The Demand for Liquid Assets and International Capital Flows

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Global Imbalances and the Demand for Liquidity

- Global imbalances are explained by a demand for liquid assets by emerging, mainly Asian, countries
- The demand for liquid assets is often considered in the context of accumulation of international reserves
- But imbalances are caused by excess saving: general equilibrium approach
- Various questions:
  1. How to model liquidity in dynamic macro models?
  2. To what extent can a demand for liquidity explain imbalances?
  3. How does such a model respond to shocks? E.g. recent financial crisis

Our contribution

- Develop a dynamic two-country model with excess corporate saving due to liquidity demand
- In the spirit of Holmstrom-Tirole (2001): future liquidity need with credit constraint generates demand for liquid assets
- The mechanism is introduced in a dynamic macro model
- Related to Woodford (1990) and Kyiotaki-Moore (2008)
- No risk in the benchmark model: different from precautionary saving
  - because the demand for liquid bonds is a complement to investment, instead of a substitute
- Simple enough to derive analytical solutions

Basic framework

- Asymmetric two-country model: Emerging and Industrial
- Bonds are liquid assets and are traded internationally
- Capital is illiquid and is not traded
- Infinitely-lived entrepreneurs and workers
- Focus on saving by entrepreneurs
- Entrepreneurs in Emerging are credit constrained and have a demand for liquidity

Main results (so far)

- Higher productivity in Emerging country generates global imbalances
  - instead of driving up the world interest rate and capital out of the Industrial country, does the opposite
  - positive instead of negative spillover
- Productivity shock in Industrial country has little impact on the Emerging surplus country and on international capital flows
  - Consistent with the resilience observed after the crisis
  - It also has smaller impact on the Industrial country, that reacts more like a closed economy
- Means asymmetric response to shocks
- Muted response of the real exchange rate

Basic mechanism

- Entrepreneurs have two-period projects
- In the first period, they install capital
- In the second period they hire labor and produce
- They need working capital in the second period to pay the wage bill in advance
- But they may be credit constrained
- They save in the first period to hire labor in the second period
- Demand for liquid assets

Basic mechanism - 2

- Capital is a two-period illiquid asset and bonds are one-period liquid asset
- Bonds and capital are complements instead of substitutes
- There is no subperiod and all markets open simultaneously
- Three crucial assumptions behind the mechanism:
  1. Time-to-build technology
  2. Working capital
  3. Credit constraints
- The rest of the model is standard

Entrepreneurs and the demand for liquidity

- First consider the behavior of a single entrepreneur
- Maximize:

$$\sum_{s=0}^{\infty} \beta^s u(c_s) \tag{1}$$

- Budget constraint in the two periods, investing at t and producing at $t+1$:

$$r_t B_t + A_{t-1} F(K_{t-1}, l_{t-1}) = c_t + K_{t+1} + B_{t+1} \tag{2}$$

$$r_{t+1} B_{t+1} = c_{t+1} + w_{t+1} l_{t+1} + B_{t+2} \tag{3}$$

- Credit constraint:

$$r_{t+2} B_{t+2} \geq -\phi K_{t+1} \tag{4}$$

First-order conditions

- Let λ_{t+1} denote the multiplier associated with this constraint. The first-order conditions are:

$$A_{t+1}F_k(K_{t+1}, l_{t+1}) = r_{t+1}r_{t+2}\left(1 + \frac{\lambda_{t+1}}{\beta u'(c_{t+2})}\left(1 - \frac{\phi}{r_{t+1}r_{t+2}}\right)\right) \tag{5}$$

$$A_{t+1}F_l(K_{t+1}, l_{t+1}) = r_{t+2}w_{t+1}\left(1 + \frac{\lambda_{t+1}}{\beta u'(c_{t+2})}\right) \tag{6}$$

$$\frac{u'(c_t)}{u'(c_{t+1})} = \beta r_{t+1} \tag{7}$$

$$\frac{u'(c_{t+1})}{u'(c_{t+2})} = \beta r_{t+2}\left(1 + \frac{\lambda_{t+1}}{\beta u'(c_{t+2})}\right) \tag{8}$$

