When is Persistent Reserve Accumulation Optimal?

"Currency manipulation" in a model of money, banking and trade

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Motivation

Persistent accumulation of official reserves by central banks observed over the last twenty-five years.

For small emerging economies (EMEs), a growing literature accounts for this with two sets of explanations:

1. Precautionary savings: insurance against sudden stops and reversals of capital inflows – international macro-prudential policy.

2. "Mercantilism": deliberate real exchange rate undervaluation to promote exports, trade surpluses, and – via tradable sector externalities – growth.

Motivation

Both precautionary and mercantilist arguments for EME reserve accumulation require capital controls or other international capital market imperfections.

1. For precautionary saving models to work, capital market imperfections prevent private international borrowing from offsetting public savings (Ricardian Equivalence).

2. For mercantilist models to work, with complete capital controls (no private capital flows) government reserve accumulation *is more or less equivalent* to trade balance determination.

Motivation

However, rich countries also exhibit persistent reserve accumulation - countries at relatively low risk for capital flight, with well-developed financial markets and open capital accounts (Japan, Switzerland).

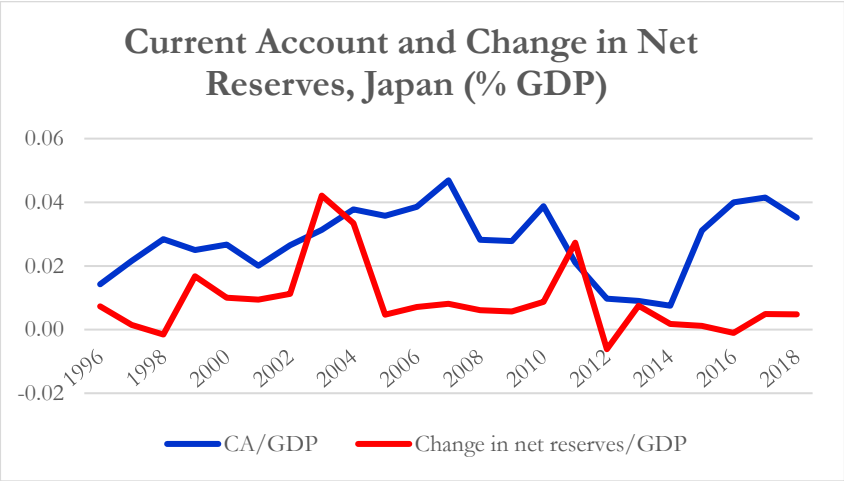
Why would they do this, with no precautionary motive? Does currency manipulation argument work? Issues:

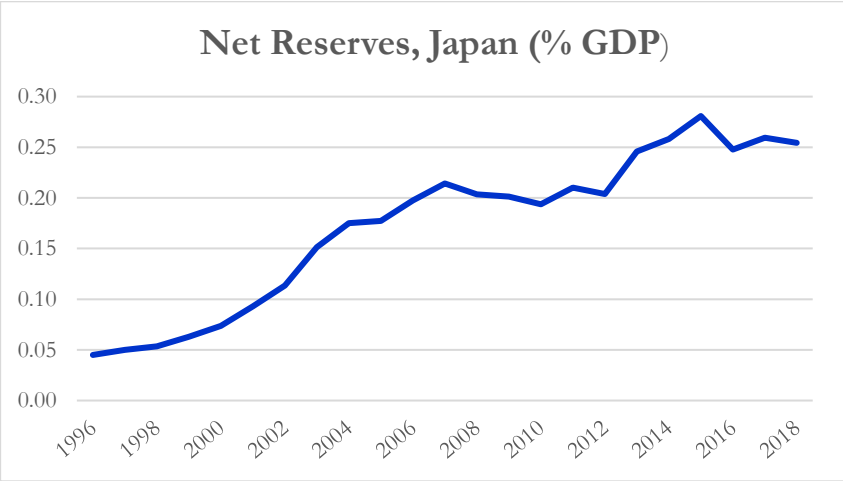
1. Cannot set a path for the trade balance by setting a path for official reserves with free private capital inflows.

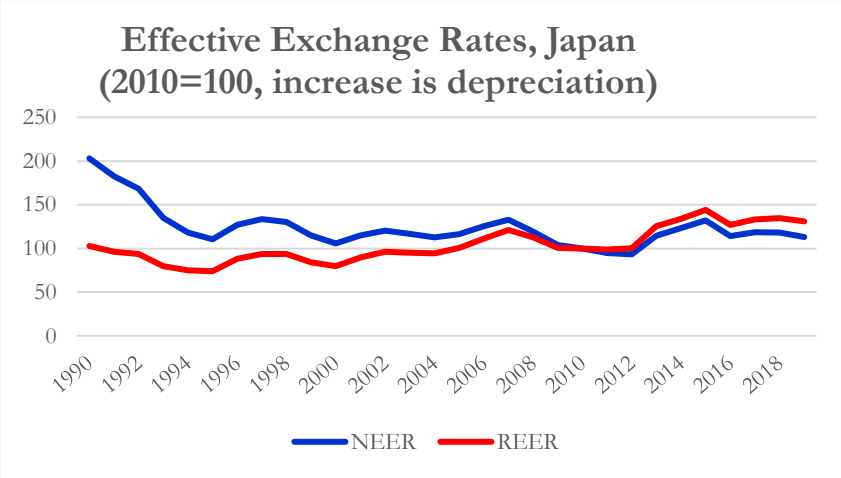
2. Currency manipulation hard to defend for *persistent* reserve accumulation: Cannot sustain real depreciation with nominal depreciation?

