern of capital flows would lead to
  - less aggressive monetary tightening in most severely hit countries
  - global welfare gains
- Casts doubts on classical view that free capital mobility promotes macro adjustment, esp. in high-inflation environment