Benchmark case

- We can derive analytical results in a special case:
  - log utility
  - Cobb-Douglas production function
  - $\phi = 0$
- In this case the demand for bonds is:

$$B_{t+1} = \beta(1 - \alpha\beta)[A_{t-1}F(K_{t-1}, l_{t-1})] \tag{9}$$

$$B_{t+2} = 0$$

- Inelastic demand, insensitive to interest rate and current productivity
- Moreover, the ratio B_t / K_t is constant
- Illustrates the complementarity between capital and bonds and the mechanism behind global imbalances

- In contrast if entrepreneur is unconstrained we have:

$$B_{t+1} = \beta[r_t B_t + A_{t-1} F(K_{t-1}, l_{t-1})] - K_{t+1} \tag{10}$$

$$B_{t+2} = \beta^2 r_{t+1}[r_t B_t + A_{t-1} F(K_{t-1}, l_{t-1})] - \frac{A_{t+1} F(K_{t+1}, l_{t+1})}{r_{t+2}} \tag{11}$$

- Elastic demand. Increases with interest rates and decreases with productivity
- B_t and K_t no longer complements
- Difference between constrained and unconstrained is key

Substitutability between capital and labor

- Plays an important role
- When we deviate from Cobb-Douglas, impact of interest rate on bond demand is ambiguous
- When capital and labor have little substitutability (e.g. Leontief), demand for bonds reacts negatively
  - revenue effect: as r_{t+1} increases, more liquidity available in the second period and smaller demand for bonds
- When capital and labor are highly substitutable, demand for bonds reacts positively
  - substitution effect: as r_{t+1} increases, use less capital and more labor. Implies stronger demand for bonds
- With full substitutability, escape the credit constraint and no demand for liquidity

Two-country general equilibrium model

- Introduce labor supply in each country
- Workers are impatient and do not save in equilibrium
- Two groups of entrepreneurs: half start their project in odd periods and half in even periods
- In each period half the entrepreneurs install their capital and the other half produces

World equilibrium

- Entrepreneurs can trade in bonds with the other country
- Bonds market equilibrium:

$$B_{t+1} + B^*_{t+1} = 0 \tag{12}$$

- B_{t+1} is the total demand for bonds of constrained entrepreneurs in the Emerging country
- B^*_{t+1} is the total demand for bonds of unconstrained entrepreneurs in the Industrial country
- Real exchange rate is w_t / w^*_t
- We assume that Emerging entrepreneurs are more impatient than Industrial: they are always constrained

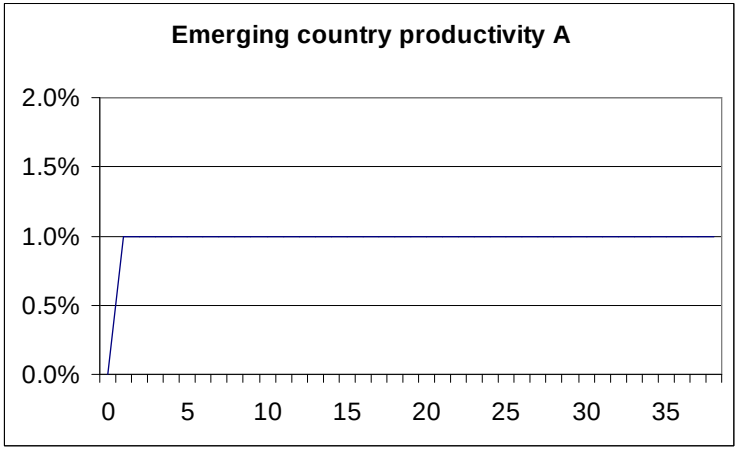
Simulation

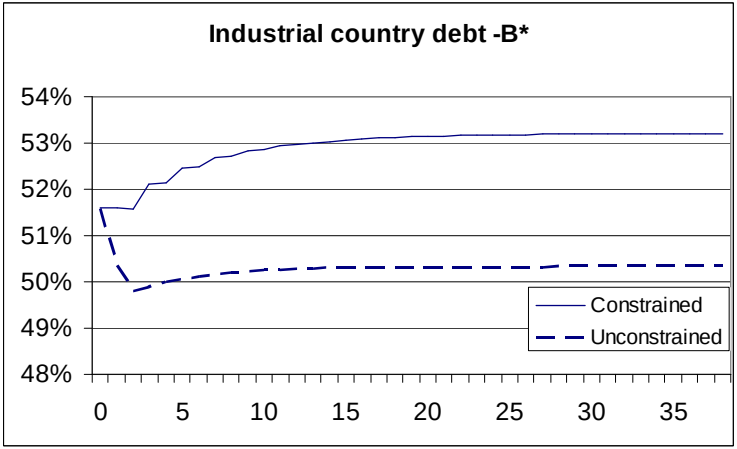
Table 1: Parameter values	
Numerical benchmark	
α	0.36
β	0.95
β^*	0.97
ϕ	0.1
ρ	1
η	1
- Look at different productivity levels

