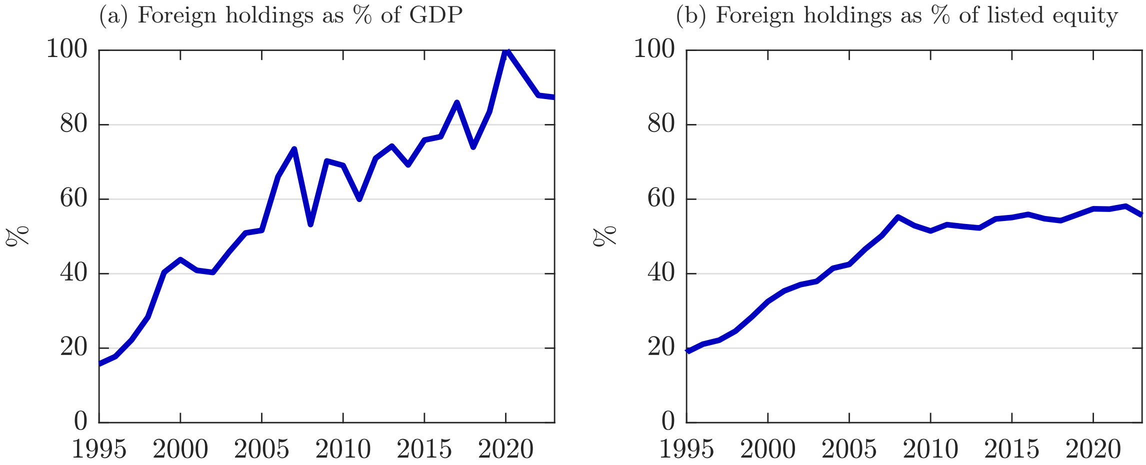
INTERNATIONAL EQUITY FLOWS, MONETARY POLICY, AND TIME CONSISTENCY

Javier Bianchi[1] Alejandro Van der Ghote[2]

[1]Federal Reserve Bank of Minneapolis

[2]European Central Bank

Rise in International Equity Flows



Data source: External Wealth of Nations Database and OECD National Accounts Statistics. Simple average across advanced and emerging economies

Introduction (ctd)

What are the implications of the rise in equity flows for macro & welfare?

Introduction (ctd)

What are the implications of the rise in equity flows for macro & welfare?

- Common view: international equity flows contribute to international risk-sharing.

Introduction (ctd)

What are the implications of the rise in equity flows for macro & welfare?

- Common view: international equity flows contribute to international risk-sharing.

This paper:

- Model of international equity flows with nominal rigidities
- Optimal monetary policy induces deviation from natural allocation
- Capital controls on equity inflows are desirable

Preview of Main Results

- Households' disposable income:

$$W_t h_t \; + \; \overset{\text{domestic equity holdings}}{\theta_t} \, \underbrace{\left(F(h_t) - W_t h_t\right)}_{\text{Profits}}$$

Preview of Main Results

- Households' disposable income:

$$F(h_t) - \overset{\text{foreigners' equity holdings}}{\theta_t^*} \underbrace{(F(h_t) - W_t h_t)}_{\text{Profits}}$$

Preview of Main Results

- Households' disposable income:

$$F(h_t) - \overset{\text{foreigners' equity holdings}}{\theta_t^*} \underbrace{(F(h_t) - W_t h_t)}_{\text{Profits}}$$

- Full domestic ownership ($\theta_t^* = 0$): Optimality $\Rightarrow -U_h(c_t, h_t) = F'(h_t) U_c(c_t, h_t)$

Preview of Main Results

- Households' disposable income:

foreigners' equity holdings

$$F(h_t) - \theta_t^* \underbrace{(F(h_t) - W_t h_t)}_{\text{Profits}}$$

- Full domestic ownership ($\theta_t^* = 0$): Optimality $\Rightarrow$ $-U_h(c_t, h_t) = F'(h_t) U_c(c_t, h_t)$
  - Wages drop out of budget constraint in equilibrium

Preview of Main Results

- Households' disposable income:

foreigners' equity holdings

$$F(h_t) - \theta_t^* \underbrace{(F(h_t) - W_t h_t)}_{\text{Profits}}$$

- Full domestic ownership ($\theta_t^* = 0$): Optimality $\Rightarrow -U_h(c_t, h_t) = F'(h_t) U_c(c_t, h_t)$

- With foreign ownership ($\theta_t^* > 0$): Share of producer surplus "leaks" abroad
  - Optimal policy induces higher real wages and lower firms' profits

