# Inflation and Capital Flows

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[1]Bank of Canada and CEPR

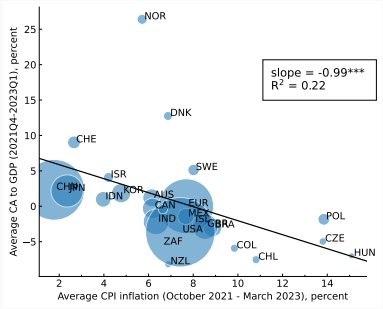
[2]University of Wisconsin-Madison and NBER

NBER Emerging Markets Conference

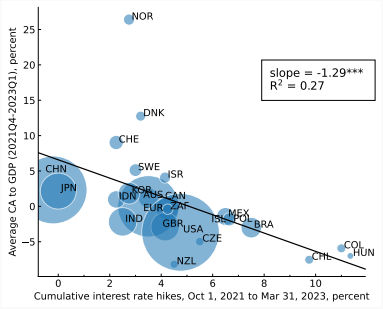
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# Motivation

**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
- 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

- **Key mechanism**
  - strong inflationary pressures lower real rate $\rightarrow$ exchange rate depreciation and capital inflows (provided Marshall-Lerner holds) $\rightarrow \uparrow$ supply of NT services (labor) and/or demand for NT goods $\rightarrow \uparrow$ marginal cost $\rightarrow \uparrow$ inflation

# Related Literature

**Aggregate demand and Pecuniary externalities:** Farhi and Werning (2012, 2016), Bianchi (2011), Korinek and Simsek (2016), Schmitt-Grohe and Uribe (2016), Bengui and Acharya (2018), Devereux et al. (2019), Fornaro and Romei (2019), Bianchi-Coulibaly (2021)

**International policy cooperation:** Canzoneri and Henderson (1991), Obstfeld and Rogoff (2002), Corsetti and Pesenti (2005), Devereux and Engel (2003), Benigno and Benigno (2006), Corsetti, Dedola and Leduc (2018), Fornaro and Romei (2022), Bianchi and Coulibaly (2023).

**Sectorial movements and inflation:** Rubbo (2020), Guerrieri, Lorenzoni, Straub and Werning (2021), Di Giovanni, Kalemli-Ozcan, Silva and Yildirim (2022, 2023), Baqaee and Farhi (2022)

# 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

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

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

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- Budget constraint

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

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- 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 $\tau_t^D = 0$]

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- 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 $\varepsilon_t^w$
- Optimal wage setting

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

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**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 $\rho_\delta$) 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

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- In each country:

  (i) households and firms optimize

$$\dot{c}_t = i_t - \pi_t - \rho$$
$$w_t = c_t + \phi y_t + u_t^w$$
$$\rho \pi_{H,t} = \kappa [w_t + \alpha s_t] + \dot{\pi}_{H,t}$$

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  - (ii) market clears local currency bonds $d_t = 0$ and for goods $y_t = \frac{1}{2}\left(c_t + c_t^* + \eta s_t\right)$

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- Law of one price holds: $s_t = -s_t^*$
- International bonds market clears ($\rightarrow$ international "risk" sharing): $c_t - c_t^* = \underbrace{\int_0^t 2\tau_s^D ds}_{\theta_t}$

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We are interested in the optimal path of $\theta_t$

# 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 $\theta_t$ that minimize the loss function
  - Loss function: $2^{\text{nd}}$ 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

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

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- Four equilibrium conditions

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

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

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**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 $\theta_t$)

- 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

- Under $\theta = 0$: capital flows in the country with most depressed output
- Optimal targeting rule for capital flow management

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

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- **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 $\uparrow$ 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

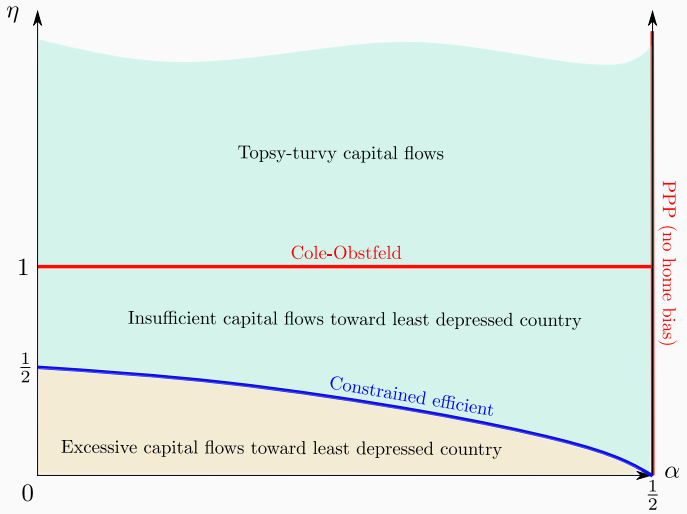
# Relaxing no home bias assumption ($\alpha < 1/2$)