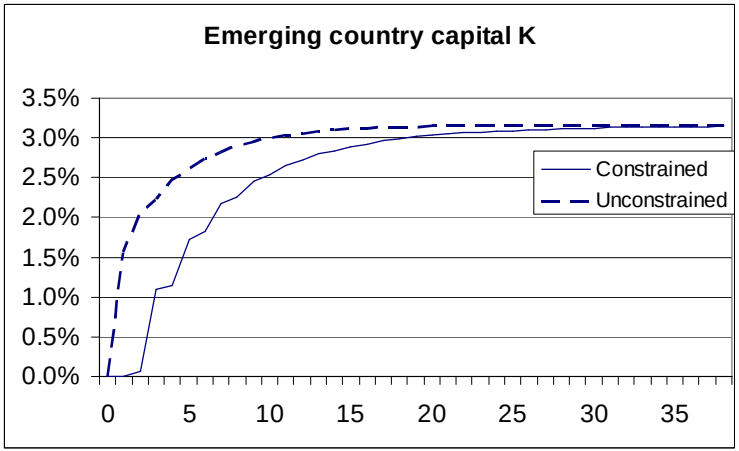
Permanently higher productivity in the Emerging market

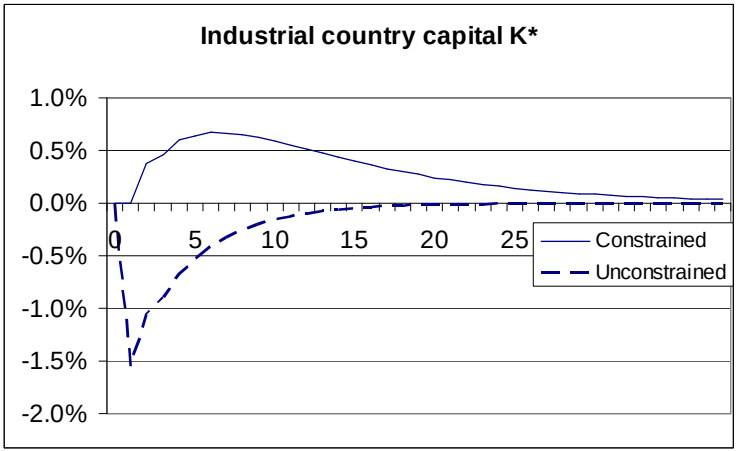
- A_t is 1% higher permanently
- Global imbalances

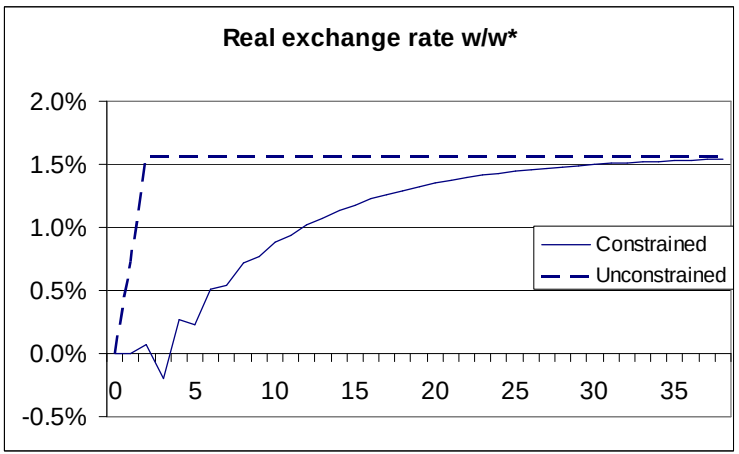
Figure 1: Global imbalances – Positive and permanent productivity shock in the Emerging country