3. Policy trilemma/dilemmas kick in: Inflation/loss of independent monetary policy (or sterilization is needed and empirical evidence suggests this mutes nominal exchange rate effects in Japan, Switzerland)

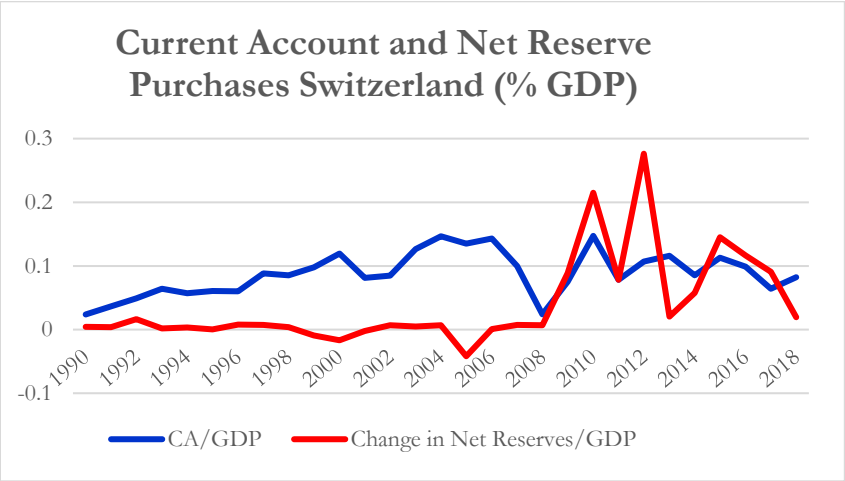
Data – Japan

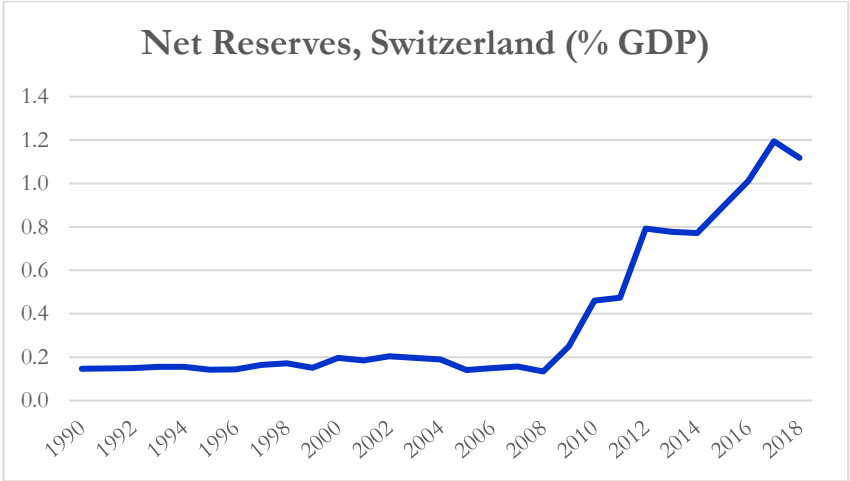

Current Account and Change in Net Reserves, Japan (% GDP)
0.06
0.04
0.02
0.00
-0.02
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
CA/GDP
Change in net reserves/GDP

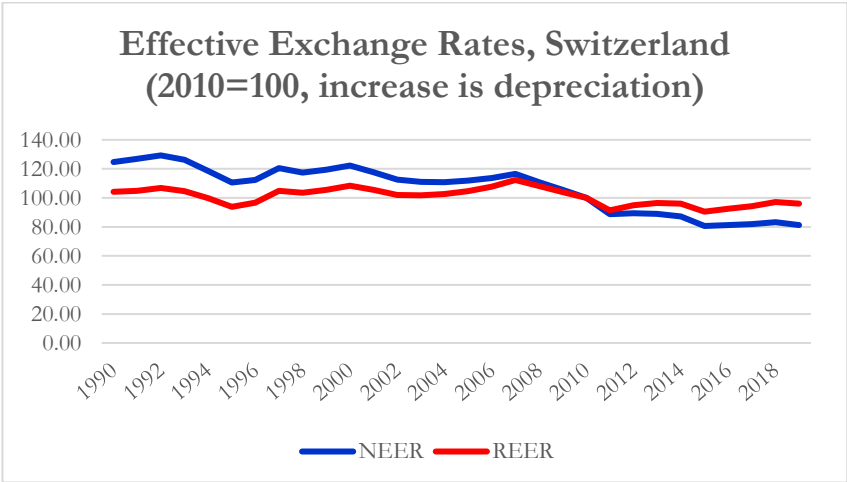

Net Reserves, Japan (% GDP)
0.30
0.25
0.20
0.15
0.10
0.05
0.00
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018


Effective Exchange Rates, Japan (2010=100, increase is depreciation)
250
200
150
100
50
0
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
NEER
REER

Data – Switzerland







This Paper

Develops a monetary model that delivers persistent reserve accumulation as equivalent to permanent targeting of the real exchange rate at a relatively depreciated value – under any capital account regime.

1. Real undervaluation ≠ nominal undervaluation in general.

2. Fiscal contraction sterilizes reserve accumulation, and preserves independent monetary policy/inflation goal.

3. Real undervaluation ≠ trade balance improvement under free capital flows but does so under capital controls even when the LOOP holds for tradable goods.

Key Features of the Model

Two country, two-good, pure exchange OLG economy. Marries an old model of money, with a classical model of the real exchange rate. Has three key features.

1. Two assets are valued by private agents in equilibrium:

   (i) Unbacked, national fiat currencies, valued for liquidity: $M_t,\ M_t^*$

   (ii) Privately issued interest-bearing consumption loans: $l_t,\ l_t^*$

2. Governments hold reserves of the liquid, return-dominated asset.

3. Prices fully flexible, LOOP holds continuously for tradable goods:

$$x = \frac{p^*}{p} \equiv \frac{p^{*N}/p^{*T}}{p^N/p^T} = \frac{ep^{*N}}{p^N}.$$

Three Key Results

Result 1. ("How") *There exists a steady state equilibrium in which one government unilaterally targets a constant RER, $\bar{x}$, depreciated relative to its non-targeting steady state value, $\bar{x} > x$, under any capital account regime. This is equivalent to permanent reserve accumulation.*

- Accomplished by constant *real* reserve adjustment, in NT goods:

$$\Delta f_t = \Delta f \propto (\bar{x} - x)\ \forall t, \quad \rightarrow \quad \frac{\Delta F_{t+1}}{\Delta F_t} = \sigma^* > 1.$$

- Sterilization: $g \downarrow$ and $g^* \uparrow$ endogenously, accommodating the constraint placed by Δf on available seigniorage revenue, at constant money growth rates (σ, σ^*).