Preview of Main Results

- Households' disposable income:

$$F(h_t) - \overset{\text{foreigners' equity holdings}}{\theta_t^*} \underbrace{(F(h_t) - W_t h_t)}_{\text{Profits}}$$

- Full domestic ownership ($\theta_t^* = 0$): Optimality $\Rightarrow -U_h(c_t, h_t) = F'(h_t) U_c(c_t, h_t)$

- With foreign ownership ($\theta_t^* > 0$): Share of producer surplus "leaks" abroad
  - Optimal policy induces higher real wages and lower firms' profits

- Ex-ante: When households sell more equity, investors are willing to pay less

Preview of Main Results

- Households' disposable income:

$$F(h_t) - \overset{\text{foreigners' equity holdings}}{\theta_t^*} \underbrace{(F(h_t) - W_t h_t)}_{\text{Profits}}$$

- Full domestic ownership ($\theta_t^* = 0$): Optimality $\Rightarrow -U_h(c_t, h_t) = F'(h_t) U_c(c_t, h_t)$

- With foreign ownership ($\theta_t^* > 0$): Share of producer surplus "leaks" abroad
  - Optimal policy induces higher real wages and lower firms' profits

- Ex-ante: When households sell more equity, investors are willing to pay less
  - Role for capital controls, but on equity inflows ($\neq$ fire-sale)

Related Literature on Equity Portfolios

- Lucas (1982): endowment economy with complete markets, including equity flows.
- Large literature on home bias in equity portfolios
    - Baxter and Jermann (1997); Heathcote and Perri (2002); Coeurdacier and Rey (2013); Kollman (2016); etc.
- Most studies consider real models
    - Exceptions: Engel and Matsumoto (2005); Devereux and Sutherland (2007)

- Our contribution: normative analysis
    - Optimal to deviate from natural allocation to reduce foreign profits
    - Households hold *too little* domestic equity

Main Elements the Model

- Small open economy (SOE) with $t = 0, 1...$ deterministic
- Identical households with preferences $\sum_{t=0}^{\infty} \beta^{t} \left[u\left(c_t\right) - v\left(\ell_t\right) \right]$
- Technology: $F\left(h_t\right)$ with decreasing returns
- Continuum of foreign investors with deep pockets
  - Trade equity claims of domestic firms $\theta_t^* \geq 0$ and international bonds b_t

Main Elements the Model

- Small open economy (SOE) with $t = 0, 1...$ deterministic
- Identical households with preferences $\sum_{t=0}^{\infty} \beta^{t} \left[u\left(c_t\right) - v\left(\ell_t\right) \right]$
- Technology: $F\left(h_t\right)$ with decreasing returns
- Continuum of foreign investors with deep pockets
  - Trade equity claims of domestic firms $\theta_t^* \geq 0$ and international bonds b_t
- Wage rigidity at period $t = 1$ (flex. wages otherwise)

Main Elements the Model

- Small open economy (SOE) with $t = 0, 1 \ldots$ deterministic
- Identical households with preferences $\sum_{t=0}^{\infty} \beta^t \left[u\left(c_t\right) - v\left(\ell_t\right) \right]$
- Technology: $F\left(h_t\right)$ with decreasing returns
- Continuum of foreign investors with deep pockets
    - Trade equity claims of domestic firms $\theta_t^* \geq 0$ and international bonds b_t
- Wage rigidity at period $t = 1$ (flex. wages otherwise)
- Baseline:
    - Single tradable good – law of one price holds: $P_t = E_t$
    - Perfect capital mobility

Firms' Problem

- Static profit maximization problem.

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

Firms' Problem

- Static profit maximization problem.

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

- Optimality:

$$h_t = F'^{-1}\left(w_t\right) \quad .$$

where $w_t = \frac{W_t}{E_t}$

Household Problem

$$V_t\left(b_t,\theta_t\right)=\max_{c_t,\ell_t,b_{t+1},\theta_{t+1}\geq 0}\left\{u\left(c_t\right)-v\left(\ell_t\right)+\beta\, V_{t+1}\left(b_{t+1},\theta_{t+1}\right)\right\}$$

subject to:

$$c_t+b_{t+1}+q_t\theta_{t+1}=w_t\ell_t+\left(1+r\right)b_t+\left(\pi_t+q_t\right)\theta_t$$

and $\ell_t = F'^{-1}\left(w_t\right)$ for $t = 1$ and no-Ponzi game

Household Problem

$$V_t\left(b_t, \theta_t\right) = \max_{c_t, \ell_t, b_{t+1}, \theta_{t+1} \geq 0} \left\{u\left(c_t\right) - v\left(\ell_t\right) + \beta V_{t+1}\left(b_{t+1}, \theta_{t+1}\right)\right\}$$

