Foreign Exchange Intervention Redux

Roberto Chang

Rutgers University and NBER

November 2017

Introduction and Motivation

Polar views about foreign exchange intervention:

Introduction and Motivation

Polar views about foreign exchange intervention:

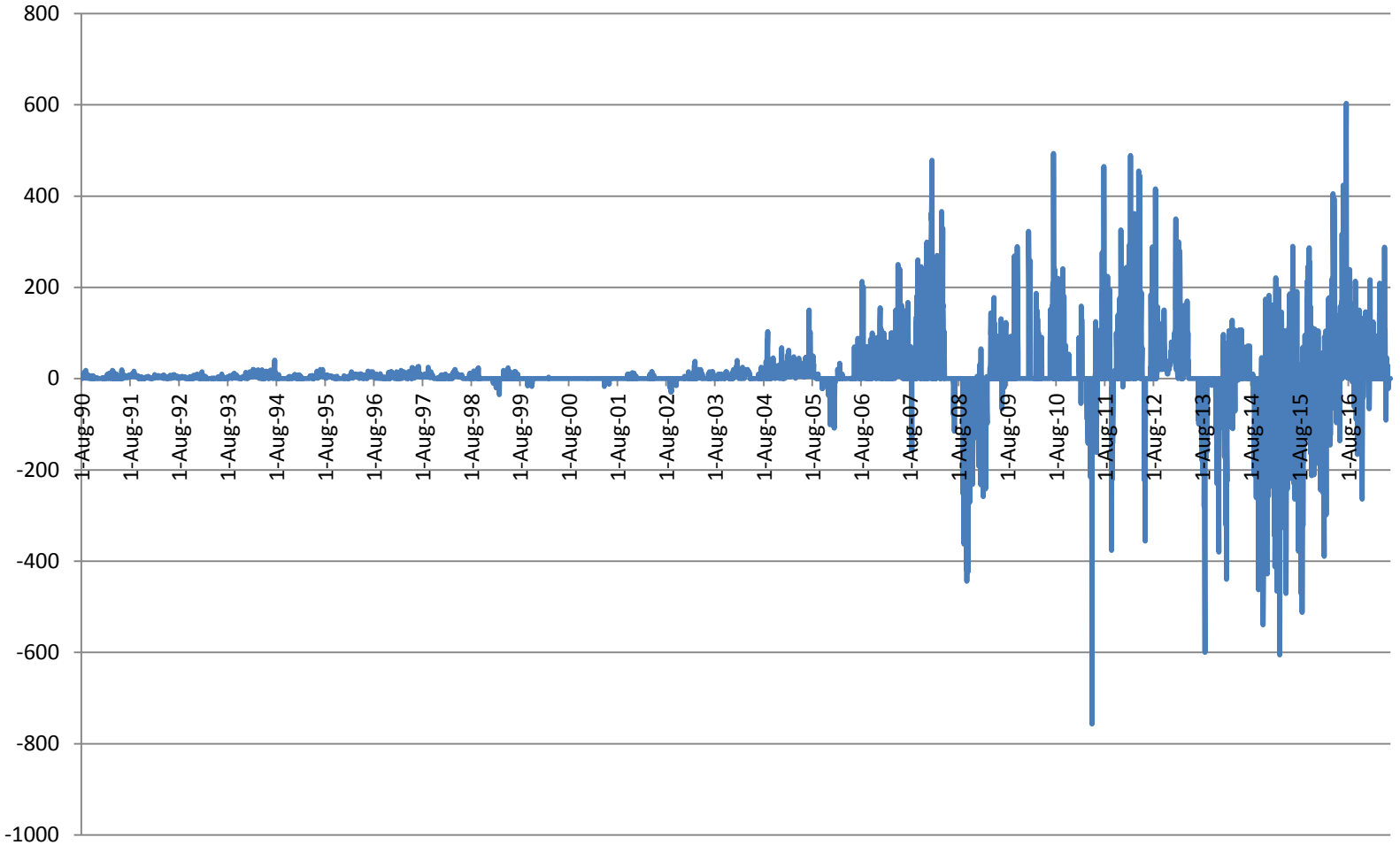
- Academic research: empirical evidence on sterilized FX intervention is mixed and inconsistent, which accords with the theory (e.g. Backus and Kehoe 1989).

Introduction and Motivation

Polar views about foreign exchange intervention:

- Academic research: empirical evidence on sterilized FX intervention is mixed and inconsistent, which accords with the theory (e.g. Backus and Kehoe 1989).
- Central bankers intervene frequently and often, and believe that FX intervention is beneficial and effective (Adler and Tovar 2011, Chutasripanish and Yetman 2015).

Peru: FX Intervention (Daily, US$ Millions)



Source: Central Bank of Peru

Table 1. Stylized Facts of Foreign Exchange Purchases, 2004–10

	Frequency (Percent of working days)	Intensity			
		Cumulative intervention as percent of GDP[1,2]	Daily average (Millions of U.S. dollars)[1]	Daily maximum (Millions of U.S. dollars)[1]	Has there been active FX intervention in 2011?
Chile	6	3.8	50	50	yes
Colombia	32	10.3	34	733	yes
Guatemala	19	1.6	9	332	yes
Mexico[3]	1	0.6	600	600	yes
Peru	39	36.1	55	494	yes
Latin America[4]	**19**	**10.5**	**150**	**442**	
Others					
Australia[5]	62	2.5	15	377	n.a.
Israel	24	22.3	84	300	no[6]
Turkey	66	12.5	61	4966	yes

Source: Adler and Tovar (2011)

This Paper

- I develop a recent perspective on FX intervention that, among other advantages, promises to reconcile the academic and policy perspectives

This Paper

- I develop a recent perspective on FX intervention that, among other advantages, promises to reconcile the academic and policy perspectives
- Point of departure: FX intervention is a particular *unconventional* central bank policy (Céspedes, Chang, and Velasco 2017)

This Paper

- I develop a recent perspective on FX intervention that, among other advantages, promises to reconcile the academic and policy perspectives
- Point of departure: FX intervention is a particular *unconventional* central bank policy (Céspedes, Chang, and Velasco 2017)
- To analyze FX intervention, then, it is crucial to allow for financial frictions, here external debt limits

This Paper

- I develop a recent perspective on FX intervention that, among other advantages, promises to reconcile the academic and policy perspectives
- Point of departure: FX intervention is a particular *unconventional* central bank policy (Céspedes, Chang, and Velasco 2017)
- To analyze FX intervention, then, it is crucial to allow for financial frictions, here external debt limits
- But to be consistent with the empirical evidence, the debt limits are taken to bind only *occasionally*

How FX Intervention "Really" Works

A typical central bank balance sheet:

Assets	**Liabilities**
FX reserves	Money Supply
Net Credit	Net Worth

How FX Intervention "Really" Works

A typical central bank balance sheet:

Assets	**Liabilities**
FX reserves	Money Supply
Net Credit	Net Worth

- A sterilized purchase of FX reserves requires a reduction of net credit to the private sector (e.g. "sterilization bonds")

How FX Intervention "Really" Works

A typical central bank balance sheet:

Assets	**Liabilities**
FX reserves	Money Supply
Net Credit	Net Worth

- A sterilized purchase of FX reserves requires a reduction of net credit to the private sector (e.g. "sterilization bonds")
- In the absence of financial frictions, banks borrow an offsetting amount from abroad, and credit to the private sector does not need to change

How FX Intervention "Really" Works

A typical central bank balance sheet:

Assets	**Liabilities**
FX reserves	Money Supply
Net Credit	Net Worth

- A sterilized purchase of FX reserves requires a reduction of net credit to the private sector (e.g. "sterilization bonds")
- In the absence of financial frictions, banks borrow an offsetting amount from abroad, and credit to the private sector does not need to change
- But if there a limit to external credit, it can be reached, and sterilization crowds out domestic loans

- Similar to Chang and Velasco (2017), Céspedes, Chang, and Velasco (2017).

- Similar to Chang and Velasco (2017), Céspedes, Chang, and Velasco (2017).
- Also Benes, Berg, Portillo and Vavra (2015), Vargas, González, and Rodríguez (2013), Cavallino (2017), Montoro and Ortiz (2017). But in these other contributions financial frictions bite all the time, which may be unrealistic.