Three Key Results

Result 2. (Macroeconomic effects) Under capital controls, targeting $\bar{x} > x$ permanently raises the trade balance of the targeting country. Under free capital flows, there are no trade balance effects BUT real activity stabilizes completely after one period.

Capital controls: A lower $p = p^*/\bar{x}$ reduces the T value of domestic loans:

$$\uparrow R^T, \downarrow c^T, \uparrow TB^T;$$

A higher $p^* = p\bar{x}$ increases the T value of foreign loans:

$$\downarrow R^{*T}, \uparrow c^{*T}, \downarrow TB^{*T}.$$

Free capital flows: RER (target) cannot influence arbitraged T returns:

$$R^T = R^{*T};$$

No change in $c^T, c^{*T}, TB^T, TB^{*T}$.

Three Key Results

Comments on results 1 and 2.

1. That mercantilism rationalizes reserve accumulation (only) under capital controls surprises nobody.

2. The mechanism for long-run trade balance improvement, however, is via the inter-temporal price, not intra-temporal relative price, of traded goods.

3. The stabilization of real activity via reserve accumulation under free capital flows is also attainable by introducing capital controls (although the two policies have very different welfare consequences).

Three Key Results

Result 3. (Welfare effects of reserve accumulation)

Free capital flows

i) There is an initial period/generation welfare gain for a targeting country, because of a one-time $\downarrow p_1^N$.

ii) Stabilization vs. the transition path of the economy *absent* reserve accumulation can ↑ welfare for every generation, $2 \leq t < \infty$, but only in countries that would otherwise experience $\downarrow x_t$ over time.

iii) Steady state welfare unambiguously ↓ for the targeting country: $\bar{x} > x$ hurts targeting country savers who hold foreign currency for liquidity (save NT, consume NT*).

Three Key Results

Result 3. (Welfare effects of reserve accumulation)
Capital controls

i) There is an unambiguous initial period/generation welfare gain for a targeting country, because of a one-time $\downarrow p_1^N$.

ii) Ambiguous steady state welfare and distributional effects:

$\uparrow R^T$ reduces the lifetime utility of borrowers, increases that of savers who lend.

$\bar{x} > x$ hurts targeting country savers who hold foreign currency for liquidity (save NT, consume NT*).

Rest of the Talk

Outline

1. Flesh out the model

2. Market clearing conditions illustrating key mechanisms

3. Results: A couple of welfare propositions, focusing on the open capital account case.

The Model

Environment

1. Two country world, lives forever, time discrete *t=1,2,…*

2. Two non-storable final consumption goods; T and NT.

3. Two symmetric locations within each country, each inhabited by an infinite sequence of two-period lived overlapping generations.

4. In a third, central location the government resides, can access private sector locations to purchase NT goods, inject currency.

The Model

Agents, preferences, and endowments

A continuum of young agents with unit mass assigned to each location in a country, $\forall t$.

- ψ *ex ante* identical workers
- $1 - \psi$ identical entrepreneurs

An initial old generation comprises a unit mass of identical generation 0 agents, who hold M_0 (M_0^*) and claims to the entire $t = 1$ per capita traded good output of their location.

The Model

Agents, preferences, and endowments

Workers of generation *t* consume and produce NT goods.

$$u_{w,t}(c^N) = ln\,(c^N_{y,t}) + \beta E_t ln\left(c^N_{o,t+1}\right)$$

$$\left(e^N_y, e^N_o\right) = (y, 0)$$

- Workers are lenders/savers.

Analogous preferences and endowments for foreign workers.

The Model

Agents, preferences, and endowments

Entrepreneurs of generation *t* consume and produce T goods:

$$u_{e,t}(c^T) = ln(c^T_{y,t}) + \beta\, ln\left(c^T_{o,t+1}\right)$$

$$\left(e^T_y, e^T_o\right) = (0, q)$$

- Entrepreneurs are borrowers.

Analogous preferences and endowments for foreign borrowers.

The Model

Trade

Each period comprises two trading sub-periods: "Local trade" followed by "spatial trade".

Local Trade

- At the beginning of a period, there is no communication between locations, and no inter-location movement of any agent or commodity.
- Young and old workers, and the national government, trade locally in NT goods. NT markets clear autarkically within each location.

The Model

Trade

Spatial Trade

- Inter-location trade is costless, and there is full and perfect communication between agents in different locations.

- Young workers, young and old entrepreneurs, and governments all can trade in assets (currencies, loans – if open capital account) and T goods globally.

The Model

Idiosyncratic liquidity shocks

Stochastic relocations of young workers, at the end of period *t* when all markets closed, in which event they can only carry currency with them (value of remotely issued private loans cannot be verified by young workers in local trade at *t+1*).

Probability of relocation at *t*		Assets valued at *t+1*
π		$M_t,\ M_t^*$
$\varepsilon\,\pi$	(domestic relocation)	M_t
$(1-\varepsilon)\pi$	(international relocation)	M_t^*

The Model

Idiosyncratic liquidity shocks

All assets held by a *relocated* agent, other than the national currency of his new location, have no value.

- Banks arise to insure young workers against these shocks, accepting their deposits and offering state contingent deposit returns.

- Play Nash, choose deposit returns to maximize the expected lifetime utility of a young worker in order to attract deposits, taking other banks' deposit returns as given.

The Model

Banks

In the equilibria I analyze currency is return-dominated by loans.