- 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

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

  - $\chi > 1$ 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



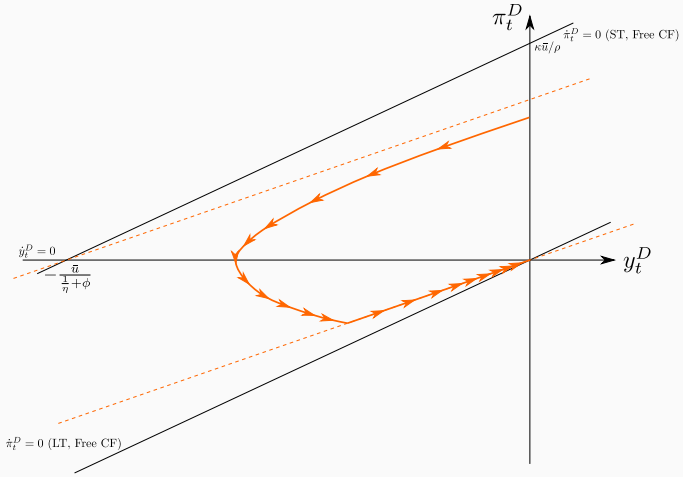
# Stabilization Gains

- 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 $t \geq 0$

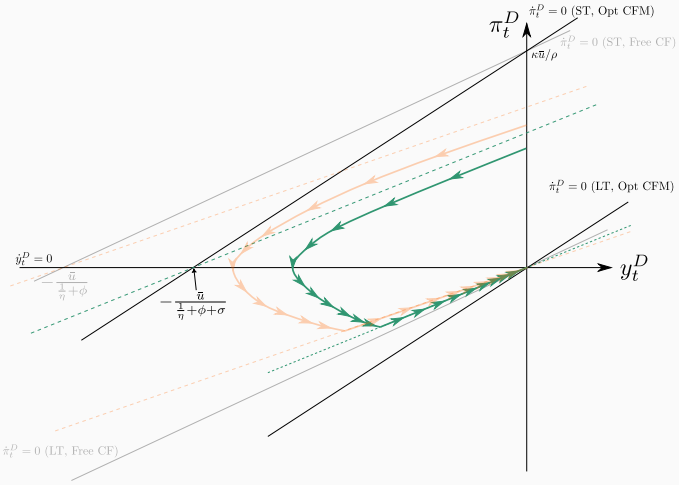
$$u_t^W = u_t^D = \begin{cases} \bar{u} > 0 & \text{for} \quad t \in [0, T) \\ 0 & \text{for} \quad t \geq T. \end{cases}$$

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

# Stabilization Gains: Dynamics of Output and Inflation during Stagflation



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# Quantitative Analysis

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

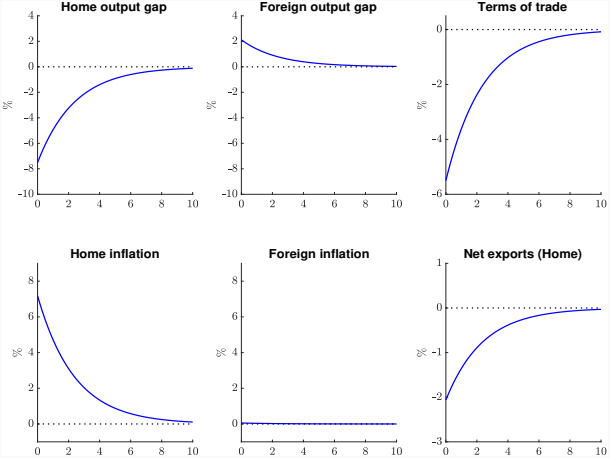
- Consider now standard Taylor rules

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

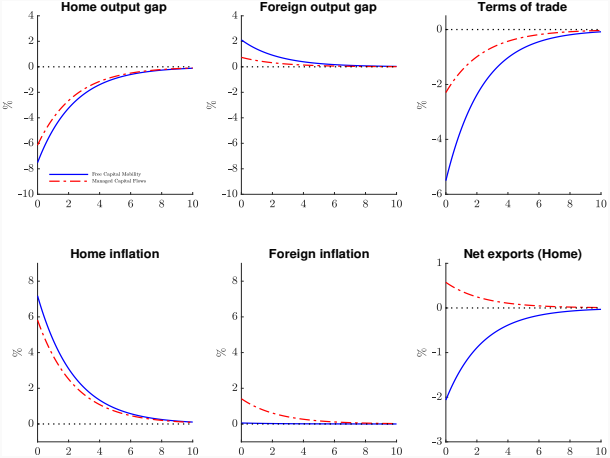
  - $\phi_\pi = \phi_\pi^* = 1.5$, $\phi_y = \phi_y^* = 0.25$

- 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]: $\theta_t = \frac{5}{3} y_t^D$

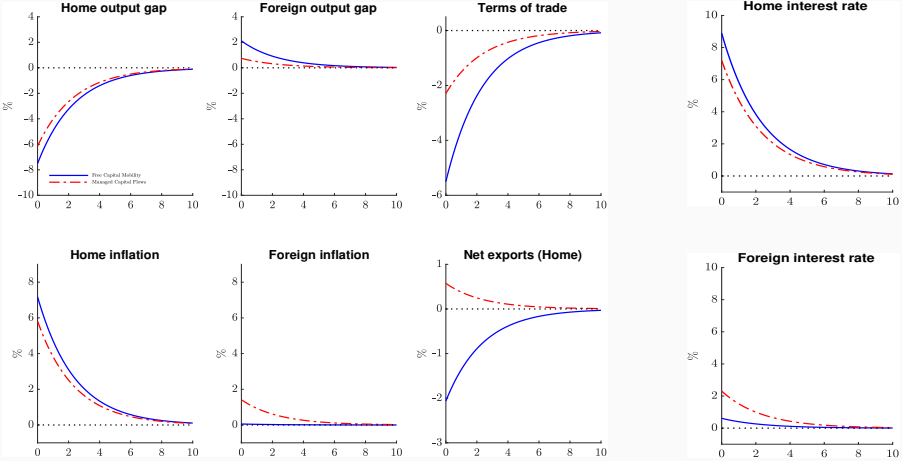
# Quantitative Analysis



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- 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

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  - Macro externality through wealth effect on demand for NT (vs. supply of labor)
  - Results continue to hold with GHH preferences and/or wage rigidity

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## Extensions

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  - 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