- Similar to Chang and Velasco (2017), Céspedes, Chang, and Velasco (2017).
- Also Benes, Berg, Portillo and Vavra (2015), Vargas, González, and Rodríguez (2013), Cavallino (2017), Montoro and Ortiz (2017). But in these other contributions financial frictions bite all the time, which may be unrealistic.
- In addition, the treatment here is much simpler and clarifies what is essential about sterilized FX intervention.

Our Mechanism Versus Others

The mechanism just described:

Our Mechanism Versus Others

The mechanism just described:

- Does *not* rely on imperfect substitutibility of assets

Our Mechanism Versus Others

The mechanism just described:

- Does *not* rely on imperfect substitutibility of assets
- Is *not* about currency denomination or currency mismatches (although it can interact with them)

Our Mechanism Versus Others

The mechanism just described:

- Does *not* rely on imperfect substitutibility of assets
- Is *not* about currency denomination or currency mismatches (although it can interact with them)
- Is *not* about policy signaling

Our Mechanism Versus Others

The mechanism just described:

- Does *not* rely on imperfect substitutibility of assets
- Is *not* about currency denomination or currency mismatches (although it can interact with them)
- Is *not* about policy signaling
- Does depend on financial frictions and institutions

Our Mechanism Versus Others

The mechanism just described:

- Does *not* rely on imperfect substitutibility of assets
- Is *not* about currency denomination or currency mismatches (although it can interact with them)
- Is *not* about policy signaling
- Does depend on financial frictions and institutions
- Has a close connection with the problem of *reserves accumulation* and fiscal policy (*quasi-fiscal deficits*)

Lessons on Intervention and Reserves Accumulation

- FX intervention policy can be effective only if it occurs at times of binding financial constraints

Lessons on Intervention and Reserves Accumulation

- FX intervention policy can be effective only if it occurs at times of binding financial constraints
- The *accumulation of FX reserves* involves a trade-off: large stocks of reserves allow the central bank to relax financial constraints if they become binding, but increase financial vulnerability

Lessons on Intervention and Reserves Accumulation

- FX intervention policy can be effective only if it occurs at times of binding financial constraints
- The *accumulation of FX reserves* involves a trade-off: large stocks of reserves allow the central bank to relax financial constraints if they become binding, but increase financial vulnerability
- Accumulation of FX reserves can be excessive and lead to a *credit crunch*

FX Intervention Rules

- A policy of FX purchases in response to appreciation and sales when there is depreciation may help relaxing financial constraints when they bind, but also make them bind in response to appreciation

FX Intervention Rules

- A policy of FX purchases in response to appreciation and sales when there is depreciation may help relaxing financial constraints when they bind, but also make them bind in response to appreciation
- A superior FX intervention policy: to respond to *credit spreads*

FX Intervention and Conventional Monetary Policy

- If there are nominal rigidities, FX intervention policy is irrelevant in a local approximation of the model.

FX Intervention and Conventional Monetary Policy

- If there are nominal rigidities, FX intervention policy is irrelevant in a local approximation of the model.
- FX intervention can be an independent instrument, but one must take nonlinearities into account

The Model

Commodities and Demand

Small open economy, $t = 0, 1, 2, ...$

Two traded goods, home and foreign

Price of foreign goods fixed at one in terms of an international currency (*dollar*)

Domestic consumption a Cobb Douglas function of home and foreign goods, with price in *pesos* (the CPI):

$$P_t = P_{ht}^{\alpha} E_t^{1-\alpha}$$

where P_{ht} is the price of domestic output and E_t the *nominal exchange rate*

Define the *real* exchange rate by

$$e_t = \frac{E_t}{P_{ht}}$$

Define the *real* exchange rate by

$$e_t = \frac{E_t}{P_{ht}}$$

$==>$ Total demand for domestic output:

$$y_t = \alpha e_t^{1-\alpha} c_t + \varkappa e_t^{\chi}$$

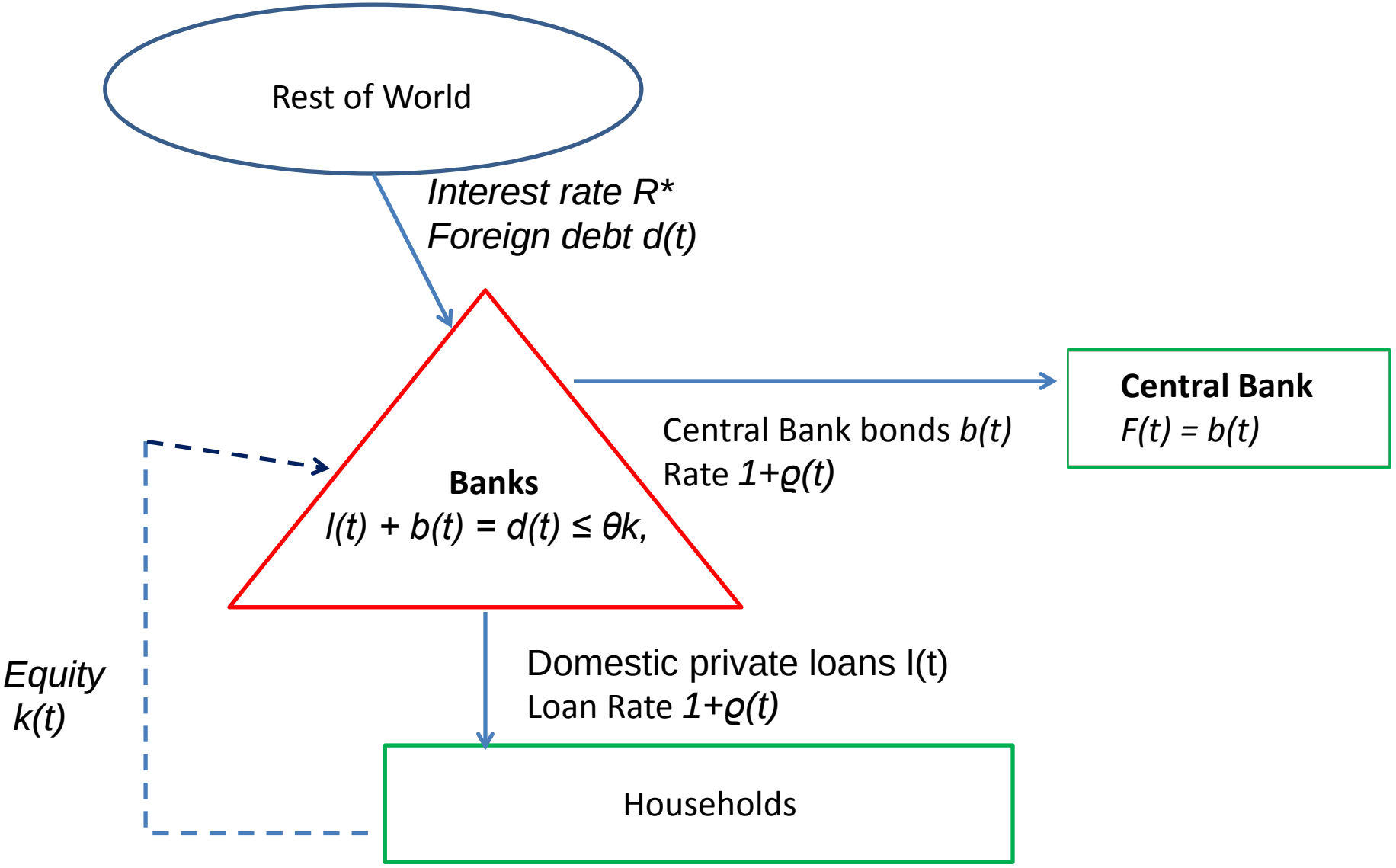
Production

The home good is the usual Dixit Stiglitz aggregate

Firm i has technology $y_{it} = A_t n_{it}$

Assuming *flexible prices* for now, usual markup rule leads to

$$P_{ht} = \left(1 - \frac{1}{\epsilon}\right) MC_t = \left(1 - \frac{1}{\epsilon}\right) \frac{W_t}{A_t}$$



Financial Flows

Banks

Banks

- At the beginning of each t, a typical bank raises *equity* k_t from households

Banks

- At the beginning of each t, a typical bank raises *equity* k_t from households
- It then borrows d_t dollars from world investors, at an interest rate R_t^*

Banks

- At the beginning of each t, a typical bank raises *equity* k_t from households
- It then borrows d_t dollars from world investors, at an interest rate R_t^*
- Financial frictions:

$$d_t \leq \theta k_t$$

Banks

- At the beginning of each t, a typical bank raises *equity* k_t from households
- It then borrows d_t dollars from world investors, at an interest rate R_t^*
- Financial frictions:

$$d_t \leq \theta k_t$$

- The bank can issue domestic *loans* l_t or purchase *central bank bonds* b_t.