subject to:

$$c_t + b_{t+1} + q_t \theta_{t+1} = w_t \ell_t + \left(1 + r\right) b_t + \left(\pi_t + q_t\right) \theta_t$$

and $\ell_t = F'^{-1}\left(w_t\right)$ for $t = 1$ and no-Ponzi game

Households indifferent across portfolios if

$$1 + r = \frac{\pi_{t+1} + q_{t+1}}{q_t}$$

Foreign Investors

- Deep pockets
- Restricted to hold non-negative shares $\theta_{t+1}^{*} \geq 0$

Like households, indifferent across portfolios as long as returns equated

Competitive Equilibrium

Given initial portfolios (b_0, θ_0), a rigid wage $\overline{W}_1$, and an exchange rate policy, $\{E_t\}_{t=0}^{\infty}$, a *competitive equilibrium* is a sequence of allocations $\{c_t, h_t\}_{t=0}^{\infty}$, portfolios $\{b_{t+1}, \theta_{t+1}\}_{t=0}^{\infty}$ and prices $\{w_t, q_t\}_{t=0}^{\infty}$ such that:

(i) Households optimize.

(ii) Firms choose employment optimally.

(iii) Returns on bonds and equity are equated and $\theta_{t+1} + \theta^*_{t+1} = 1$

Competitive Equilibrium

Given initial portfolios (b_0, θ_0), a rigid wage $\overline{W}_1$, and an exchange rate policy, $\{E_t\}_{t=0}^{\infty}$, a *competitive equilibrium* is a sequence of allocations $\{c_t, h_t\}_{t=0}^{\infty}$, portfolios $\{b_{t+1}, \theta_{t+1}\}_{t=0}^{\infty}$ and prices $\{w_t, q_t\}_{t=0}^{\infty}$ such that:

(i) Households optimize.

(ii) Firms choose employment optimally.

(iii) Returns on bonds and equity are equated and $\theta_{t+1} + \theta_{t+1}^{*} = 1$

Focus on symmetric equilibrium

Accounting: Profits, GNI, and the Balance of Payments

Equilibrium profits:

$$\pi_t = F(h_t) - F'(h_t)h_t \equiv \Pi(h_t),$$

where $\Pi'(h) = -F''(h)h > 0$

Accounting: Profits, GNI, and the Balance of Payments

Equilibrium profits:

$$\pi_t = F(h_t) - F'(h_t)h_t \equiv \Pi(h_t),$$

where $\Pi'(h) = -F''(h)h > 0$

$$GNI_t \equiv F(h_t) + rb_t - \theta_t^* \Pi(h_t),$$

$$CA_t \equiv GNI_t - c_t,$$

$$NFA_t \equiv b_t - q_t\theta_t^*.$$

Accounting: Profits, GNI, and the Balance of Payments

Equilibrium profits:

$$\pi_t = F(h_t) - F'(h_t)h_t \equiv \Pi(h_t),$$

where $\Pi'(h) = -F''(h)h > 0$

$$GNI_t \equiv F(h_t) + rb_t - \theta_t^* \Pi(h_t),$$

$$CA_t \equiv GNI_t - c_t,$$

$$NFA_t \equiv b_t - q_t\theta_t^*.$$

Balance of payment condition:

$$NFA_t - NFA_{t-1} = \underbrace{(b_{t+1} - b_t) - q_t(\theta_{t+1}^* - \theta_t^*)}_{CA_t} - \theta_t^*(q_t - q_{t-1}).$$

Roadmap

1. Steady-state equilibrium $t \geq 2$ (flexible prices)
2. Equilibrium for $t \geq 1$ for given $\overline{W}$ and monetary policy
    - Optimal monetary policy at $t = 1$
3. Equilibrium for $t \geq 0$
    - Optimal capital controls at $t = 0$