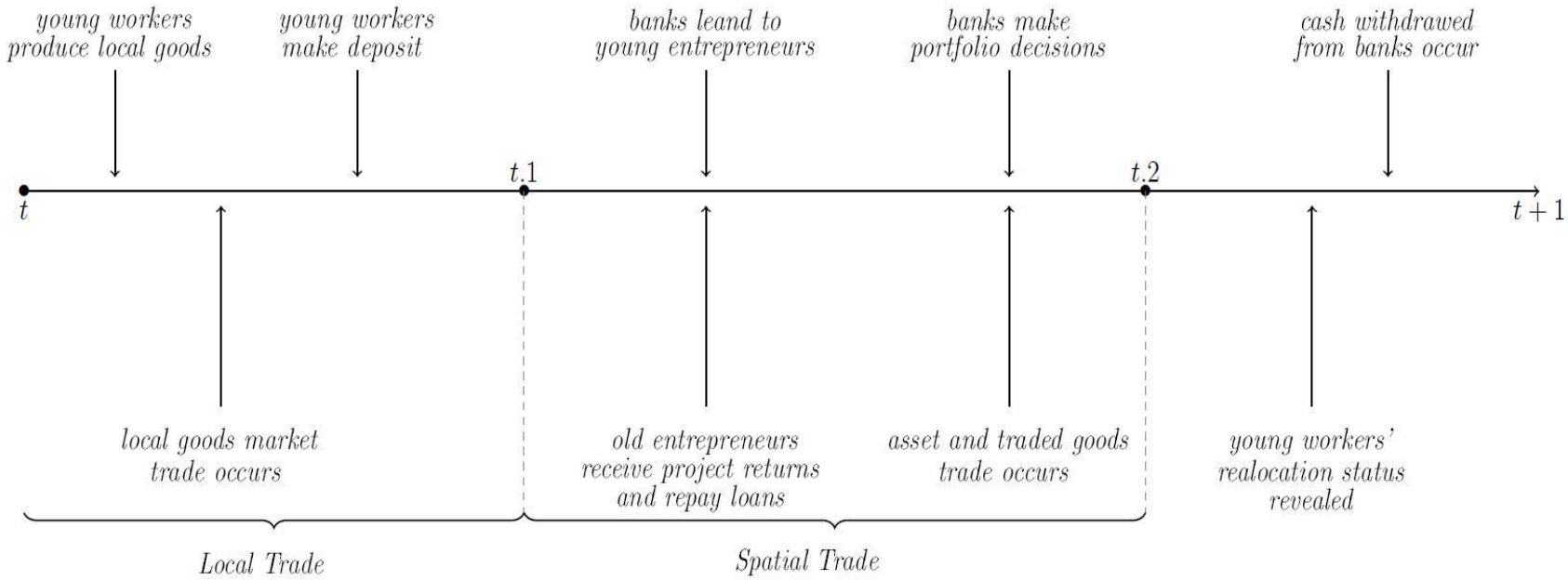
Optimal asset portfolio shares		Returns in domestic NT goods
domestic currency	$\varepsilon\pi$	$\frac{p_t^N}{p_{t+1}^N}$
foreign currency	$(1-\varepsilon)\pi$	$\frac{p_t^{*N}}{p_{t+1}^{*N}}\left(\frac{x_{t+1}}{x_t}\right)$
loans	$(1-\pi)$	$R_{t+1}^T \frac{p_t}{p_{t+1}}$

Total deposits backed by these assets $d_t = \frac{\beta y}{1+\beta}$

Analogous solutions for foreign banks.

The Model

Figure 1: Timing of Transactions



The Model

Governments

Monetary policy: set constant growth rates of money outstanding in hands of the public, seigniorage revenue finances consumption of NT goods.

$$\frac{M_t}{M_{t-1}} = \sigma > 1, t \geq 1,$$

$$\frac{M_t^*}{M_{t-1}^*} = \sigma^* > 1, t \geq 1.$$

Real exchange rate targeting: domestic government targets a constant real exchange rate, via reserve accumulation

$$x_t = \bar{x} > max(x_1, x)\,,\ \forall t \geq 1.$$

The Model

Governments

The foreign government never targets its real exchange rate, nor responds to domestic government targeting.

$$m_t - m_{t-1}\frac{p_{t-1}^N}{p_t^N} = \underbrace{g_t}_{} + \underbrace{\frac{e_t}{p_t^N}(F_t - F_{t-1})}_{},$$

seigniorage revenue *NT consumption* *foreign reserve purchase* Δf_t

$$m_t^* - m_{t-1}^*\frac{p_{t-1}^{*N}}{p_t^{*N}} = \underbrace{g_t^*}_{} - \underbrace{\frac{(F_t - F_{t-1})}{p_t^{*N}}}_{\frac{\Delta f_t}{x_t}}.$$

Equilibrium

Money markets (outstanding in the hands of the public)

$$m_t = \frac{M_t}{p_t^N} = \frac{\varepsilon\pi\psi\beta y}{1+\beta} + \frac{(1-\varepsilon^*)\pi^*\psi\beta y^* x_t}{1+\beta}$$

per capita real supply *domestic bank purchases* *foreign bank purchases*

$$m_t^* = \frac{M_t^*}{p_t^{*N}} = \frac{\varepsilon^*\pi^*\psi\beta y^*}{1+\beta} + \frac{(1-\varepsilon)\pi\psi\beta y/x_t}{1+\beta}.$$

per capita real supply *foreign bank purchases* *domestic bank purchases*

Equilibrium

Note: In any steady state, or with a RER target $\bar{x}$:

$$x_t = x \rightarrow \qquad m_t = m \rightarrow$$

$$\frac{p_{t+1}^N}{p_t^N} = \sigma \qquad \frac{p_{t+1}^{*N}}{p_t^{*N}} = \sigma^* \qquad \frac{e_{t+1}}{e_t} = \frac{x_{t+1}}{x_t}\frac{p_{t+1}^N}{p_t^N}\frac{p_t^{*N}}{p_{t+1}^{*N}} = \frac{\sigma}{\sigma^*}$$

In addition: With a RER target $\bar{x} > max(x_1, x)$

$$\rightarrow \quad \bar{p}_1^N < p_1^N, \qquad \bar{p}_1^{*N} > p_1^{*N}.$$

There is an initial period “internal devaluation”, which mitigates the need for nominal depreciation (and increases initial old welfare).