Banks

- At the beginning of each t, a typical bank raises *equity* k_t from households
- It then borrows d_t dollars from world investors, at an interest rate R_t^*
- Financial frictions:

$$d_t \leq \theta k_t$$

- The bank can issue domestic *loans* l_t or purchase *central bank bonds* b_t.
- Loans and bonds are perfect substitutes and carry the same interest rate ϱ_t (everything in *dollars*, for now).

Banks

- At the beginning of each t, a typical bank raises *equity* k_t from households
- It then borrows d_t dollars from world investors, at an interest rate R_t^*
- Financial frictions:

$$d_t \leq \theta k_t$$

- The bank can issue domestic *loans* l_t or purchase *central bank bonds* b_t.
- Loans and bonds are perfect substitutes and carry the same interest rate ϱ_t (everything in *dollars*, for now).
- Banks' flow constraint:

$$b_t + l_t = k_t + d_t$$

The bank's profits are

$$\begin{aligned}\pi_{t+1} &= (1+\varrho_t)(l_t+b_t) - R_t^* d_t \\ &= R_t^* k_t + (1+\varrho_t - R_t^*)(l_t+b_t)\end{aligned}$$

The bank's profits are

$$\begin{aligned}\pi_{t+1} &= (1+\varrho_t)(l_t+b_t) - R_t^* d_t \\ &= R_t^* k_t + (1+\varrho_t - R_t^*)(l_t+b_t)\end{aligned}$$

$==>$ The bank's problem is then just to maximize π_{t+1}

The bank's profits are

$$\begin{aligned}\pi_{t+1} &= (1+\varrho_t)(l_t+b_t) - R_t^* d_t \\ &= R_t^* k_t + (1+\varrho_t - R_t^*)(l_t+b_t)\end{aligned}$$

$==>$ The bank's problem is then just to maximize π_{t+1}

$==>$ Optimal policy:

- If $1+\varrho_t > R_t^*$, $d_t = \theta k_t$, and so credit supply is $b_t + l_t = (1+\theta)k_t$
- If $1+\varrho_t = R_t^*$, indeterminate as long as $b_t + l_t = k_t + d_t$ and $d_t \leq \theta k_t$

The Central Bank

Sterilized FX intervention: The central bank simply buys dollars by issuing bonds.

$==>$ Hence b_t denotes the quantity of *sterilization* bonds as well as *official FX reserves*

The Central Bank

Sterilized FX intervention: The central bank simply buys dollars by issuing bonds.

$==>$ Hence b_t denotes the quantity of *sterilization* bonds as well as *official FX reserves*
$==>$ We assume that $b_t \geq 0$ (official reserves cannot be negative)

The Central Bank

Sterilized FX intervention: The central bank simply buys dollars by issuing bonds.

==> Hence b_t denotes the quantity of *sterilization* bonds as well as *official FX reserves*
==> We assume that $b_t \geq 0$ (official reserves cannot be negative)
==> Same as Benes et al., Vargas et al., Casalino, CCV

The Central Bank

Sterilized FX intervention: The central bank simply buys dollars by issuing bonds.

==> Hence b_t denotes the quantity of *sterilization* bonds as well as *official FX reserves*
==> We assume that $b_t \geq 0$ (official reserves cannot be negative)
==> Same as Benes et al., Vargas et al., Casalino, CCV
==> Crucial: sterilization bonds are financed by domestic banks, which can be subject to the external credit limit

Between periods, the central bank invests official reserves at the external interest rate R_t^*.

$==>$ In period t, the central bank has a *quasifiscal deficit:*

$$T_t = (1 + \varrho_{t-1} - R_{t-1}^*) b_{t-1}$$

Between periods, the central bank invests official reserves at the external interest rate R_t^*.

$==>$ In period t, the central bank has a *quasifiscal deficit:*

$$T_t = (1 + \varrho_{t-1} - R_{t-1}^*) b_{t-1}$$

We assume that T_t is financed with a lump sum tax on households (but the role of the quasifiscal deficit is an open and interesting issue)

Households

Standard utility function which depends on consumption and labor effort.

Households borrow from banks and also can hold equity in banks, subject to the equity constraint:

$$k_t \leq \widetilde{k}$$

They receive an endowment of dollars z_t (e.g. copper income).
The budget constraint, in dollars:

$$\begin{aligned} & e_t^{-\alpha} c_t + k_t - l_t \\ = \; & (1+\omega_{t-1}) R_{t-1}^* k_{t-1} - (1+\varrho_{t-1}) l_{t-1} \; + e_t^{-\alpha} w_t n_t + v_t + z_t - T_t \end{aligned}$$

Households

Standard utility function which depends on consumption and labor effort.

Households borrow from banks and also can hold equity in banks, subject to the equity constraint:

$$k_t \leq \widetilde{k}$$

They receive an endowment of dollars z_t (e.g. copper income).
The budget constraint, in dollars:

$$\begin{aligned} & e_t^{-\alpha} c_t + k_t - l_t \\ = \quad & (1+\omega_{t-1}) R_{t-1}^* k_{t-1} - (1+\varrho_{t-1}) l_{t-1} \; + e_t^{-\alpha} w_t n_t + v_t + z_t - T_t \end{aligned}$$

==> The equity constraint binds in equilibrium if and only if the external constraint binds, so wlog we set $k_t = \tilde{k}$

The External Cost of Credit

Debt elastic interest rate (Schmitt Grohé-Uribe 2003):

$$\begin{aligned} R_t^* &= \bar{R}^* + \tilde{\Psi}(e^{l_t - \bar{l}} - 1) \\ &= \bar{R}^* + \tilde{\Psi}(e^{d_t - b_t - (\bar{d} - \bar{b})} - 1) \end{aligned}$$

where the world interest rate is $\bar{R}^*$

Equilibrium With Flexible Prices

Aggregate Supply:

$$e_t^{-(1-\alpha)} c_t^{-\sigma} = (1 - \frac{1}{\epsilon})\eta y_t^{\phi} / A_t^{1+\phi}$$

External balance:

$$(1-\alpha)e_t^{-\alpha} c_t - [z_t + \varkappa e_t^{\chi-1}] = d_t - b_t - R_t^*(d_{t-1} - b_{t-1})$$

Collateral constraints:

$$\begin{aligned} d_t &= \theta \tilde{k} \quad \text{if} \quad 1 + \varrho_t > R_t^* \\ d_t &\leq \theta \tilde{k} \quad \text{if} \quad 1 + \varrho_t = R_t^* \end{aligned}$$

Equilibrium is defined once we specify an *FX intervention policy*, i.e. a rule for choosing b_t

FX Intervention and Reserves Accumulation

Is FX Intervention Irrelevant?

Proposition: *FX intervention can affect equilibria if and only if it affects binding financial constraints* or *makes the constraints bind in states of nature in which they would have not*

Is FX Intervention Irrelevant?

Proposition: *FX intervention can affect equilibria if and only if it affects binding financial constraints* or *makes the constraints bind in states of nature in which they would have not*

==> Similar to Backus and Kehoe (1989)

Is FX Intervention Irrelevant?

Proposition: *FX intervention can affect equilibria if and only if it affects binding financial constraints* or *makes the constraints bind in states of nature in which they would have not*

==> Similar to Backus and Kehoe (1989)
==> But, in contrast to BK, we explore what happens if FX intervention *does* matter

For a precise statement: rewrite all equilibrium conditions, except the collateral constraints, in terms of a vector of variables that excludes d_t and b_t.

The collateral constraints then can be rewritten as:

$$\begin{aligned} l_t &= (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t > R_t^* \\ l_t &\leq (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t = R_t^* \end{aligned}$$

For a precise statement: rewrite all equilibrium conditions, except the collateral constraints, in terms of a vector of variables that excludes d_t and b_t.

The collateral constraints then can be rewritten as:

$$\begin{aligned} l_t &= (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t > R_t^* \\ l_t &\leq (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t = R_t^* \end{aligned}$$

- If constraint does not bind at t, a change in b_t does not affect equilibria (unless it leads to a violation of the inequality)

For a precise statement: rewrite all equilibrium conditions, except the collateral constraints, in terms of a vector of variables that excludes d_t and b_t.