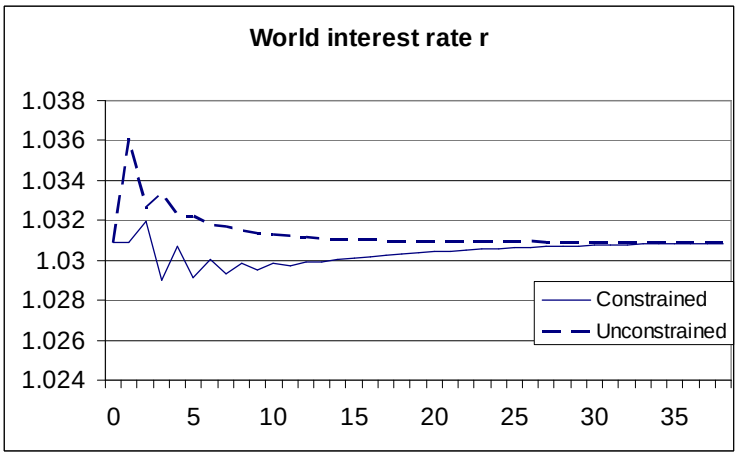





Emerging country capital K
3.5%
3.0%
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
0
5
10
15
20
25
30
35
Constrained
Unconstrained


Industrial country capital K*
1.0%
0.5%
0.0%
-0.5%
-1.0%
-1.5%
-2.0%
0
5
10
15
20
25
Constrained
Unconstrained

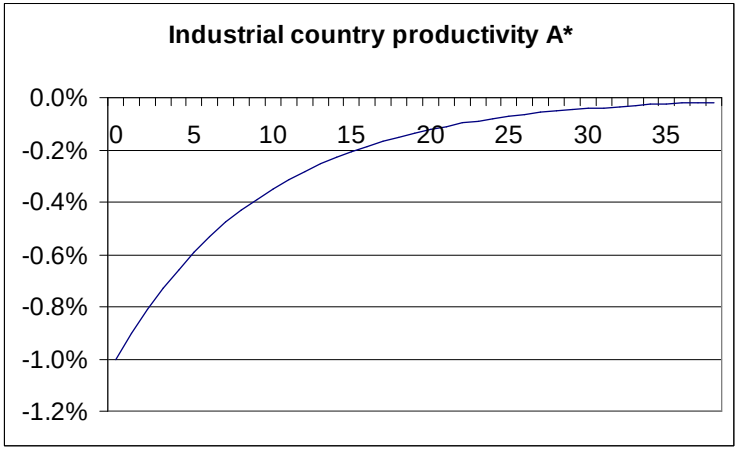

Real exchange rate w/w*
2.0%
1.5%
1.0%
0.5%
0.0%
-0.5%
0
5
10
15
20
25
30
35
Constrained
Unconstrained

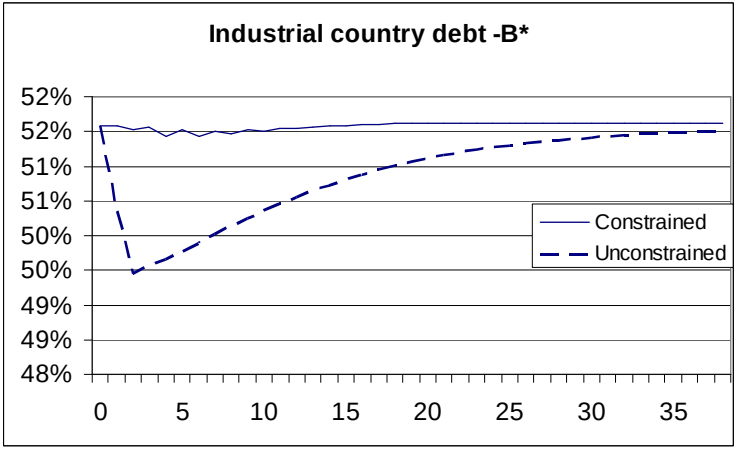

World interest rate r
1.038
1.036
1.034
1.032
1.03
1.028
1.026
1.024
0
5
10
15
20
25
30
35
Constrained
Unconstrained

