International Equity Flows, Monetary Policy, and Time Consistency

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Monetary Policy in Emergining Markets: Crafting Integrated Solutions
National Bank of Ukraine

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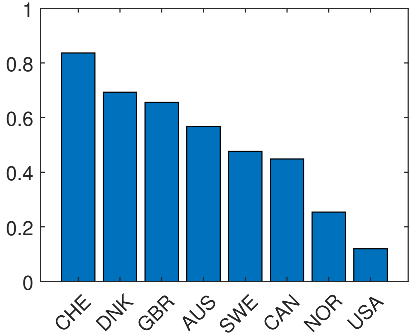
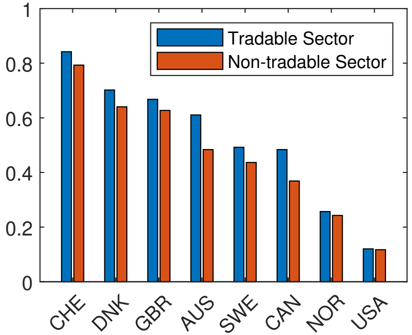
Motivation



(a) Foreign ownership of domestic equities



(b) Break down of ownership across sectors

Notes: Foreign ownership is constructed using The Global Capital Allocation Project database (Maggiori et al. 2020 and Coppola et al. 2021). The figure reports averages over 2005-2020 for several small open economies (SOEs) and the United States (USA).

Literature & This Paper

- International macro literature focuses on credit flows in the form of bank finance or corporate bonds despite recent relative increases in equity flows.
  - Papers that incorporate equity flows mostly in the context of real models.
- Missing: analysis of monetary policy in the presence of equity flows.

This paper:

Studies implications of international equity flows for exchange rate policy and the conduct of capital controls.

Main Results

→ Foreign ownership of domestic equities induces distortionary incentives to exchange rate policy.

Mechanism: Exchange rate policy seeks to boost real wages and squeeze firm profits.

→ Competitive equilibrium may exhibit too much equity inflows.

Reason: Domestic agents do not internalize that by internationally selling more equity, they depress the equity price.

→ Capital controls induce repurchase of part—but not all—the equity owned by foreigners.

Additional result in environment with non-tradable goods:

→ Composition of capital controls between equities of firms in tradable and non-tradable sectors can eliminate distortionary incentives to future exchange rate policy.

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Baseline Model

Main Elements of Baseline Model

Infinite time horizon. No uncertainty.

A tradable good. Law of one price holds.

A small open economy (SOE) with identical households and firms.

A continuum of foreign investors with deep pockets.

Wage rigidity at period $t = 1$. Exchange rate policy has no commitment.

At $t = 0$ domestic financial regulatory authority can set capital controls.

Competitive equilibrium. Policy can influence the equilibrium.

Optimization Problems

Firms produce the tradable good. They maximize profits:

$$\Pi_t \equiv \max_{h_t \geq 0} \{E_t F(h_t) - W_t h_t\}$$

Households consume and supply labor hours. They maximize utility:

$$V_t(b_t, \theta_t) = \max_{c_t, l_t, b_{t+1}, \theta_{t+1}} \{u(c_t) - v(l_t) + \beta V_{t+1}(b_{t+1}, \theta_{t+1})\}$$

subject to:

$$c_t + b_{t+1} + Q_t \theta_{t+1} = \frac{W_t}{E_t} l_t + R b_t + \left(\frac{\Pi_t}{E_t} + Q_t\right) \theta_t$$

$$\text{if } t = 1 \Rightarrow l_1 = F'^{-1}\left(\frac{\overline{W}_1}{E_1}\right)$$

Foreigners trade domestic firms' shares and int. bonds. They break even:

$$R Q_t = \frac{\Pi_{t+1}}{E_{t+1}} + Q_{t+1}, \ \forall t \geq 0$$

Continuation Equilibrium at Period $t = 2$

Assume $\beta R = 1$. Then, stationary equilibrium from $t = 2$ onwards.