The collateral constraints then can be rewritten as:

$$\begin{aligned} l_t &= (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t > R_t^* \\ l_t &\leq (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t = R_t^* \end{aligned}$$

- If constraint does not bind at t, a change in b_t does not affect equilibria (unless it leads to a violation of the inequality)
- To affect equilibria, a change in b_t must take place when constraint binds, or must make a nonbinding constrait bind.

Intervention and Reserves Accumulation

$$
\begin{aligned}
I_t &= (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t > R_t^* \\
I_t &\leq (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t = R_t^*
\end{aligned}
$$

- When collateral constraints bind, a sale of FX reserves (a fall in b_t) results in an expansion of private loans

Intervention and Reserves Accumulation

$$
\begin{aligned}
l_t &= (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t > R_t^* \\
l_t &\leq (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t = R_t^*
\end{aligned}
$$

- When collateral constraints bind, a sale of FX reserves (a fall in b_t) results in an expansion of private loans
- This reflects sterilization: selling reserves reduces the quantity of central bank bonds, making room for private credit

Intervention and Reserves Accumulation

$$
\begin{aligned}
I_t &= (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t > R_t^* \\
I_t &\leq (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t = R_t^*
\end{aligned}
$$

- When collateral constraints bind, a sale of FX reserves (a fall in b_t) results in an expansion of private loans
- This reflects sterilization: selling reserves reduces the quantity of central bank bonds, making room for private credit
- If b_t cannot be negative, this can be seen as a *benefit* of reserves accumulation

Intervention and Reserves Accumulation

$$
\begin{aligned}
l_t &= (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t > R_t^* \\
l_t &\leq (1+\theta)\tilde{k} - b_t \quad \text{if} \quad 1+\varrho_t = R_t^*
\end{aligned}
$$

- When collateral constraints bind, a sale of FX reserves (a fall in b_t) results in an expansion of private loans
- This reflects sterilization: selling reserves reduces the quantity of central bank bonds, making room for private credit
- If b_t cannot be negative, this can be seen as a *benefit* of reserves accumulation
- Large average values of b_t, however, make it more likely that the collateral constraint binds, which can be seen as a *cost* of reserves accumulation

FX Intervention and Exchange Rates

Euler equation, in equilibrium:

$$c_t^{-\sigma} = \beta E_t c_{t+1}^{-\sigma} R_{t+1}$$

where:

$$R_{t+1} = (1 + \varrho_t) \left(\frac{e_{t+1}}{e_t} \right)^{\alpha}$$

FX Intervention and Exchange Rates

Euler equation, in equilibrium:

$$c_t^{-\sigma} = \beta E_t c_{t+1}^{-\sigma} R_{t+1}$$

where:

$$R_{t+1} = (1 + \varrho_t) \left(\frac{e_{t+1}}{e_t} \right)^{\alpha}$$

- When financial constraint bind, sterilized FX affects consumption growth

FX Intervention and Exchange Rates

Euler equation, in equilibrium:

$$c_t^{-\sigma} = \beta E_t c_{t+1}^{-\sigma} R_{t+1}$$

where:

$$R_{t+1} = (1 + \varrho_t) \left(\frac{e_{t+1}}{e_t} \right)^{\alpha}$$

- When financial constraint bind, sterilized FX affects consumption growth
- Then real *consumption based* interest rate must adjust

FX Intervention and Exchange Rates

Euler equation, in equilibrium:

$$c_t^{-\sigma} = \beta E_t c_{t+1}^{-\sigma} R_{t+1}$$

where:

$$R_{t+1} = (1 + \varrho_t) \left(\frac{e_{t+1}}{e_t} \right)^{\alpha}$$

- When financial constraint bind, sterilized FX affects consumption growth
- Then real *consumption based* interest rate must adjust
- This requires changes in the loan interest rate as well as real exchange rates

Numerical Illustrations

Calibration and Numerical Approximation

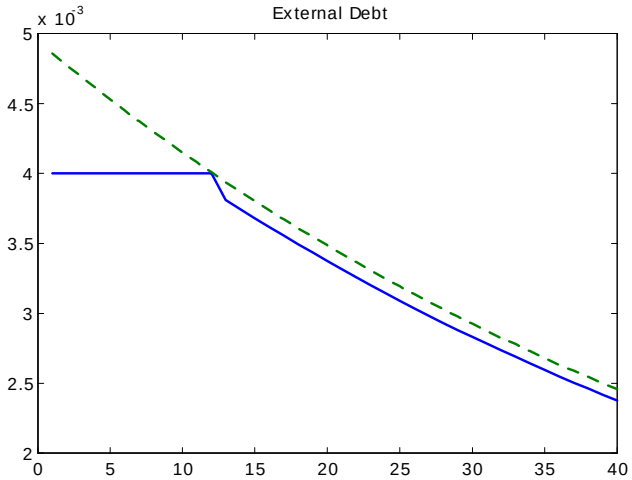
- Calibration is intended to illustrate our discussion and ideas rather than empirical realism

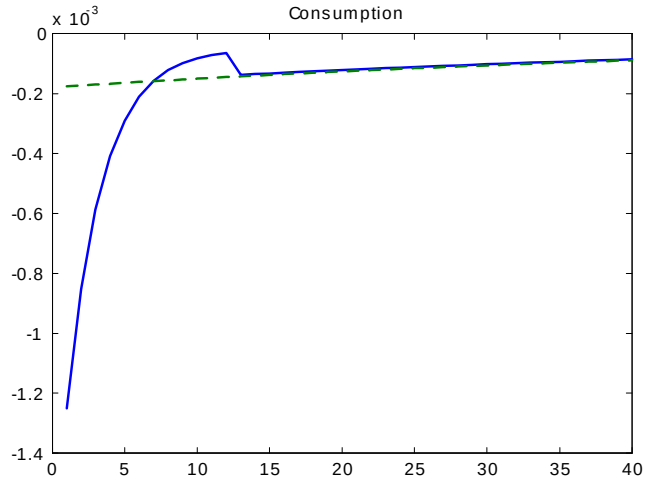
Calibration and Numerical Approximation

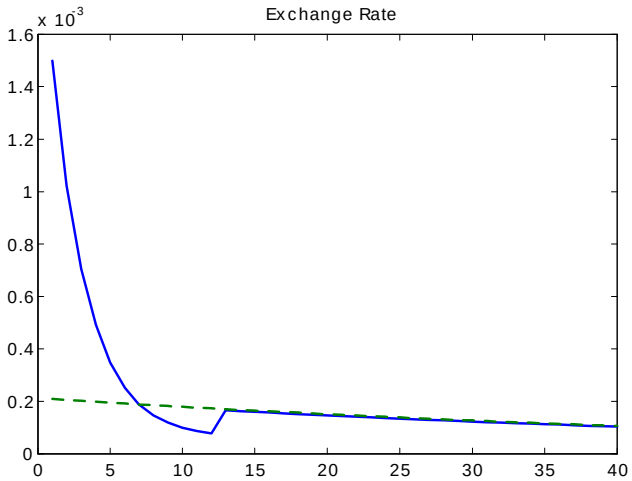
- Calibration is intended to illustrate our discussion and ideas rather than empirical realism
- Numerical solution: `occbin` (Guerrieri and Iacovello)

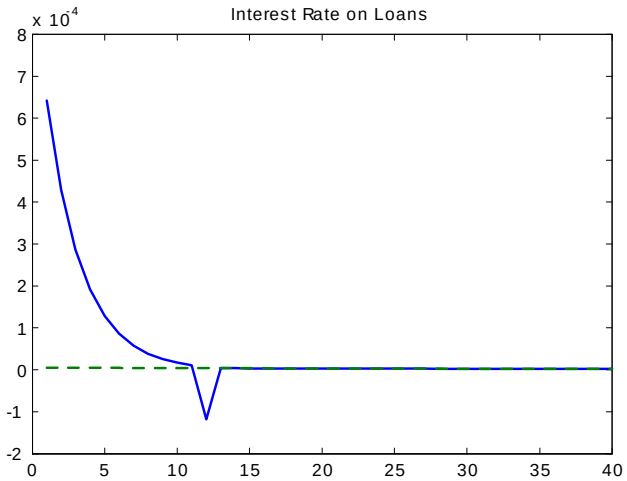
Calibration and Numerical Approximation

- Calibration is intended to illustrate our discussion and ideas rather than empirical realism
- Numerical solution: `occbin` (Guerrieri and Iacovello)
- One cost: will not be able to talk about macroprudential issues