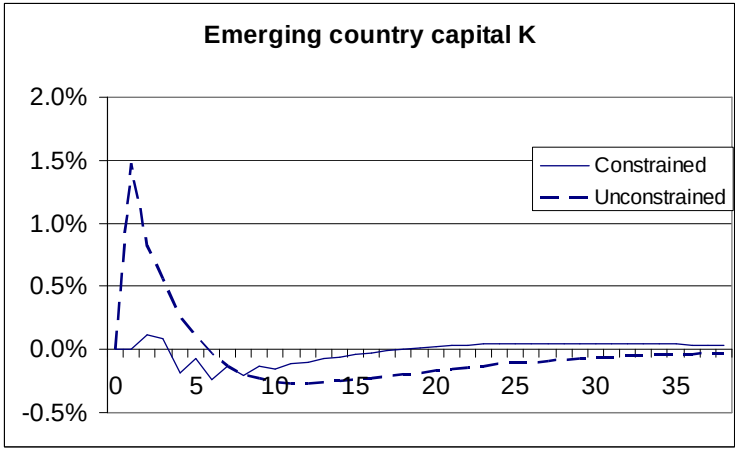
Temporarily lower productivity in the Industrial country

- A_t^* temporarily lower
- Small impact on capital flows
- Reduced impact on the Industrial country

Figure 2: The crisis – Negative and temporary productivity shock in the Industrial country






Emerging country capital K
2.0%
1.5%
1.0%
0.5%
0.0%
-0.5%
0
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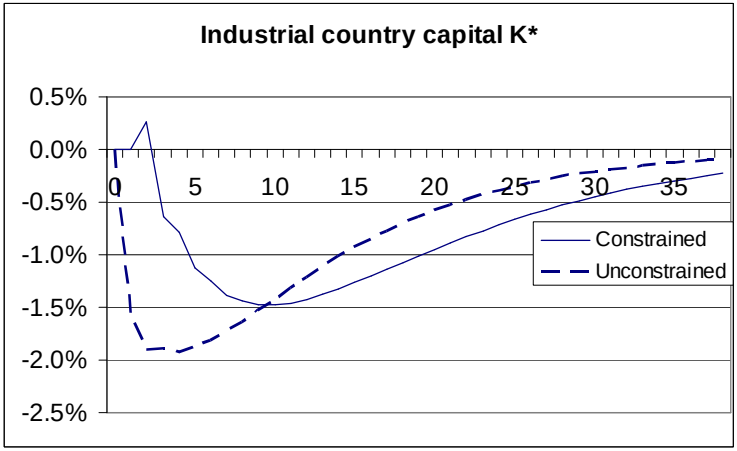
35
Constrained
Unconstrained


Industrial country capital K*
0.5%
0.0%
-0.5%
-1.0%
-1.5%
-2.0%
-2.5%
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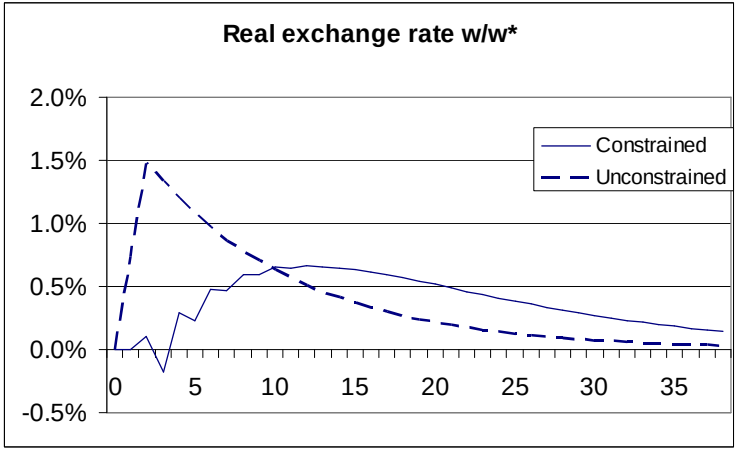
Constrained
Unconstrained