Equilibrium

Traded goods market

$$q + q^* = \frac{q}{(1+\beta)R_{t+1}^T} \quad \frac{q^*}{(1+\beta)R_{t+1}^{*T}} + \frac{(q+q^*)\beta}{(1+\beta)}, t > 1.$$

Note: Under free capital flows, with $R_{t+1}^T = R_{t+1}^{*T}$, the unique solution is

$$R_{t+1}^T = R_{t+1}^{*T} = 1, \quad \forall t > 1.$$

Equilibrium

Traded goods market:

Under free capital flows, RER/reserve policy cannot influence:

1. **Tradable returns**

$$R_{t+1}^{T} = R_{t+1}^{*T} = 1, \quad \forall t > 1.$$

2. **Tradable borrowing and consumption** of young ents

$$\frac{q}{(1+\beta)R_{t+1}^{T}} \; \forall t \geq 1.$$

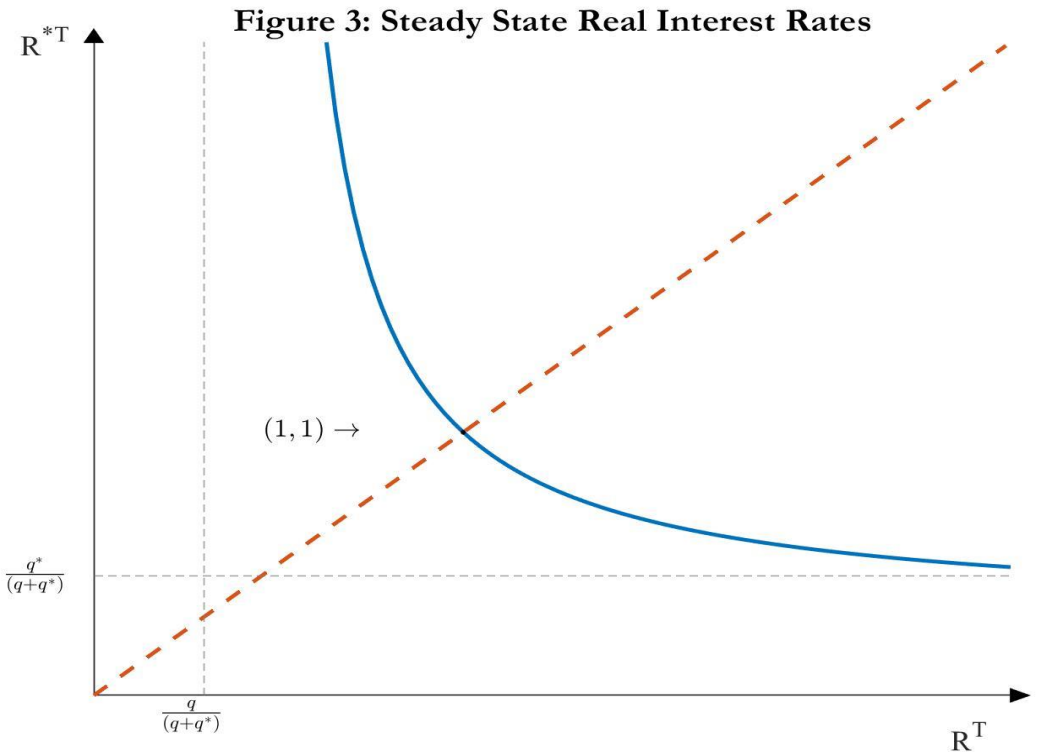
3. **Trade balances**

$$TB_1^T = q - \frac{q}{(1+\beta)R_2^T} = 0, \;\; t = 1.$$

$$TB_t^T = q - \frac{q}{(1+\beta)R_{t+1}^T} - \frac{q\beta}{(1+\beta)} = 0, \;\; \forall t > 1.$$

Equilibrium

Under capital controls, for traded goods markets to clear, an inverse relationship between domestic and foreign tradable returns obtains at every date, including in the steady state:



Equilibrium

Loan market under free capital flows

$$\frac{\psi(1-\pi)\beta y p_t}{(1+\beta)} + \frac{\psi(1-\pi^*)\beta y^* p_t^* (= p_t x_t)}{(1+\beta)} = \frac{(1-\psi)q}{(1+\beta)R_{t+1}^T} + \frac{(1-\psi)q^*}{(1+\beta)R_{t+1}^{*T}}$$

per capita world loan supply by banks, in T goods *per capita world loan demand*

$$R_{t+1}^T = R_{t+1}^{*T}$$

Note: Since $R_{t+1}^T = R_{t+1}^{*T} = 1 \ \vee t > 1$, targeting $x_t = \bar{x}, \forall t \rightarrow$

$$p_t = p, \qquad p_t^* = p^* = p\bar{x}, \qquad \forall t > 1.$$

Equilibrium

Loan markets under capital controls

$$\underbrace{\frac{(1-\pi)\psi\beta y p_t}{(1+\beta)}}_{\text{per capita bank loan supply in T goods}} = \underbrace{\frac{(1-\psi)q}{(1+\beta)R_{t+1}^{T}}}_{\text{per capita entrepreneur loan demand}}$$

$$\underbrace{\frac{(1-\pi^*)\psi\beta y^* p_t^*}{(1+\beta)}}_{\text{per capita bank loan supply in T goods}} = \underbrace{\frac{(1-\psi)q^*}{(1+\beta)R_{t+1}^{*T}}}_{\text{per capita entrepreneur loan demand}}$$

Note: A RER/reserve policy of $\bar{x} > max(x_1, x) \rightarrow \downarrow p_t, \uparrow p_t^*$ relative to equilibrium *absent* a target, and $\uparrow R_{t+1}^{T}, \downarrow R_{t+1}^{*T}$.