A Transitory Fall in z

Consider a simple intervention policy of the form:

$$b_t = Max\{\bar{b} + \rho_b(b_{t-1} - \bar{b}) + \varepsilon_{bt}, 0\}$$

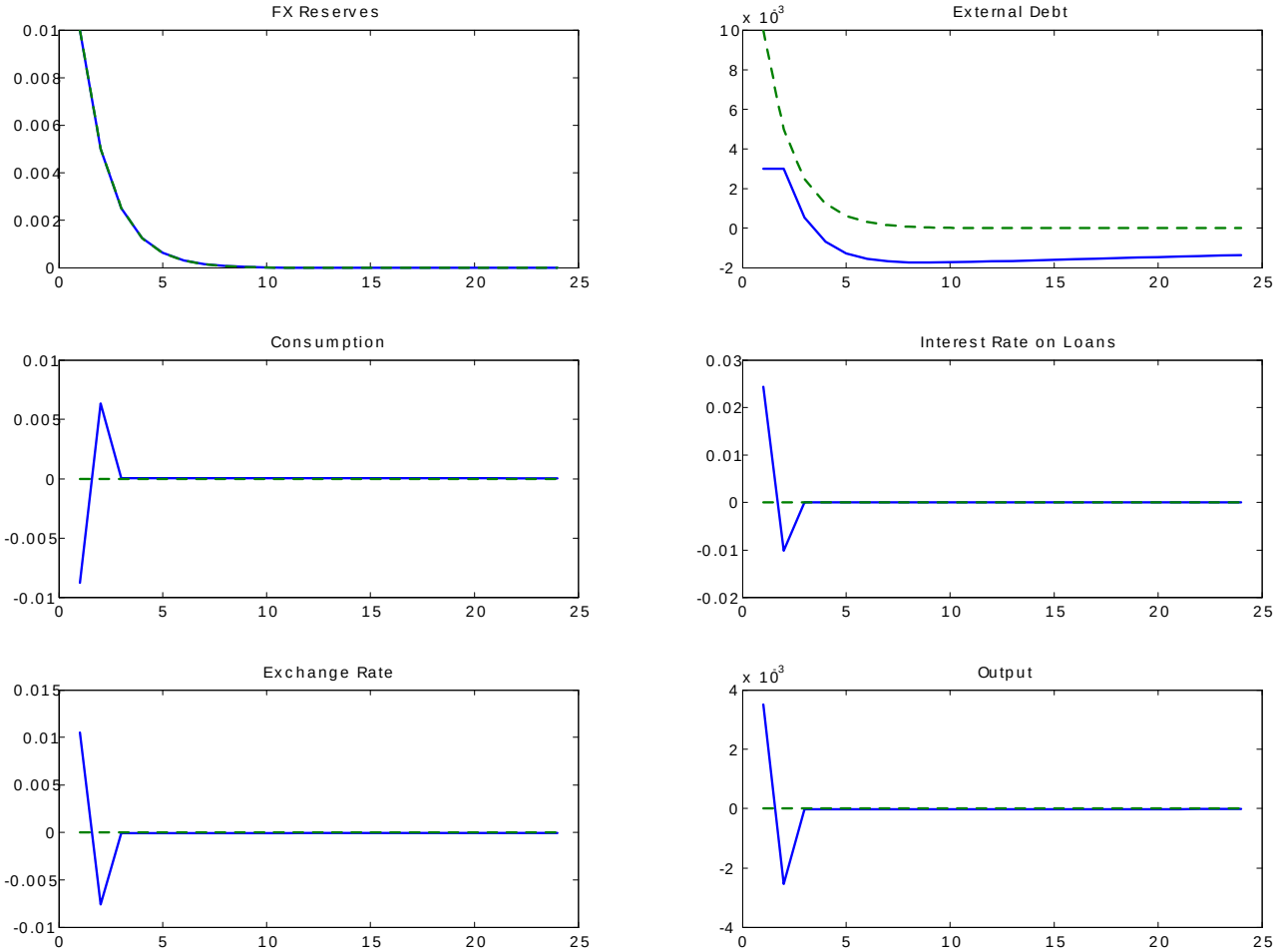
with $\bar{b} \geq 0$ the ss value of official reserves, and $0 \leq \rho_b < 1$

Consider a simple intervention policy of the form:

$$b_t = Max\{\bar{b} + \rho_b(b_{t-1} - \bar{b}) + \varepsilon_{bt}, 0\}$$

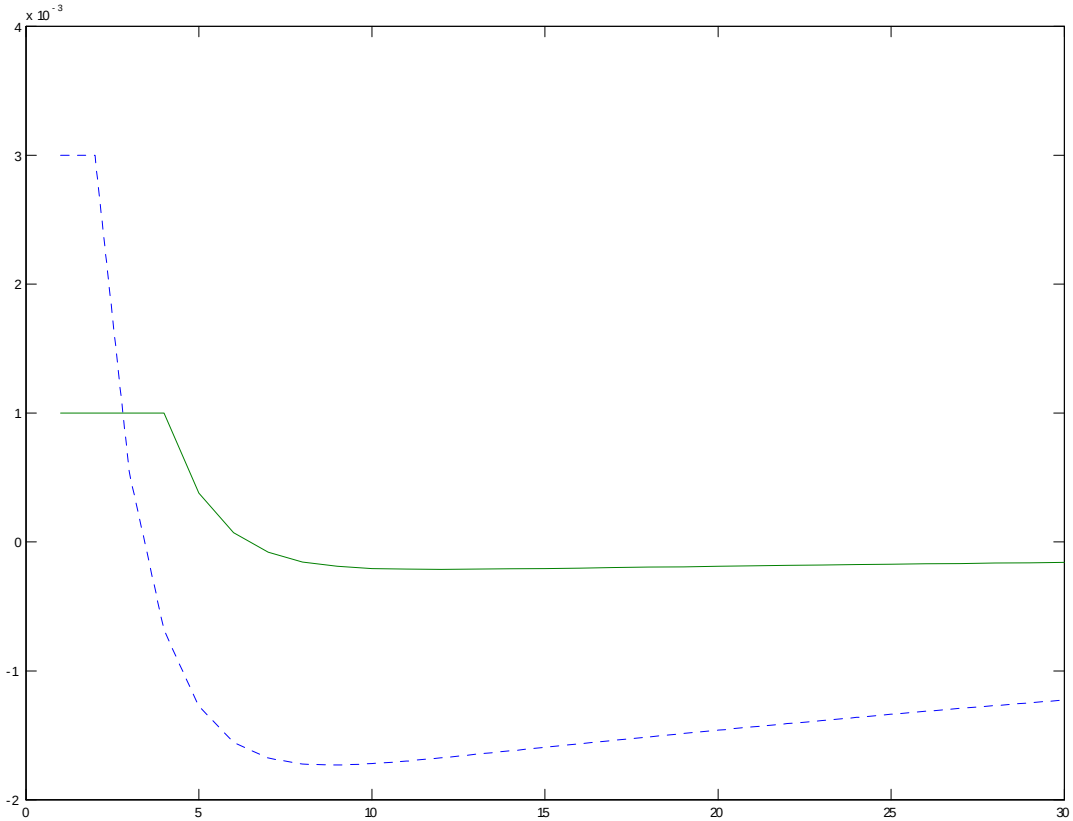
with $\bar{b} \geq 0$ the ss value of official reserves, and $0 \leq \rho_b < 1$

$==>$ Small ε_{bt} do not affect real allocations (they are matched one for one by changes in d_t)
$==>$ A sufficiently negative value of ε_{bt} leads to the exhaustion of FX reserves
$==>$ A large, positive ε_{bt} brings the economy to the constrained region



A Large Purchase of FX Reserves

The average value of reserves, $\bar{b}$, affects the probability that financial constraints bind



Low vs High Reserves

Response of $d(t)$ to the same shock to FX rule

Solid line: High $\bar{b}$. Dashed line: Low $\bar{b}$

Exchange Rate Stabilization and FX Intervention

Consider now a rule of the form:

$$b_t - \bar{b} = \rho_b(b_{t-1} - \bar{b}) - v_e(e_t - \bar{e})$$

Here, the central bank sells reserves in response to a real depreciation.

Exchange Rate Stabilization and FX Intervention

Consider now a rule of the form:

$$b_t - \bar{b} = \rho_b(b_{t-1} - \bar{b}) - v_e(e_t - \bar{e})$$

Here, the central bank sells reserves in response to a real depreciation.