Real exchange rate w/w*
2.0%
1.5%
1.0%
0.5%
0.0%
-0.5%
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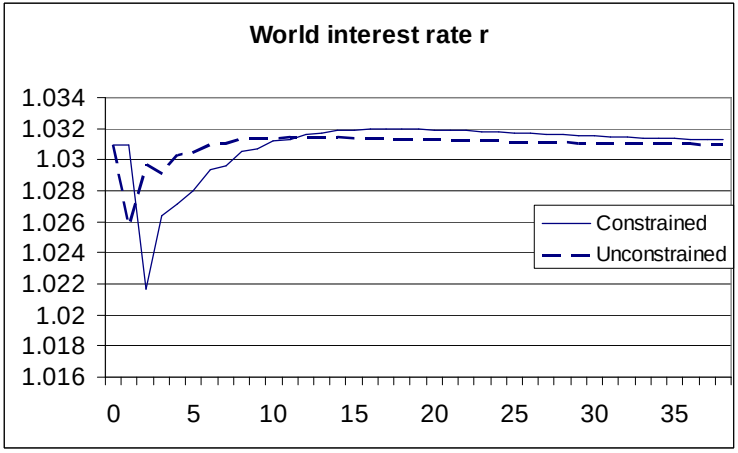
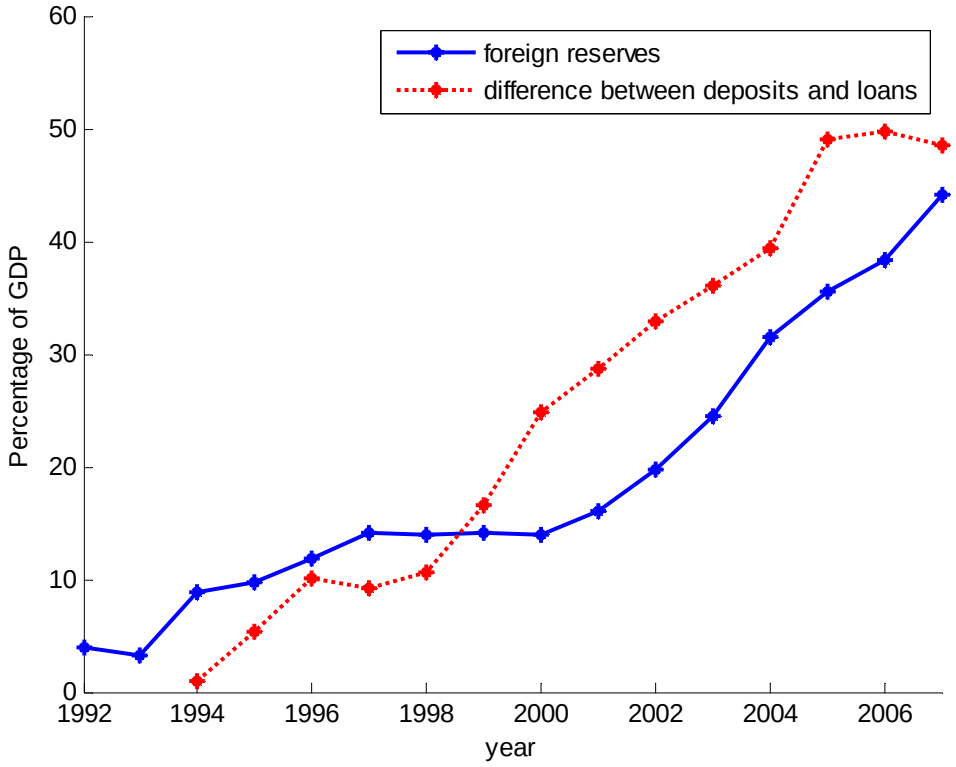
35
Constrained
Unconstrained


World interest rate r
1.034
1.032
1.03
1.028
1.026
1.024
1.022
1.02
1.018
1.016
0
5
10
15
20
25
30
35
Constrained
Unconstrained

Conclusions

- We developed a two-country dynamic general equilibrium model, where the demand for liquidity is modeled in a simple way
- The model generates global imbalances
- The model can be used to analyze the global impact of shocks
- The impact is quite different from standard models
- The analysis can be extended in different directions. Suggestions welcome

Figure 1 Foreign Reserves and the Difference between Deposits and Loans



The figure plots China's foreign reserves (solid line) and the domestic bank deposits minus domestic loans (dotted line), both expressed as a percentage of GDP. Data source: CSY, various issues.