Steady-State Equilibrium, $t \geq 2$

Given an initial portfolio (b_2, θ_2^*), the continuation eqm. at period $t = 2$ features constant consumption and labor. In particular, the steady-state values, h and c, are given by

$$\frac{v'(h)}{u'(c)} = F'(h),$$

$$c = F(h) + rb_2 - \Pi(h)\theta_2^*,$$

and the sequence of portfolios $\left\{b_{t+1}, \theta_{t+1}^*\right\}_{t\geq 2}$ and the steady-state price of equity, q, satisfy

$$b_{t+1} - q\,\theta_{t+1}^* = b_2 - q\,\theta_2^*$$

and

$$q = \frac{F(h) - F'(h)h}{r}.$$

Equilibrium for $t \geq 1$, given (b_1, θ_1^*) and E_1

i) h_1 is given by

$$\frac{\overline{W}_1}{E_1} = F'\left(h_1\right) \,,$$

ii) $h_t = \mathcal{H}(c)$ for $t > 1$, with $u'(c)F'\big((\mathcal{H}(c)\big) - v'\big((\mathcal{H}(c)\big) = 0$, and $c_t = c$ for $t \geq 1$, with

$$c = \frac{r}{1+r}\Big[F(h_1) + rb_1 - \Pi(h_1)\theta_1^*\Big] + \frac{1}{1+r}\Big[F\big(\mathcal{H}(c)\big) + rb_1 - \Pi(\mathcal{H}(c))\theta_1^*\Big],$$

iii Portfolio satisfies constant NFA for $t \geq 2$ and (b_2, θ_2^*) and q:

$$q = \frac{F(\mathcal{H}(c))) - F'(\mathcal{H}(c))\mathcal{H}(c)}{r}.$$

$$\left(b_2 - q\,\theta_2^*\right) = \left(b_1 - q\,\theta_1^*\right) + \frac{F(h_1) - \Pi(h_1)\theta_1^* - \left[F\left(\mathcal{H}(c)\right) - \Pi\left(\mathcal{H}(c)\right)\theta_1^*\right]}{1+r}.$$

Optimal Exchange Rate Policy

$$V_1(b_1, \theta_1^*) \;=\; \max_{c,h_1}\left\{u(c) - v(h_1) + \frac{u(c) - v\left(\mathcal{H}(c)\right)}{r}\right\}$$

subject to

$$\left(\frac{1+r}{r}\right)c = F(h_1) + rb_1 - \Pi(h_1)\theta_1^* + \frac{F(\mathcal{H}(c)) + rb_1 - \Pi(\mathcal{H}(c))\theta_1^*}{r}$$

Optimal Exchange Rate Policy

$$V_1(b_1, \theta_1^*) = \max_{c, h_1} \left\{ u(c) - v(h_1) + \frac{u(c) - v(\mathcal{H}(c))}{r} \right\}$$

subject to

$$\left(\frac{1+r}{r}\right) c = \underbrace{F(h_1) + rb_1 - \Pi(h_1)\theta_1^*}_{\text{current GNI}} + \underbrace{\frac{F(\mathcal{H}(c)) + rb_1 - \Pi(\mathcal{H}(c))\theta_1^*}{r}}_{\text{PV of future GNI}}$$

Optimal Exchange Rate Policy

$$V_1(b_1, \theta_1^*) = \max_{c,h_1} \left\{ u(c) - v(h_1) + \frac{u(c) - v\left(\mathcal{H}(c)\right)}{r} \right\}$$

subject to

$$\left(\frac{1+r}{r}\right) c = F(h_1) + rb_1 - \Pi(h_1)\theta_1^* + \frac{F(\mathcal{H}(c)) + rb_1 - \Pi(\mathcal{H}(c))\theta_1^*}{r}$$

Optimal Exchange Rate Policy $\theta_1^* = 0$

$$V_1(b_1, \theta_1^*) = \max_{c, h_1} \left\{ u(c) - v(h_1) + \frac{u(c) - v\left(\mathcal{H}(c)\right)}{r} \right\}$$

subject to

$$\left(\frac{1+r}{r}\right) c = F(h_1) + r b_1 + \frac{F(\mathcal{H}(c)) + r b_1}{r}$$

Optimal Exchange Rate Policy $\theta_1^* = 0$

$$V_1(b_1, \theta_1^*) = \max_{c,h_1} \left\{ u(c) - v(h_1) + \frac{u(c) - v\left(\mathcal{H}(c)\right)}{r} \right\}$$

subject to

$$\left(\frac{1+r}{r}\right) c = F(h_1) + rb_1 + \frac{F(\mathcal{H}(c)) + rb_1}{r}$$

With $\theta_1^* = 0$ $\qquad v'(h_1) = u'(c)F'(h_1)$

Optimal Exchange Rate Policy

$$V_1(b_1, \theta_1^*) = \max_{c, h_1} \left\{ u(c) - v(h_1) + \frac{u(c) - v(\mathcal{H}(c))}{r} \right\}$$

subject to

$$\left(\frac{1+r}{r}\right) c = F(h_1) + rb_1 - \Pi(h_1)\theta_1^* + \frac{F(\mathcal{H}(c)) + rb_1 - \Pi(\mathcal{H}(c))\theta_1^*}{r}$$