Equilibrium

Nontraded goods markets $t > 1$

$$\underbrace{\psi y}_{\text{young worker supply}} = \underbrace{\frac{\psi y}{1+\beta}}_{\text{young worker consumption}} + \underbrace{m_{t-1}\frac{p_{t-1}^N}{p_t^N}}_{\text{relocated old workers}} + \underbrace{g_t}_{\text{govt}} + \underbrace{\frac{(1-\pi)\psi\beta y}{1+\beta} R_t^T \frac{p_{t-1}}{p_t}}_{\text{old non-movers}}$$

$$\psi y = \frac{\psi y}{1+\beta} + \frac{\varepsilon\pi\psi\beta y}{1+\beta} + \frac{(1-\varepsilon^*)\pi^*\psi\beta y^* x_t}{1+\beta} - \Delta f_t + \frac{(1-\pi)\psi\beta y}{1+\beta} R_t^T \frac{p_{t-1}}{p_t}$$

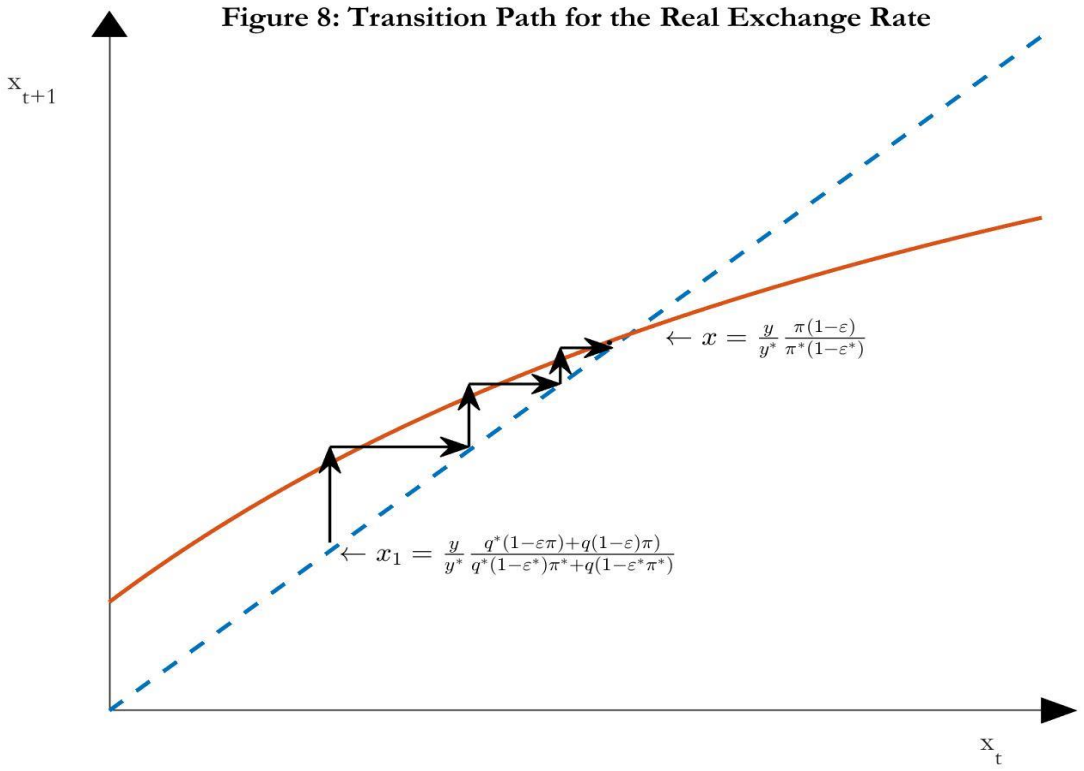
$$\psi y^* = \frac{\psi y^*}{1+\beta} + \frac{\varepsilon^*\pi^*\psi\beta y^*}{1+\beta} + \frac{(1-\varepsilon)\pi\psi\beta y}{(1+\beta)x_t} + \frac{\Delta f_t}{x_t} + \frac{(1-\pi^*)\psi\beta y^*}{1+\beta} \frac{R_t^T x_{t-1} p_{t-1}}{x_t p_t}$$

Note: Either two equations in $(x_t, p_t)|\Delta f_t = 0$ or two equations in $(\Delta f_t, p_t)|x_t = \bar{x}$.

Equilibrium

Free capital flows without RER /reserve policy

The economy exhibits monotone equilibrium dynamics, converges asymptotically to a unique steady state.



Equilibrium

Free capital flows without RER/reserve policy

Steady state equilibrium

$$x^{FK} = \left(\frac{y}{y^*}\right)\left(\frac{\pi(1-\varepsilon)}{\pi^*(1-\varepsilon^*)}\right)$$

$$p^{FK} = \frac{p^{*FK}}{x^{FK}} \propto \left(\frac{(1-\psi)(q+q^*)}{\psi\beta y}\right)$$

$$R^{T,FK} = R^{*T,FK} = 1.$$

Equilibrium

Capital controls without RER /reserve policy

The economy can attain a unique SS equilibrium at $t = 2$; NT goods market clearing conditions are completely static.

$$\psi y = \frac{\psi y}{1+\beta} + \frac{\varepsilon\pi\psi\beta y}{1+\beta} + \frac{(1-\varepsilon^*)\pi^*\psi\beta y^* x_t}{1+\beta} - \Delta f_t + \frac{(1-\psi)q}{(1+\beta)}\frac{1}{p_t}$$

$$\psi y^* = \frac{\psi y^*}{1+\beta} + \frac{\varepsilon^*\pi^*\psi\beta y^*}{1+\beta} + \frac{(1-\varepsilon)\pi\psi\beta y}{(1+\beta)x_t} + \Delta f_t/x_t + \frac{(1-\psi)q^*}{1+\beta}\frac{1}{x_t p_t}$$

Note: Capital controls eliminate persistent equilibrium dynamics in real activity observed under free capital flows.

Equilibrium

Capital controls without RER/reserve policy

Steady state equilibrium

$$x^{KK} = \left(\frac{y}{y^*}\right)\left(\frac{(1-\varepsilon\pi)+(q/q^*)\pi(1-\varepsilon)}{\pi^*(1-\varepsilon^*)+(q/q^*)(1-\varepsilon^*\pi^*)}\right)$$

$$R^{TKK} \neq R^{TKK} \qquad unless$$

a) countries are completely symmetric, or
b) countries have comparable aggregate liquidity needs π, π^*

The country with relatively high π and low $1-\pi$ (loan supply) has the relatively high R^T, relatively low c^T, and runs a $TB^T > 0$.

Equilibrium

Free capital flows with RER/reserve policy

World loan market yields a constant equilibrium p_t from $t = 2$.
The T goods market yields a constant $R^T = R^{*T} = 1$ from $t = 2$.