Lemma 1.
Given initial portfolio (B_2, Θ_2), $H_t = H_{ss}$ and $C_t = C_{ss}$ $\forall t \geq 2$, with

$$\frac{v'(H_{ss})}{u'(C_{ss})} = F'(H_{ss})$$

$$C_{ss} = I(H_{ss}, \Theta_2) + (R-1)B_2$$

where

$$I(H, \Theta) \equiv F(H) - (1-\Theta)\underbrace{[F(H) - F'(H)H]}_{=\pi(H)},$$

and $\{B_{t+1}, \Theta_{t+1}\}_{t \geq 2}$ satisfy

$$B_{t+1} - Q_{ss}(1 - \Theta_{t+1}) = B_2 - Q_{ss}(1 - \Theta_2)$$

for all $t \geq 2$, where

$$Q_{ss} = \frac{1}{R-1}\pi(H_{ss}).$$

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Continuation Equilibrium at Period $t = 1$ (given E_1)

Recall: $\overline{W}_1$ rigid. Consider first equilibrium given exchange rate E_1.

Lemma 2.
Given initial portfolio (B_1, Θ_1) and exchange rate E_1, H_1 is given by

$$\frac{\overline{W}_1}{E_1} = F'(H_1).$$

Moreover, $C_1 = C_{ss}(B_2, \Theta_2)$, where (B_2, Θ_2) satisfy

$$B_2 - (1 - \Theta_2) Q_{ss}(\cdot,\cdot) = B_1 - (1 - \Theta_1) Q_{ss}(\cdot,\cdot) + \frac{I(H_1, \Theta_1) - I(\mathcal{H}_{ss}(\cdot,\cdot), \Theta_1)}{R}.$$

$\hookrightarrow$ Exchange rate E_1 affects equilibrium allocation.

Questions: How is the optimal exchange rate determined? Does the optimal exchange rate depend on portfolio position (B_1, Θ_1)?

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Optimal Exchange Rate Policy

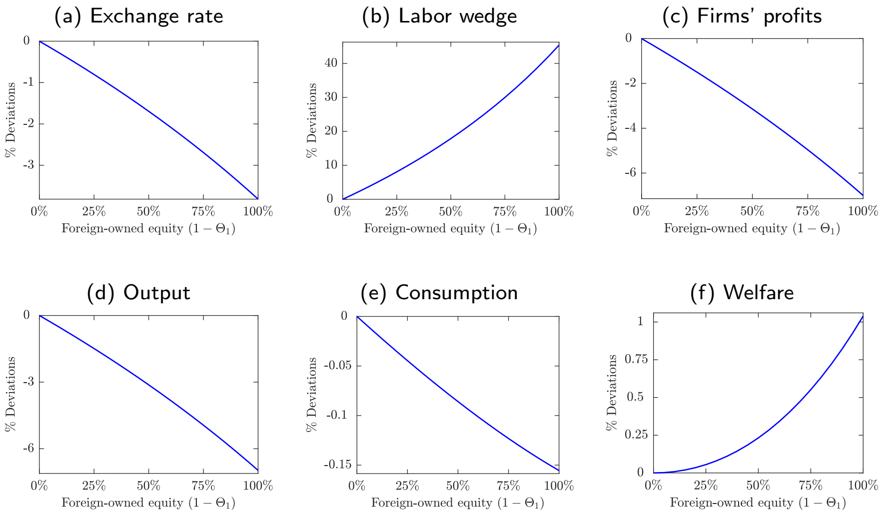
Proposition 1. Necessary condition for optimality:

$$F'(\mathcal{H}_1) - \frac{v'(\mathcal{H}_1)}{u'(\mathcal{C}_{ss})} - (1-\Theta_1)\left[\pi'(\mathcal{H}_1) + \frac{1}{R-1}\pi'(\mathcal{H}_{ss})\frac{\partial\mathcal{H}_{ss}/\partial E_1}{\partial\mathcal{H}_1/\partial E_1}\right] = 0\ ,$$

where

$$\frac{\partial\mathcal{H}_{ss}/\partial E_1}{\partial\mathcal{H}_1/\partial E_1} = \frac{u''(\mathcal{C}_{ss})\,F'(\mathcal{H}_{ss})\,\frac{R-1}{R}I_H(\mathcal{H}_1,\Theta_1)}{v''(\mathcal{H}_{ss}) - F''(\mathcal{H}_{ss})\,u'(\mathcal{C}_{ss}) - u''(\mathcal{C}_{ss})\,F'(\mathcal{H}_{ss})\,\frac{1}{R}I_H(\mathcal{H}_{ss},\Theta_1)}.$$

Optimal Exchange Rate Policy



Equilibrium at Period $t = 0$

Now: determine (B_1, Θ_1) taking as given exchange rate policy $\mathcal{E}_1(B_1, \Theta_1)$.