With $\theta_1^* > 0$ $\qquad v'(h_1) = \lambda \left[F'(h_1) - \Pi'(h_1)\theta_1^* \right]$

- Lower employment reduces profits and rents to foreigners
  - Central bank over-appreciates E to keep output below natural level

Optimal Exchange Rate Policy

$$V_1(b_1, \theta_1^*) \;=\; \max_{c,h_1} \left\{ u(c) - v(h_1) + \frac{u(c) - v\left(\mathcal{H}(c)\right)}{r} \right\}$$

subject to

$$\left(\frac{1+r}{r}\right) c = F(h_1) + rb_1 - \Pi(h_1)\theta_1^* + \frac{F(\mathcal{H}(c)) + rb_1 - \Pi(\mathcal{H}(c))\theta_1^*}{r}$$

$$F(h) = h^\alpha$$

With $\theta_1^* > 0$ $\qquad v'(h_1) = \lambda\left[1 - (1-\alpha)\theta_t^*\right]\alpha h^{\alpha-1}$

- Lower employment reduces profits and rents to foreigners
  - Central bank over-appreciates E to keep output below natural level
  - As if planner perceives **lower productivity** ⇐ Foreign ownership

Optimality (ctd)

$$\underbrace{F'(h_1)u'(c) - v'(h_1)}_{\text{Labor wedge}} = \left(\frac{\Pi'(h_1)u'(c) + \frac{1}{1+r}\Big[\Pi'(h_1)\, v'\big(\mathcal{H}(c)\big) - \Pi'(\mathcal{H}(c))\, v'(h_1)\Big]\mathcal{H}'(c)}{1 - \frac{1}{1+r}F'(\mathcal{H}(c))\mathcal{H}'(c)} \right) \theta_1^*$$

Optimality (ctd)

$$\downarrow h_1 \rightarrow \downarrow NFA_2 \rightarrow \downarrow w_1$$

$$\underbrace{F'(h_1)u'(c) - v'(h_1)}_{\text{Labor wedge}} = \left(\frac{\Pi'(h_1)u'(c) + \frac{1}{1+r}\left[\Pi'(h_1)\, v'\big(\mathcal{H}(c)\big) - \Pi'(\mathcal{H}(c))\, v'(h_1)\right]\mathcal{H}'(c)}{1 - \frac{1}{1+r}F'(\mathcal{H}(c))\mathcal{H}'(c)} \right)\theta_1^*$$

Formalizing the results

Let $h_1(\cdot), c(\cdot)$ denote the solution to govt. problem and $\zeta(\cdot)$ the associated labor wedge.

- What are the effects of a change in foreign equity, keeping NFA constant ?

Formalizing the results

Proposition. If $\theta_1^* = 0$, then $\zeta(b_1, 0) = 0$. Suppose that regularity conditions hold. Then, if $\theta_1^* > 0$ we have that $\zeta(b_1, \theta_1^*) > 0$. Moreover, consider another portfolio $(\hat{b}_1, \hat{\theta}_1^*)$

$$\hat{\theta}_1^* = \theta_1^* + \varepsilon \quad \text{and} \quad \hat{b}_1 = b_1 + q_1 \varepsilon\,,$$

where $\varepsilon > 0$ and q_1 is the equity price associated with (b_1, θ_1^*), i.e.

$$q_1 \;=\; \frac{1}{1+r}\left[\Pi\Big(h_1(b_1, \theta_1^*)\Big) + \frac{1}{r}\,\Pi\Big(\mathcal{H}(c(b_1, \theta_1^*))\Big)\right].$$

we have that

$$c(\hat{b}_1, \hat{\theta}_1^*) < c(b_1, \theta_1^*) \qquad h_1(\hat{b}_1, \theta_1^*) < h_1(b_1, \theta_1^*)\,, \qquad \zeta(\hat{b}_1, \hat{\theta}_1^*) > \zeta(b_1, \theta_1^*)\,.$$

Simple Calibration

$$u\left(c\right)=\frac{c^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}},\qquad v\left(\ell_t\right)=\chi\frac{\ell^{1+\psi}}{1+\psi},\qquad F\left(h\right)=h^{\alpha},$$

Parameter	Description	Value
β	Discount factor	0.96
α	Labor Share	0.65
σ	Intertemporal elasticity	1
ψ	Inverse Frisch elasticity	1