All dynamics originating in NT goods markets stabilize from $t = 2$, and the economy attains a SS.

$$\psi y = \frac{\psi y}{1+\beta} + \frac{\varepsilon\pi\psi\beta y}{1+\beta} + \frac{(1-\varepsilon^*)\pi^*\psi\beta y^*\bar{x}}{1+\beta} - \Delta f + \frac{(1-\pi)\psi\beta y}{1+\beta}$$

Equilibrium

Free capital flows with RER/reserve policy

Steady state equilibrium

$$\Delta f^{FK} = (\bar{x} - x^{FK})\left(\frac{\psi\beta}{1+\beta}\right)(y^*(1-\varepsilon^*)\pi^*)$$

$$\bar{p}^{FK} = \frac{\bar{p}^{*FK}}{\bar{x}} = \left(\frac{(1-\psi)(q+q^*)}{\psi\beta}\right)\left(\frac{1}{y(1-\pi)+y^*\bar{x}(1-\pi^*)}\right)$$

$$\bar{R}^{T,FK} = \bar{R}^{*T,FK} = 1.$$

Note: The higher are foreign bank holdings of domestic currency, the larger is the Δf^{FK} required to sustain a given target.

Equilibrium

Free capital flows with RER/reserve policy

Steady state equilibrium

Fiscal policy: g and g^* endogenously adjust, but Δf, and hence $\bar{x}$, must satisfy an upper bound for $\bar{g}^{FK} \geq 0$.

$$\bar{m}^{FK}\left(\frac{\sigma-1}{\sigma}\right) = \Delta f^{FK} + \bar{g}^{FK}$$

$$\bar{m}^{*FK}\left(\frac{\sigma^*-1}{\sigma^*}\right) = \bar{g}^{*FK} - \frac{\Delta f^{FK}}{\bar{x}}.$$

$$\bar{g}^{FK} = (\bar{x}^{max} - \bar{x})\left(\frac{1}{\sigma}\right)\left(\frac{\psi\beta}{1+\beta}\right) y^*(1-\varepsilon^*)\pi^*$$

$$\bar{g}^{*FK} = \left(\bar{x} - \bar{x}^{min}\right)\left(\frac{1}{\sigma^*}\right)\left(\frac{\psi\beta}{1+\beta}\right)\frac{y^*(\sigma^*-\varepsilon^*)\pi^*}{\bar{x}}$$

Equilibrium

Free capital flows with RER/reserve policy

Steady state equilibrium

Fiscal and monetary policy: g and g^* endogenously adjust, but Δf, and hence $\bar{x}$, must satisfy an upper bound for $\bar{g}^{FK} \geq 0$: $\bar{x}^{max} \geq \bar{x}$, which is increasing in the money growth rate.

$$\bar{x}^{max} = \frac{y}{y^*} \frac{\pi(\sigma - \varepsilon)}{\pi^*(1 - \varepsilon^*)},$$

$$\bar{x}^{max} > x^{FK} > \bar{x}^{min}$$

$$\frac{\partial \bar{x}^{max}}{\partial \sigma} > 0$$

Welfare

Steady state welfare under free capital flows

"Aggregate" steady state welfare

$$w(c) = \psi\left(ln\left(\frac{y}{1+\beta}\right) + \varepsilon\pi\beta ln\left(\frac{\varepsilon\pi\beta y}{(1+\beta)\sigma}\right) + (1-\varepsilon)\pi\beta ln\left(\frac{(1-\varepsilon)\pi\beta y}{(1+\beta)\sigma^* x}\right)\right.$$
$$\left. + (1-\pi)\beta\ln\left(\frac{(1-\pi)\beta y}{1+\beta}\right)\right) + (1-\psi)\left(ln\left(\frac{q}{1+\beta}\right) + \beta\ln\left(\frac{q\beta}{1+\beta}\right)\right),$$

$$w^*(c^*) = \psi\left(ln\left(\frac{y^*}{1+\beta}\right) + \varepsilon^*\pi^*\beta ln\left(\frac{\varepsilon^*\pi^*\beta y^*}{(1+\beta)\sigma^*}\right) + (1-\varepsilon^*)\pi^*\beta ln\left(\frac{(1-\varepsilon^*)\pi^*\beta y^* x}{(1+\beta)\sigma}\right)\right.$$
$$\left. + (1-\pi^*)\beta\ln\left(\frac{(1-\pi^*)\beta y^*}{1+\beta}\right)\right) + (1-\psi)\left(ln\left(\frac{q^*}{1+\beta}\right) + \beta\ln\left(\frac{q^*\beta}{1+\beta}\right)\right)$$

Only domestic (foreign) workers who hold foreign (domestic) currency experience steady state welfare changes across regimes.

Welfare

Steady state welfare under free capital flows

Steady state welfare effects of RER/reserve policy

$$\Delta w(c) = \psi(1-\varepsilon)\pi\beta ln\left(\frac{x^{FK}}{\bar{x}}\right) < 0,$$

$$\Delta w^*(c^*) = \psi(1-\varepsilon^*)\pi^*\beta ln\left(\frac{\bar{x}}{x^{FK}}\right) > 0.$$

Domestic workers who save domestic NT goods and consume foreign NT goods experience a decline in PP; the converse is true of foreign workers who save foreign and consume domestic NT goods.

Welfare

Initial period welfare under free capital flows

Initial period welfare effects of RER target/reserve policy

$$\Delta w_1(c_1) = \psi\beta ln\left(\left(\frac{M_0 + q\bar{p}_1^{T,FK}}{\bar{p}_1^{N,FK}}\right) / \left(\frac{M_0 + qp_1^{T,FK}}{p_1^{N,FK}}\right)\right) > 0$$

$$\Delta w_1^*(c_1^*) = \psi\beta ln\left(\left(\frac{M_0^* + q^*\bar{p}_1^{*T,FK}}{\bar{p}_1^{*N,FK}}\right) / \left(\frac{M_0^* + q^*p_1^{*T,FK}}{p_1^{*N,FK}}\right)\right) < 0$$

Initial old agents holding domestic currency and claims to traded goods benefit from lower initial NT price, in currency and T goods; the converse is true of initial old foreign agents.