Lemma 3.
Given initial portfolio (B_0, Θ_0) and period-one exchange rate policy $\mathcal{E}_1(B_1, \Theta_1)$, $C_0 = \mathcal{C}_{ss}(B_1, \Theta_1)$ and $H_0 = \mathcal{H}_{ss}(B_1, \Theta_1)$, where (B_1, Θ_1) satisfy

$$B_1 - (1 - \Theta_1) Q_0 = B_0 - (1 - \Theta_0) Q_0 + \frac{R-1}{R} \frac{I(\mathcal{H}_{ss}, \Theta_0) - I(\mathcal{H}_1, \Theta_0)}{R},$$

with

$$Q_0 = \frac{1}{R}\left[\pi(\mathcal{H}_1) + \frac{1}{R-1}\pi(\mathcal{H}_{ss})\right] \quad \text{and} \quad \frac{\overline{W}_1}{\mathcal{E}_1} = F'(\mathcal{H}_1).$$

$\hookrightarrow$ Continuum of equilibria with different allocations (indexed by Θ_1)!

$\hookrightarrow$ Externality within SOE because households do not internalize how their individual portfolio affects future exchange rate policy.

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- ↪ Continuum of equilibria with different allocations (indexed by Θ_1)!
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Optimal capital control

Let $\hat{\Theta}_1 \in [0,1]$ denote the capital control policy. Optimal policy solves:

$$\max_{\hat{\Theta}_1 \in [0,1]} \left\{ \frac{R}{R-1} u\left(\mathcal{C}_{ss}(\hat{\Theta}_1)\right) - \left[\left(\frac{R}{R-1} - \frac{1}{R} \right) v\left(\mathcal{H}_{ss}(\hat{\Theta}_1)\right) + \frac{1}{R} v\left(\mathcal{H}_1(\hat{\Theta}_1)\right) \right] \right\}.$$

Proposition 2. Necessary condition for optimality:

$$F'\left(\mathcal{H}_1\right) - \frac{v'\left(\mathcal{H}_1\right)}{u'\left(\mathcal{C}_{ss}\right)} - \left(1-\Theta_0\right)\left[\pi'\left(\mathcal{H}_1\right) + R\left(\frac{R}{R-1} - \frac{1}{R}\right)\pi'\left(\mathcal{H}_{ss}\right)\frac{\partial \mathcal{H}_{ss}/\partial \hat{\Theta}_1}{\partial \mathcal{H}_1/\partial \hat{\Theta}_1}\right] = 0$$

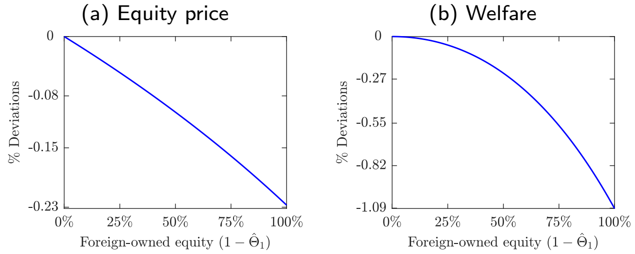
where

$$\frac{\partial \mathcal{H}_{ss}/\partial \hat{\Theta}_1}{\partial \mathcal{H}_1/\partial \hat{\Theta}_1} = \frac{u''\left(\mathcal{C}_{ss}\right) F'\left(\mathcal{H}_{ss}\right) \frac{R-1}{R} \frac{1}{R} I_H\left(\mathcal{H}_1, \Theta_0\right)}{v''\left(\mathcal{H}_{ss}\right) - F''\left(\mathcal{H}_{ss}\right) u'\left(\mathcal{C}_{ss}\right) - u''\left(\mathcal{C}_{ss}\right) F'\left(\mathcal{H}_{ss}\right)\left(1 - \frac{R-1}{R}\frac{1}{R}\right) I_H\left(\mathcal{H}_{ss}, \Theta_0\right)}.$$