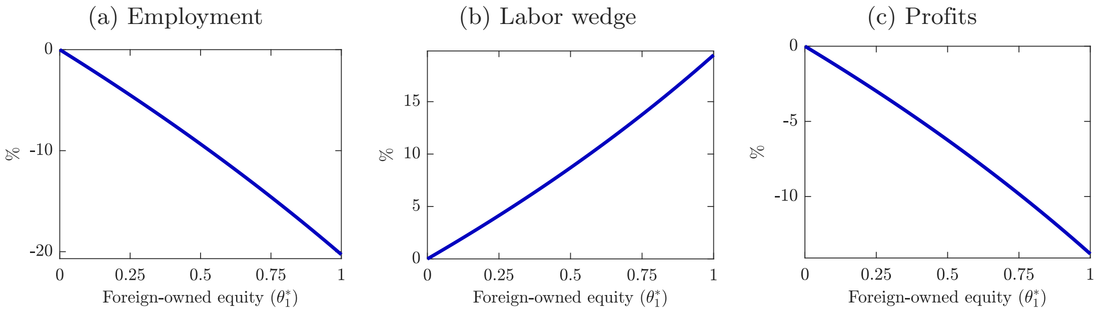
Simple Calibration

$$u\left(c\right)=\frac{c^{1-\frac{1}{\sigma}}}{1-\frac{1}{\sigma}}, \quad v\left(\ell_t\right)=\chi\frac{\ell^{1+\psi}}{1+\psi}, \quad F\left(h\right)=h^{\alpha},$$

Parameter	Description	Value
β	Discount factor	0.96
α	Labor Share	0.65
σ	Intertemporal elasticity	1
ψ	Inverse Frisch elasticity	1

- Initial NFA=-60% of GDP
    - Range of values for θ^*

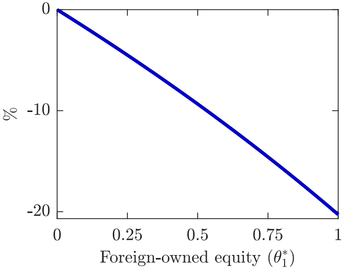
Optimal Policy as a function of Foreign Ownership

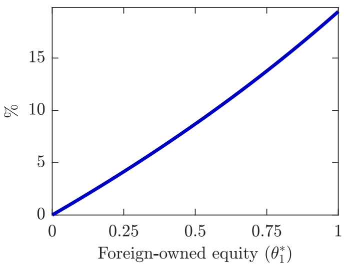

(a) Employment

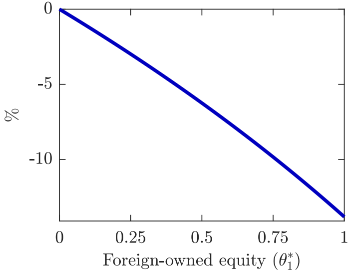
(b) Labor wedge

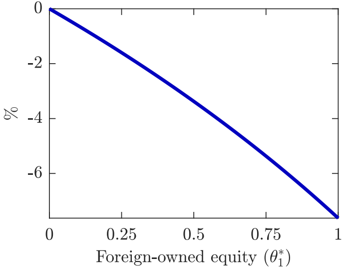
(c) Profits

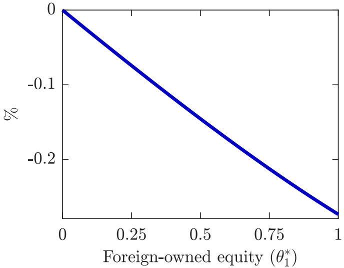
Notes: Allocations are in deviations relative to allocation with $\theta_1^* = 0$. $b_1 = -60\% + \tilde{q}\theta_1^*$.

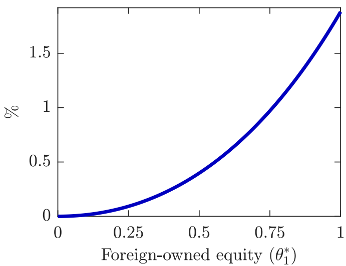

(a) Employment


(b) Labor wedge


(c) Profits


(d) Exchange Rate


(e) Consumption


(f) Welfare

Roadmap

1. Steady-state equilibrium $t \geq 2$ (flexible prices)
2. Equilibrium for $t \geq 1$ for given $\overline{W}$ and monetary policy
    - Optimal monetary policy at $t = 1$
3. **Equilibrium for $t \geq 0$**, given $\mathcal{E}(b_1, \theta_1{}^*)$
    - Optimal capital controls

Equilibrium for $t \geq 0$, given period-1 monetary policy

- Households are indifferent across portfolios at any equilibrium prices

Equilibrium for $t \geq 0$, given period-1 monetary policy

- Households are indifferent across portfolios at any equilibrium prices
- But on the aggregate, portfolio decisions affect future monetary policy