Welfare

Relative to transition path under free capital flows

Effects of RER target/reserve policy for generation $1 \leq t < \infty$

SS vs. monotone dynamics → the same sign for every generation.

$$\Delta w_t = \psi\left(\varepsilon\pi\beta ln\left(\left(\frac{1}{\sigma}\right)/\left(\frac{p_{t-1}^{N,FK}}{p_t^{N,FK}}\right)\right) + (1-\varepsilon)\pi\beta ln\left(\left(\frac{1}{\sigma^*\bar{x}}\right)/\left(\frac{p_{t-1}^{*N,FK}}{x_{t-1}^{FK}p_t^{*N,FK}}\right)\right) \right.$$
$$\left. + (1-\pi)\beta \ln\left(1/\left(\frac{p_{t-1}^{FK}}{p_t^{FK}}\right)\right)\right)$$

$$\Delta w_t^* = \psi\left(\varepsilon^*\pi^*\beta ln\left(\left(\frac{1}{\sigma^*}\right)/\left(\frac{p_{t-1}^{*N,FK}}{p_t^{*N,FK}}\right)\right) + (1-\varepsilon^*)\pi^*\beta ln\left(\left(\frac{\bar{x}}{\sigma}\right)/\left(\frac{x_{t-1}^{FK}p_{t-1}^{N,FK}}{p_t^{N,FK}}\right)\right) \right.$$
$$\left. + (-\pi^*)\beta \ln\left(1/\left(\frac{p_{t-1}^{FK}x_{t-1}^{FK}}{p_t^{FK}x_t^{FK}}\right)\right)\right)$$

Welfare

Relative to transition path under free capital flows

Effects of RER/reserve policy for generation $1 \leq t < \infty$

Proposition. *Let* $\hat{\pi} \equiv \frac{q^*\pi^*(1-\varepsilon^*)}{q^*\pi^*(1-\varepsilon^*)+q(1-\pi^*)(1-\varepsilon)}$. *Then:*

a) The lifetime utility of domestic workers who use "own", domestic currency to purchase non-traded goods is $\lesseqgtr$ *that in the absence of a target iff* $\pi \gtreqless \hat{\pi}$.

b) The lifetime utility of domestic workers using foreign currency to purchase non-traded goods abroad $<$ *that in the absence of a target.*

c) The lifetime utility of domestic workers using tradable loan proceeds to purchase local non-traded goods $\lesseqgtr$ *that in the absence of a target iff* $\pi \gtreqless \hat{\pi}$.

Welfare

Relative to transition path under free capital flows

Effects of RER/reserve policy for generation $1 \leq t < \infty$.

1. The RER is *always* below the target value on any transition path, so – crudely – old workers consuming foreign NT goods via foreign currency are always strictly worse off with a target.

2. Now consider $\pi \geq \hat{\pi}$. A high value of π relative to π^* implies an unambiguous welfare loss of RER/reserve targeting for every generation at every finite date, relative to the transition path: Old workers using domestic currency and checks backed by loan income are also worse off.

Welfare

Transition path under free capital flows

a) $\pi \geq \hat{\pi}$ implies relatively low bank lending and low loan return income of non-movers in NT goods markets from $t \geq 2$.

b) The x_t that clears the NT goods market at $t \geq 2$ is higher than x_1 (initial old workers have no loan income) to raise the PP of internationally relocated foreign workers.

c) $x_t = \frac{p_t^*}{p_t} = \frac{e_t p_t^{N*}}{p_t^N} \uparrow$ and $p_t \downarrow$ on the transition path

$$R_t^N = \frac{R_t^T p_{t-1}}{p_t} > 1 \qquad \text{(return to loans higher)}$$

$$\frac{p_t^N}{p_{t-1}^N} < \sigma \rightarrow \frac{p_{t-1}^N}{p_t^N} > \frac{1}{\sigma} \qquad \text{(return to currency higher)}$$

Welfare

Relative to transition path under free capital flows

Effects of RER/reserve policy for generation $2 \leq t < \infty$

For a country with free capital flows to experience aggregate welfare gains from stabilizing real activity with a RER/reserve policy, relative to the equilibrium transition path, two conditions must be satisfied:

$$a)\ \pi < \hat{\pi} \equiv \frac{q^*\pi^*(1-\varepsilon^*)}{q^*\pi^*(1-\varepsilon^*) + q(1-\pi^*)(1-\varepsilon)}$$

$$b)\ |(1-\varepsilon)\pi\beta ln\left(\left(\frac{1}{\sigma^*\bar{x}}\right)/\left(\frac{\check{p}_{t-1}^{*N}}{\check{x}_{t-1}\check{p}_t^{*N}}\right)\right)| <$$

$$\varepsilon\pi\beta ln\left(\left(\frac{1}{\sigma}\right)/\left(\frac{\check{p}_{t-1}^{N}}{\check{p}_t^{N}}\right)\right) + \ (1-\pi)\beta \ln\left(1/\left(\frac{\check{p}_{t-1}}{\check{p}_t}\right)\right)$$

Conclusion

Trying to rationalize persistent reserve accumulation, especially for large and rich countries with open capital accounts.

1. You can do it, and it is not inflationary, with fiscal consolidation and coordination of fiscal and reserve policy.

2. Steady state welfare effects *always* negative.

3. There is also *always* an initial period welfare gain from internal devaluation.

4. Stabilizing real activity may be welfare enhancing for countries with otherwise appreciating real exchange rates, countries with $\pi < \hat{\pi}$.

Conclusion

An alternative stabilization policy is introducing capital controls.

1. This always redistributes consumption across lenders and borrowers, for $\pi \neq \hat{\pi}$, by changing R^T: Has ambiguous steady state and transition-path welfare consequences.

2. Makes more sense for countries with $\pi > \hat{\pi}$ (China?) since for these countries there are unambiguous welfare losses from RER targeting with an open capital account vs. transition path.

3. RER/reserve targeting in addition to capital controls ("looks like" currency manipulation, if $\varepsilon > 1 - \varepsilon^*$) improves the trade balance via $\uparrow R^T$ that hurts domestic entrepreneurs.