1. With adverse shocks and binding financial constraints, the policy does alleviate the constraints (since the exchange rate depreciates in response to shocks and the central bank then sells reserves)

Exchange Rate Stabilization and FX Intervention

Consider now a rule of the form:

$$b_t - \bar{b} = \rho_b(b_{t-1} - \bar{b}) - v_e(e_t - \bar{e})$$

Here, the central bank sells reserves in response to a real depreciation.

1. With adverse shocks and binding financial constraints, the policy does alleviate the constraints (since the exchange rate depreciates in response to shocks and the central bank then sells reserves)
2. In "normal " times i.e., if financial constraints do not bind, this policy does not affect equilibria as long as shocks and v_e are small enough

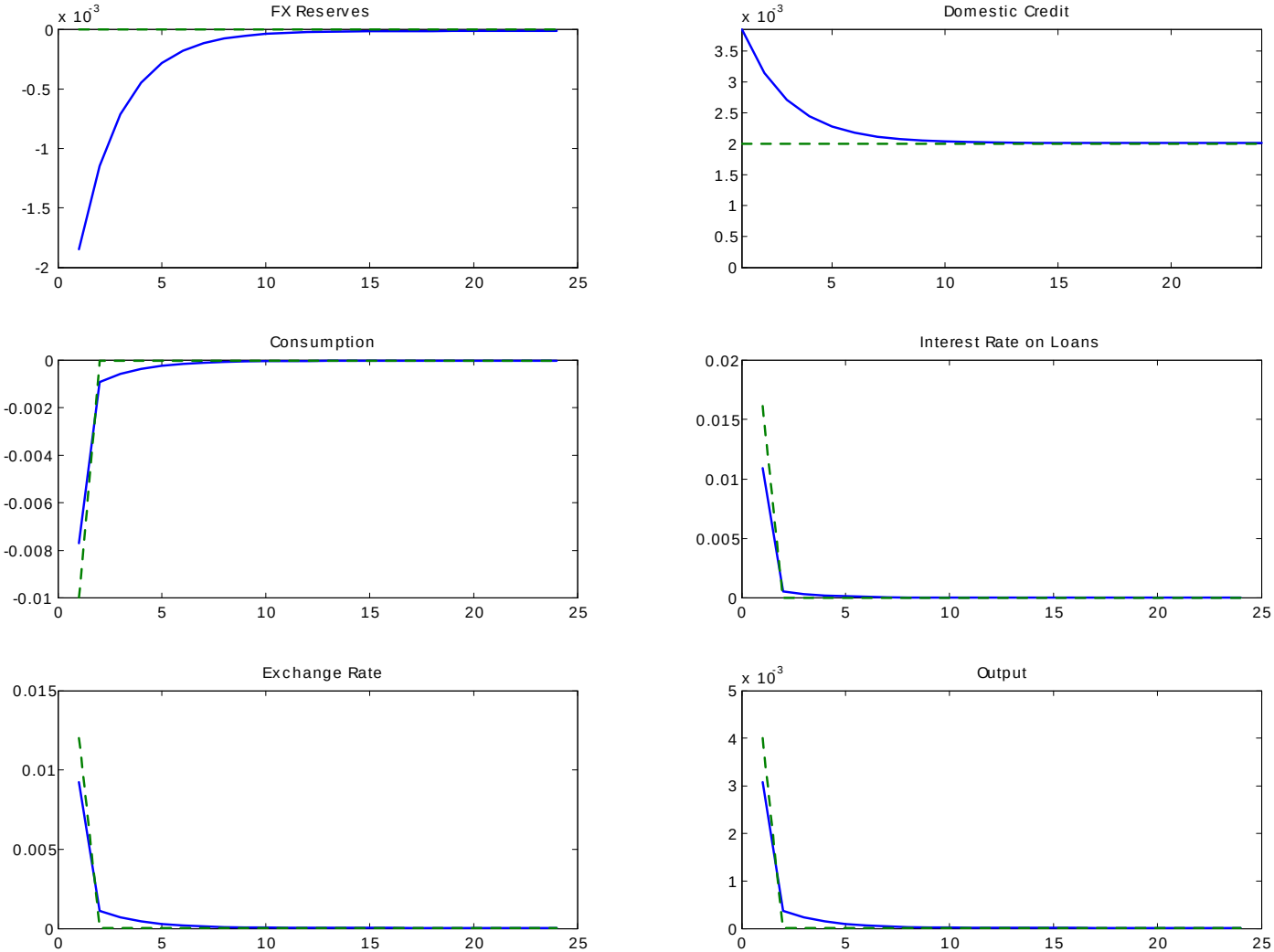
Exchange Rate Stabilization and FX Intervention

Consider now a rule of the form:

$$b_t - \bar{b} = \rho_b(b_{t-1} - \bar{b}) - v_e(e_t - \bar{e})$$

Here, the central bank sells reserves in response to a real depreciation.

1. With adverse shocks and binding financial constraints, the policy does alleviate the constraints (since the exchange rate depreciates in response to shocks and the central bank then sells reserves)
2. In "normal " times i.e., if financial constraints do not bind, this policy does not affect equilibria as long as shocks and v_e are small enough
3. In fact, if v_e is too large, the policy may have perverse effects.

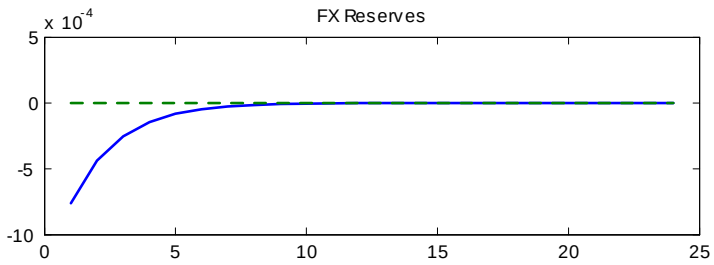


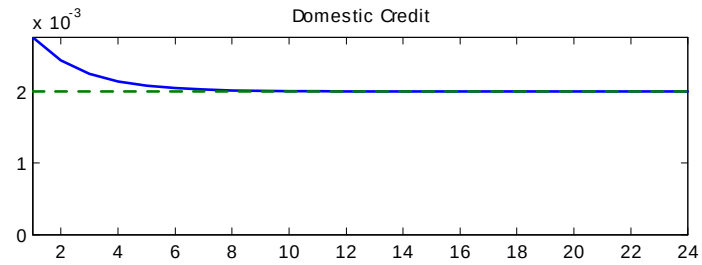
Intervention and Exchange Rate Stabilization

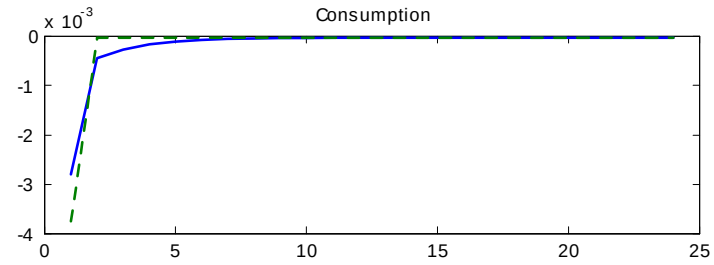
A policy that depends on the credit spread:

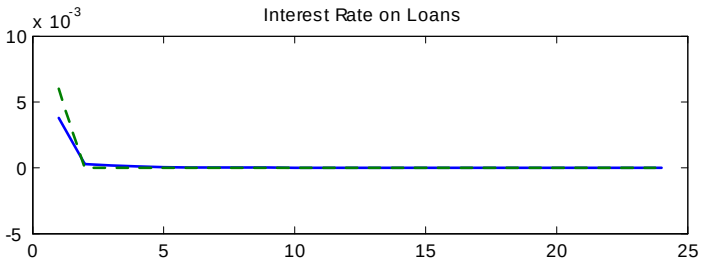
$$b_t - \bar{b} = \rho_b(b_{t-1} - \bar{b}) - v_\varrho(1 + \varrho_t - R_t^*)$$

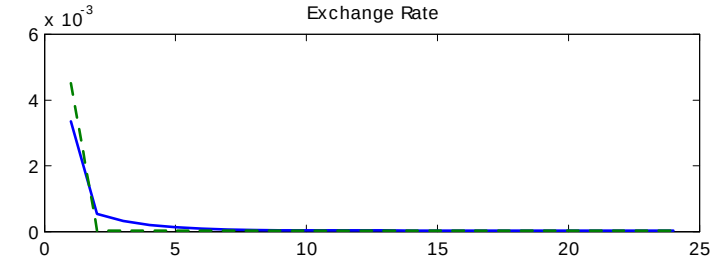
is superior, in that it prescribes intervention only when financial constraints bind.