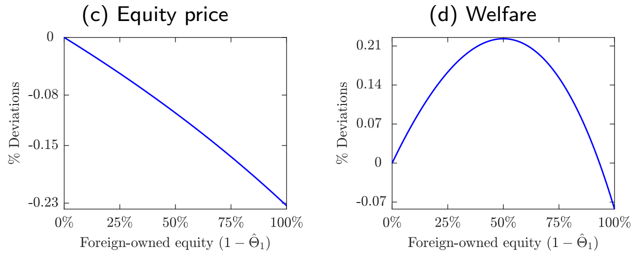
Corollary. If $\Theta_0 = 1 \Rightarrow \hat{\Theta}_1 = 1$. If $\Theta_0 < 1 \Rightarrow \hat{\Theta}_1 \in (\Theta_0, 1)$.

Optimal capital control

Case with $\Theta_0 = 1$



Case with $\Theta_0 = 0.5$



Extension: Non-tradable Goods

Model with a Non-tradable Good

Preferences: $\sum_{t=0}^{\infty} \beta^t [u(c_t) - v(l_t)]$, with $c_t = c(c_t^T, c_t^N)$ and $l_t = l_t^T + l_t^N$.

Budget constraint:

$$c^T + \frac{P_t^N}{E_t} c_t^N + b_{t+1} + \sum_j Q_t^j \theta_{t+1}^j = \frac{W_t}{E_t} l_t + b_t R + \sum_j \left(\frac{\Pi_t^j}{E_t} + Q_t^j \right) \theta_t^j$$

Profit maximization:

$$\Pi_t^j \equiv \max_{h_t^j \geq 0} \left\{ P_t^j F^j \left(h_t^j \right) - W_t h_t^j \right\} \ , \text{ for } j \in \{N, T\} \ .$$

Let $U(c^T, c^N) \equiv u[c(c^T, c^N)]$. New equilibrium condition:

$$\frac{P_t^N}{E_t} = \frac{U_N(C_t^T, C_t^N)}{U_T(C_t^T, C_t^N)}, \text{ with } C_t^N = F^N(H_t^N).$$

A Simple Example

Consider a specification with isoelastic utility and production functions.

Firm profits in non-tradable sector:

$$\frac{\Pi_t^N}{E_t} = \underbrace{\frac{1-\omega}{\omega}\left(\frac{F^N\left(H_t^N\right)}{C_{ss}^T}\right)^{-1/\sigma}}_{=P_t^N/E_t}\left(1-\alpha^N\right)F^N\left(H_t^N\right),$$

where

$$\begin{aligned} C_{ss}^T =& I^T\left(H_1^T,\Theta_1^T\right) + \frac{I^T\left(H_{ss}^T,\Theta_1^T\right) - I^T\left(H_1^T,\Theta_1^T\right)}{R} + (R-1)B_1 + \\ & -(1-\Theta_1^N)\left\{\frac{\Pi_1^N}{E_1} + \frac{1}{R}\left[\frac{\Pi_{ss}^N}{E_{ss}} - \frac{\Pi_1^N}{E_1}\right]\right\} \end{aligned}$$

$\hookrightarrow$ Given H_t^T, if $\sigma < 1$, exchange rate now has incentives to over depreciate!

Optimal Composition of Equity Portfolio

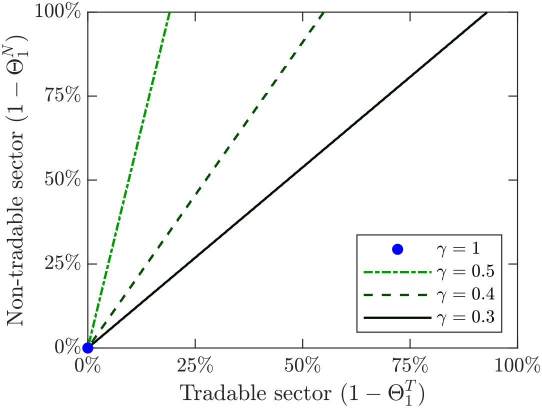


Figure: Compositions of equity portfolio that induce non-distortionary incentives to exchange rate policy

Conclusion

Foreign ownership of domestic equities induces distortionary incentives to exchange rate policy.

Capital controls induce repurchase of part—but not all—the equity owned by foreigners.

Composition of capital controls between equities of firms in tradable and non-tradable sectors can eliminate distortionary incentives to future exchange rate policy.