Equilibrium for $t \geq 0$, given period-1 monetary policy

- Households are indifferent across portfolios at any equilibrium prices
- But on the aggregate, portfolio decisions affect future monetary policy
  - Higher sales of equity induce a higher labor wedge in period 1

Equilibrium for $t \geq 0$, given period-1 monetary policy

- Households are indifferent across portfolios at any equilibrium prices
- But on the aggregate, portfolio decisions affect future monetary policy
  - Higher sales of equity induce a higher labor wedge in period 1
- And this affects initial asset prices through expectation of future dividends

Equilibrium for $t \geq 0$, given period-1 monetary policy

- Households are indifferent across portfolios at any equilibrium prices
- But on the aggregate, portfolio decisions affect future monetary policy
    - Higher sales of equity induce a higher labor wedge in period 1
- And this affects initial asset prices through expectation of future dividends
- However, households do not internalize that selling more equity, induces lower asset prices and wealth

Equilibria for $t \geq 0$

Given (b_0, θ_0^*), a period-1 exchange rate policy $\mathcal{E}(b_1, \theta_1^*)$ and associated allocations $h_1(b_1, \theta_1^*), c(b_1, \theta_1^*)$, there exists a continuum of competitive eqm. where $\{b_1, \theta_1^*, q_0\}$ satisfy

$$c(b_1, \theta_1^*) = F(\mathcal{H}(c(b_1, \theta_1^*))) - \Pi(\mathcal{H}(c(b_1, \theta_1^*)))\theta_0^* + q_0\,(\theta_1^* - \theta_0^*) + (1+r)b_0 - b_1$$

and

$$q_0 = \frac{1}{1+r}\left[\Pi\left(h_1(b_1, \theta_1^*)\right) + \frac{1}{r}\Pi\left(\mathcal{H}(c(b_1, \theta_1^*))\right)\right].$$

Optimal Capital Controls

- Equilibria are Pareto ranked

- When households sell more equity, $\downarrow q_0$, and this reduces households' resources
    - Similar mechanism to fire sale, but not no financial frictions!

- Role for capital controls
    - Assume government controls portfolios at $t = 0$ and no commitment for monetary policy at $t = 1$

Optimal Capital Controls

Central Bank sets θ_1^* while b_1 is chosen by households

$$V_0(b_0, \theta_0^*) = \max_{c_0, b_1, \theta_1^*} \left\{ u(c_0) - v(\mathcal{H}(c_0)) + \frac{1}{1+r} V_1(b_1, \theta_1^*) \right\}$$

subject to:

$$c_0 = F(\mathcal{H}(c_0)) - \Pi(\mathcal{H}(c_0))\theta_0^* + q_0(b_1, \theta_1^*)\,(\theta_1^* - \theta_0^*) + (1+r)b_0 - b_1$$

$$c_0 = c(b_1, \theta_1^*)$$

Optimal Capital Controls (ctd)

- If $\theta_0^* = 0$, then $\hat{\theta}_1^* = 0 \Rightarrow$ Full restriction of equity inflows
- If $\theta_0^* > 0$, government faces a tradeoff:
  - lower foreign equity holdings reduce labor wedge and improve asset prices
  - ...but the more SOE buys back equity, the higher the price it pays
- Optimal capital control $\hat{\theta}_1^* \in (0, \theta_0^*)$

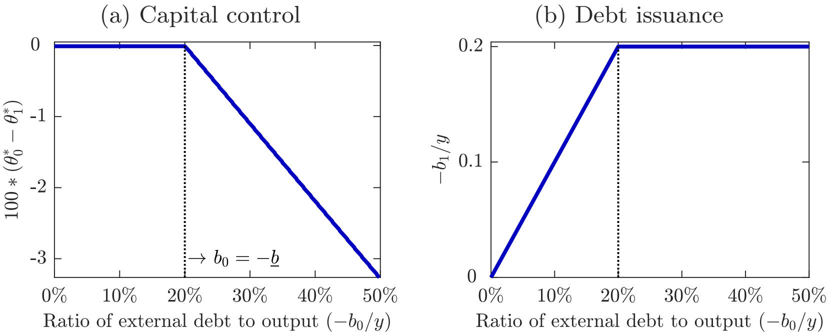
Extensions

Binding Borrowing Limits

- Suppose households face borrowing limit
- Selling equity desirable to smooth consumption
- Planner balances these benefits against reduced asset prices
- With $\theta_0^* = 0$, planner allows equity inflows