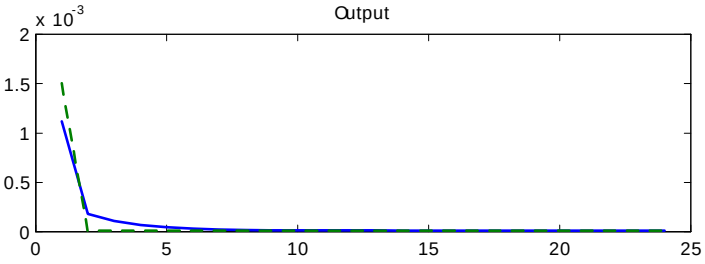












FX Intervention and Credit Spreads Stabilization

Nominal Rigidities

Introducing Price Rigidities

- Calvo protocol

Introducing Price Rigidities

- Calvo protocol
- Domestic inflation then has the form

$$\pi_{ht} = \beta E_t \pi_{h,t+1} + \lambda(\log mc_t - \mu)$$

Introducing Price Rigidities

- Calvo protocol
- Domestic inflation then has the form

$$\pi_{ht} = \beta E_t \pi_{h,t+1} + \lambda(\log mc_t - \mu)$$

- Marginal costs are

$$\begin{aligned} mc_t &= \frac{MC_t}{P_{ht}} = \frac{(W_t / A_t)}{P_{ht}} \\ &= \eta e_t^{1-\alpha} c_t^{\sigma} y_t^{\phi} / A_t^{1+\phi} \end{aligned}$$

Monetary Policy

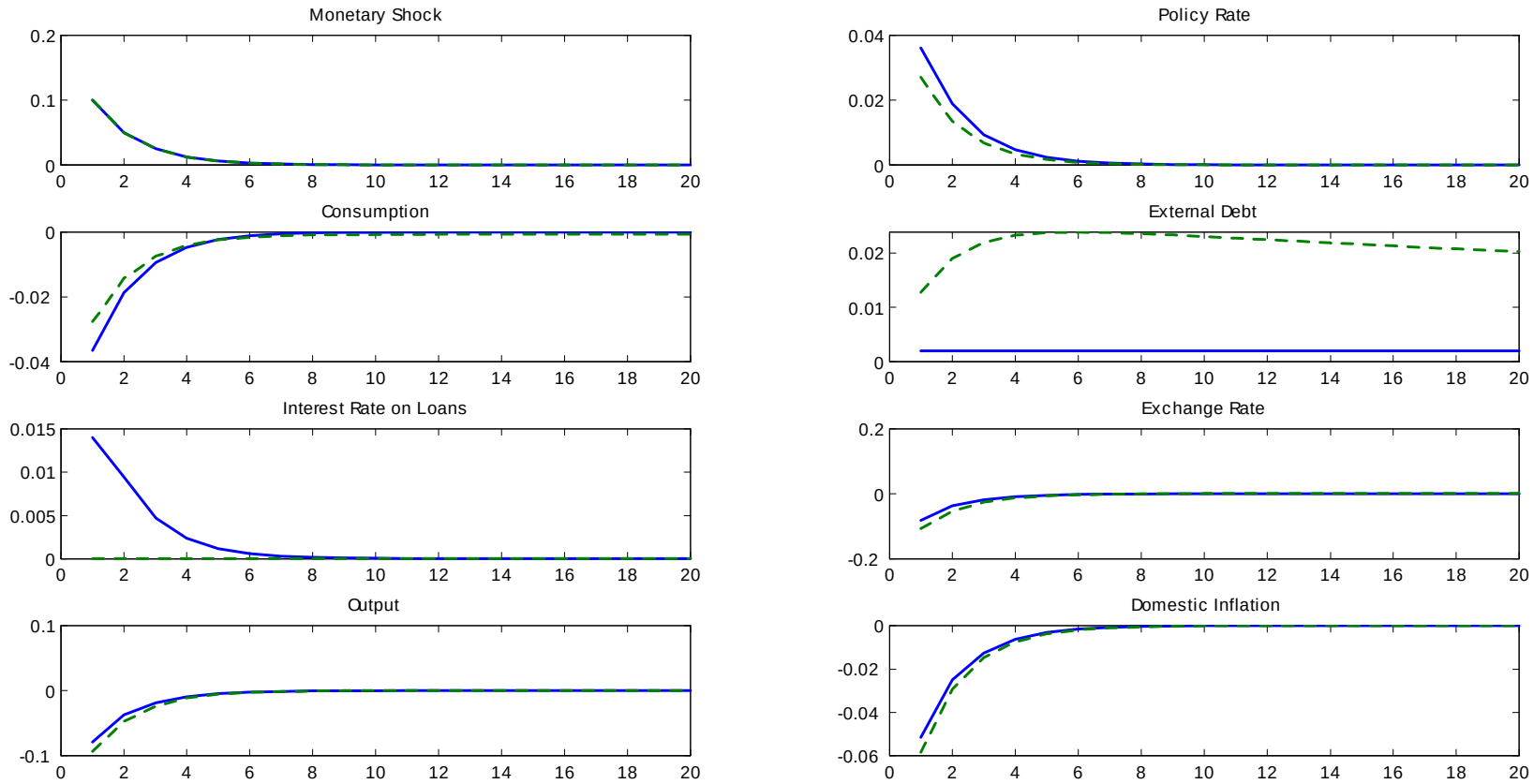
To close the model we need to specify a monetary policy rule.

For the time being, assume that the policy instrument is the expected consumption based interest rate:

$$i_t \equiv E_t R_{t+1} = E_t(1+\varrho_t)\left(\frac{e_{t+1}}{e_t}\right)^{\alpha}$$

And start with a Taylor rule such as:

$$i_t = \log R_t^* + \phi_\pi \pi_t + u_{mt}$$



A (Large) Monetary Policy Contraction

Conventional Monetary Policy and FX Intervention

- Now we can use the model to understand interaction between monetary policy and FX Intervention

Conventional Monetary Policy and FX Intervention

- Now we can use the model to understand interaction between monetary policy and FX Intervention
- Here FX **is** an independent policy tool

Conventional Monetary Policy and FX Intervention

- Now we can use the model to understand interaction between monetary policy and FX Intervention
- Here FX **is** an independent policy tool
- But nonlinearities are essential, and alter the analysis in significant ways

Monetary Policy and FX Intervention

Assume monetary policy is given by a Taylor rule. Then we see that:

Monetary Policy and FX Intervention

Assume monetary policy is given by a Taylor rule. Then we see that:

1. If the economy is financially unconstrained, FX intervention is irrelevant for small enough shocks (unless it brings the economy to the financially constrained region)

Monetary Policy and FX Intervention

Assume monetary policy is given by a Taylor rule. Then we see that:

1. If the economy is financially unconstrained, FX intervention is irrelevant for small enough shocks (unless it brings the economy to the financially constrained region)
2. In particular, FX intervention plays no useful role responding to shocks that imply an exchange rate *appreciation*

Monetary Policy and FX Intervention

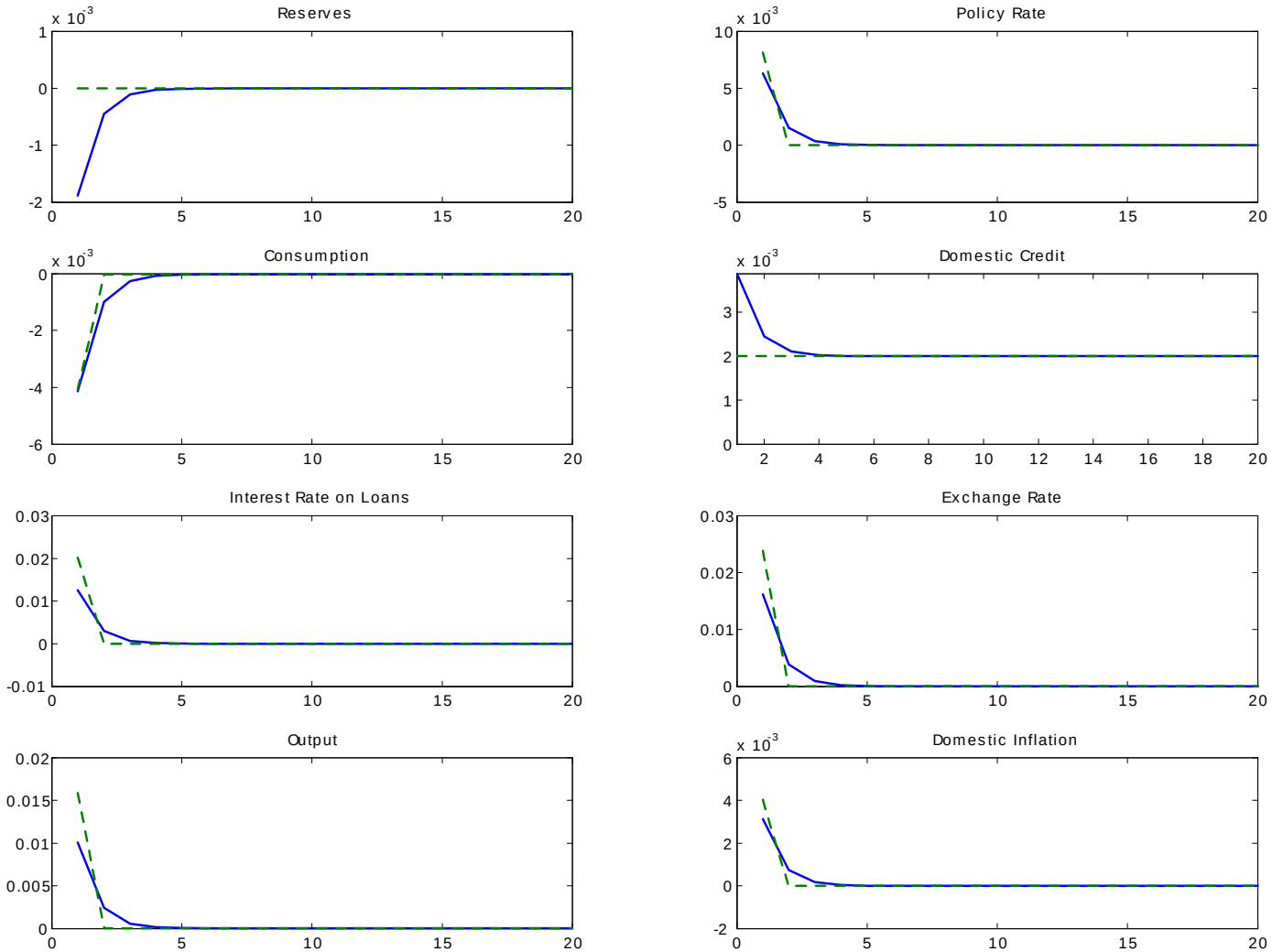
Assume monetary policy is given by a Taylor rule. Then we see that:

1. If the economy is financially unconstrained, FX intervention is irrelevant for small enough shocks (unless it brings the economy to the financially constrained region)
2. In particular, FX intervention plays no useful role responding to shocks that imply an exchange rate *appreciation*
3. Selling official reserves does play a beneficial role in response to an adverse shock that makes constraints bind

Monetary Policy and FX Intervention

Assume monetary policy is given by a Taylor rule. Then we see that:

1. If the economy is financially unconstrained, FX intervention is irrelevant for small enough shocks (unless it brings the economy to the financially constrained region)
2. In particular, FX intervention plays no useful role responding to shocks that imply an exchange rate *appreciation*
3. Selling official reserves does play a beneficial role in response to an adverse shock that makes constraints bind
4. An FX intervention rule that responds to credit spreads is better than one that responds to the exchange rate

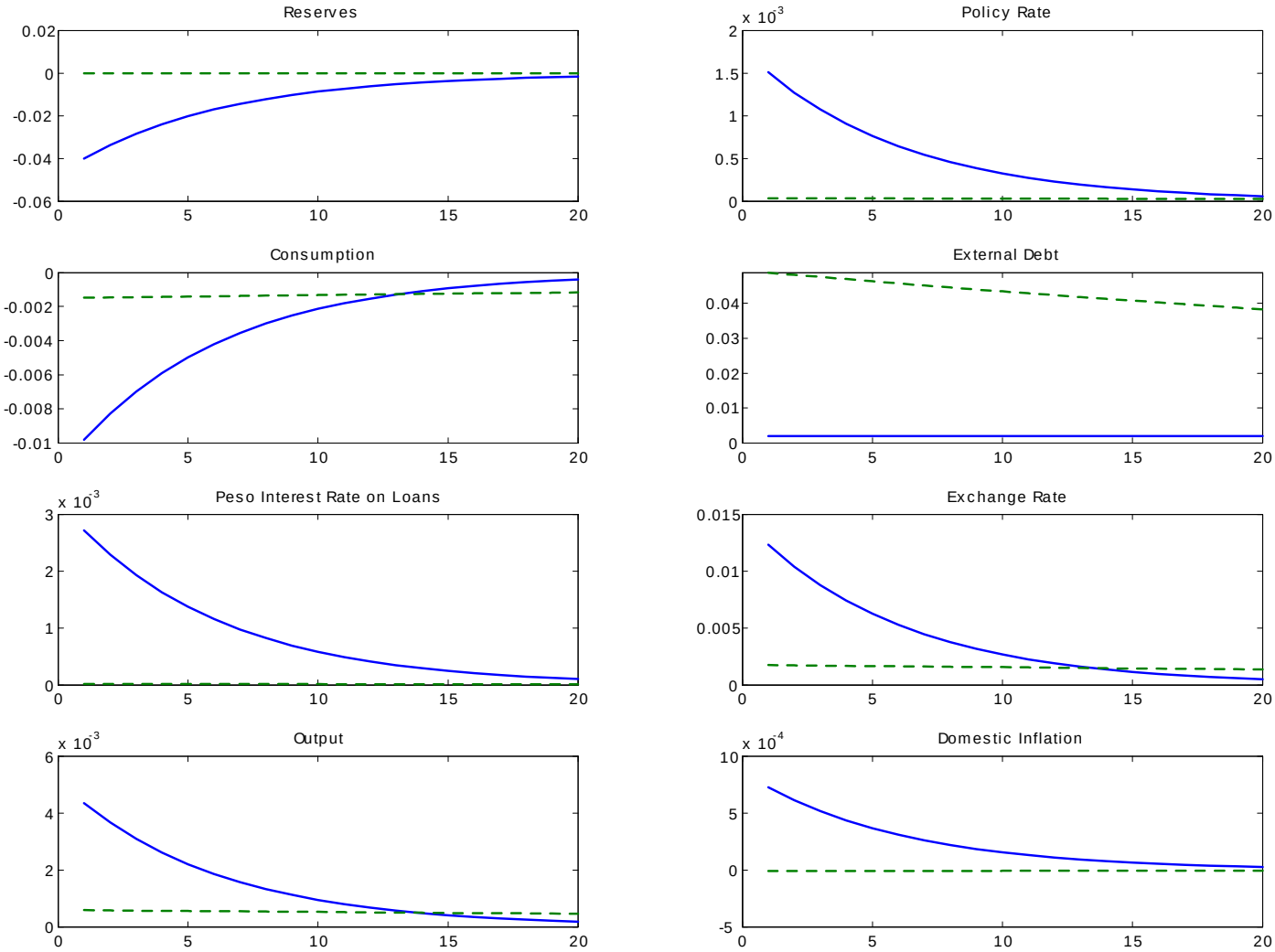


Monetary Policy and Active FX Intervention

The Role of Currency Denomination and Mismatches

The Role of Currency Denomination

- We have assumed that the economy is "financially dollarized "
- But it is not too hard to introduce assets in domestic currency
- The model looks almost the same if domestic loans and central bank debt are denominated in pesos



Allowing for Peso Securities

Currency Mismatches

- Our discussion on the effectiveness of FX intervention has not relied on the interaction between currency mismatches and balance sheet effects
- Clearly, one can add such effects in this model
- For instance, the equity constraint may be denominated in pesos, implying that $e_t^{\alpha} k_t \leq \tilde{k}$ rather than $k_t \leq \tilde{k}$
- In that case, a real depreciation tightens the debt limit

Final Remarks

Final Remarks

- This perspective may explain e.g. why empirical evidence on the impact of foreign exchange intervention has been elusive
- The effectiveness of FX intervention is tied to the degree of financial frictions and details of financial institutions
- No "competitiveness" rationale for reserves accumulation
- As mentioned, no discussion of macroprudential issues
- Lots of room for further research, especially optimal policy, quasifiscal policy, and empirical issues