Binding Borrowing Limits

- Suppose households face borrowing limit
- Selling equity desirable to smooth consumption
- Planner balances these benefits against reduced asset prices
- With $\theta_0^* = 0$, planner allows equity inflows



Extension: Non-Tradables

- Suppose now $c_t = c(c^T, c^N)$ with c a CES aggregator
- Higher labor in non-tradables lowers P^N/P^T and reduces profits for *given wages*
- Depending on elasticity of substitution, optimal to have positive or negative labor wedge
- Optimal capital control policy: allows for inflows but set right mix between T and N equity flows to avoid distortionary exchange rate policy

Conclusions

- Equity flows are central to international capital markets
- Important implications for monetary policy:
  - Optimal to deviate from the natural allocation, raising real wages to reduce profits accrued to foreigners
- Ex-ante, households sell too much equity because they do not internalize incentive effects on central bank policy
  - Role for capital controls on equity flows

Conclusions

- Equity flows are central to international capital markets
- Important implications for monetary policy:
  - Optimal to deviate from the natural allocation, raising real wages to reduce profits accrued to foreigners
- Ex-ante, households sell too much equity because they do not internalize incentive effects on central bank policy
  - Role for capital controls on equity flows

Extra Slides

Non-tradable Good

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

Budget constraint:

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

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:

$$P_t^N \qquad U_N(C_t^T, C_t^N) \qquad \text{with } C^N \quad F^N(H^N)$$

Optimal Exchange Rate Policy

Proposition 3. Necessary condition for optimality:

$$\sum_j \left\{ \frac{\mathcal{P}_1^j}{E_1} \left[F'^j\left(\mathcal{H}_1^j\right) - \frac{v'\left(\mathcal{H}_1^j + \mathcal{H}_1^{-j}\right)}{U_j\left(\mathcal{C}_1^j, \mathcal{C}_1^{-j}\right)} \right] \frac{\partial \mathcal{H}_1^j}{\partial E_1} - \left(1 - \theta_1^j\right) \left[\frac{\partial\left(\Pi_1^j / E_1\right)}{\partial E_1} + \frac{1}{R-1} \frac{\partial\left(\Pi_{ss}^j / E_{ss}\right)}{\partial E_1} \right] \right\} = 0.$$

Question:

$$\exists \left(\theta_1^T, \theta_1^N\right) \neq (1,1) : \sum_j \left(1 - \theta_1^j\right) \left[\frac{\partial\left(\Pi_1^j / E_1\right)}{\partial E_1} + \frac{1}{R-1} \frac{\partial\left(\Pi_{ss}^j / E_{ss}\right)}{\partial E_1} \right] = 0 \ ?$$

A Simple Example

Consider a specification with isoelastic utility and production functions.

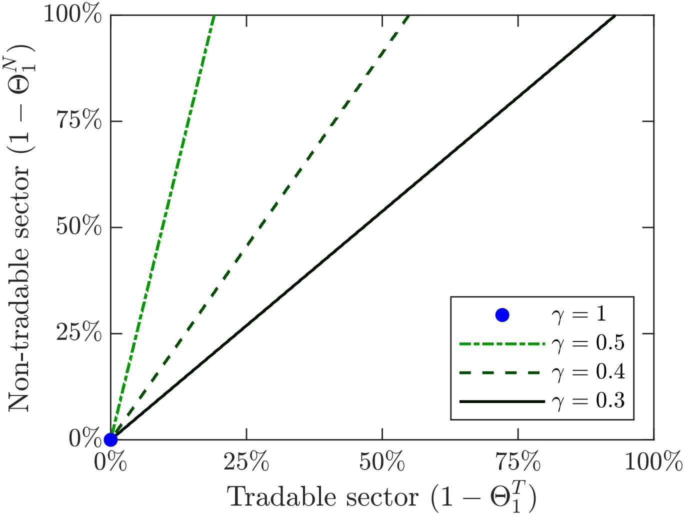
Firm profits in non-tradable sector:

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

where

$$\begin{aligned} c_{ss}^T = & I^T\left(H_1^T,\theta_1^T\right) + \frac{I^T\left(h_{ss}^T,\theta_1^T\right) - I^T\left(H_1^T,\theta_1^T\right)}{R} + (R-1)b_1 + \\ & -(1-\theta_1^N)\left\{\frac{\Pi_1^N}{E_1} + \frac{1}{R}\left[\frac{\Pi_{ss}^N}{E_{ss}} - \frac{\Pi_1^N}{E_1}\right]\right\} \end{aligned}$$

Optimal Composition of Equity Portfolio



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