

# Foreign exchange reserve diversification and the “exorbitant privilege”

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## International Dimensions of Conventional and Unconventional Monetary Policy

The views expressed herein are solely the authors', and do not reflect those of Banca d'Italia



# Motivation

- ▶ After a short-lived break in 2008 reserve accumulation has resumed
- ▶ Size is huge: at end-2012, 5 times larger wrt 10 years earlier
- ▶ Very little change in the shares that countries allocate to USD and EUR. [Res]
- ▶ Shifts in reserve allocation, in particular by China, may impact on global interest and exchange rates
- ▶ Reserve re-composition would affect the so called “exorbitant privilege” of the core currency and the global economy



## Contribution of the paper

- ▶ Even if the relation between official reserve accumulation and the “privilege” is a key feature of the international monetary system, there is (surprisingly) little quantitative analysis of it
- ▶ This paper fills this gap by investigating on the following question: *how large are the macroeconomic benefits/costs of reserve accumulation/recomposition?*
  - ▶ for countries issuing reserve currencies?
  - ▶ for countries accumulating reserves?
- ▶ we develop a large scale DSGE model of the world economy featuring a *crucial and novel* role for reserve currencies and international liquidity and capturing both financial/valuation and trade channels



## Main results

- ▶ Welfare costs/gains of the “exorbitant privilege” are small, but not trivial
- ▶ A country whose currency is held internationally enjoys benefits when the times are ‘good’, but privilege can be lost as other reserve currencies emerge
- ▶ Countries holding reserve currency assets face no *additional* costs from rebalancing their portfolios (trade surplus rebalancing).



## Main novel features

- ▶ Building on Canzoneri, Cumby, Diba, and Lopez-Salido (2013), develop a 5-country large-scale DSGE model calibrated to the US, EA, JAP, CHN, and ROW
- ▶ Government bonds are assumed to provide liquidity services (Krishnamurthy and Vissing-Jorgensen, 2012)
- ▶ Each country/region issues government bonds that are imperfect substitutes for money
- ▶ Only government bonds issued in reserve currency economies can be exchanged internationally
- ▶ Allow also for the existence of an international (*less liquid*) asset that can be exchanged internationally in USD



## Other features (common to large scale quantitative DSGEs)

- ▶ Price and wage nominal rigidities (Rotemberg, 1982)
- ▶ Investment adjustment costs
- ▶ Tradable and non-tradable intermediate goods
- ▶ Consumption habits
- ▶ Ricardian and hand-to-mouth consumers
- ▶ Local-currency pricing



## Household budget constraint

$$\begin{aligned}
 M_t + B_t - M_{t-1} - B_{t-1}R_{t-1} + B_t^{RC} - B_{t-1}^{RC}R_{t-1}^{RC} \\
 = P_t Y_t - (1 + \tau_t) P_t C_t - P_t I_t - T_t
 \end{aligned}$$

where the “transaction cost” is proportional to consumption and velocity, which in turn depends on effective money balances

$$\tau_t = f \left( \underset{+}{C}, \underset{-}{\tilde{M}} \right)$$



## “Effective” money balances

Each household holds “effective” money balances:

$$\tilde{M}_t^{US} = \left(M_t^{US}\right)^{\zeta_1} \left(B_t^{US}\right)^{\zeta_2} \left(\frac{B_t^{EA,US}}{S_t^{EA}}\right)^{1-\zeta_1-\zeta_2}$$

$$\tilde{M}^{EA} = \left(M_t^{EA}\right)^{\omega_1} \left(B_t^{EA}\right)^{\omega_2} \left(S_t^{EA} B_t^{US,EA}\right)^{1-\omega_1-\omega_2}$$

$$\tilde{M}^J = \left(M_t^J\right)^{\omega_1^J} \left(B_t^J\right)^{\omega_2^J} \left(S_t^J B_t^{US,J}\right)^{\omega_3^J} \left(S_t^{J,EA} B_t^{EA,J}\right)^{1-\omega_1^J-\omega_2^J-\omega_3^J}$$

$J = \text{CHN, JAP, RW}$





# Implications

- ▶ Consumption choices depend directly upon asset holdings:  
 $M^J, B^J, B^{RC}$
- ▶ There is a liquidity premium on Gov't bond yields due to the transaction cost



# Gov't budget constraint

Focus on *imperfect asset substitutability* and *Governments*

$$\begin{aligned}
 M_t^J + B_{G,t}^J + S_t^{J,EA} B_{G,t}^{EA,J} + S_t^J B_{G,t}^{US,J} \\
 &= M_{t-1}^J + R_{t-1}^J B_{G,t-1}^J + S_t^{J,EA} R_{t-1}^{EA} B_{G,t-1}^{EA,J} \\
 &+ S_t^J R_{t-1}^{US} B_{G,t-1}^{US,J} + P_t^J G_t^J + TR_t^J
 \end{aligned}$$

where  $B_G^{RC,J}$  = official foreign exchange reserve holdings (exogenous);  $RC$  = reserve currency



## Calibration (asset holdings)

Rely on data for calibration of asset holdings/shares by the private and public sectors to back out parameters affecting transactions services

	US	EA	CHN	JAP	RW
Private agents					
curr. in circ./dom. govt bond	0.27	0.22	0.48	0.06	0.19
curr. in circ./USD govt bond	...	8.39	2.53	2.22	4.86
curr. in circ./EUR govt bond	8.77	...	3.14	2.70	6.21
Official holdings					
of USD govt bonds (% of GDP)	...	3.87	16.40	16.00	6.80
of EUR govt bonds (% of GDP)	0.51	...	8.05	5.56	2.42



## Calibration (trade)

We set the weights of bilateral imports to match a disaggregated steady-state matrix delineating the pattern and composition of exports and imports in all regions.

		EA	US	CHN	JAP	RW
Imp cons goods from	EA	...	1.1	1	0.8	3.4
	US	0.9	...	0.8	0.7	4.3
	CHN	1.3	1.4	...	1.8	2.5
	JAP	0.3	0.5	0.9	...	0.9
	RW	10.5	4.9	7.6	5.9	...
Imp inv't goods from	EA	...	0.8	1.1	0.4	2.9
	US	0.9	...	0.9	0.6	1.7
	CHN	1.2	1.3	...	1.4	2.7
	JAP	0.3	0.4	1.3	...	0.9
	RW	8.4	4	8.6	4.3	...
	NFA (%GDP)	-17.6	-27.4	21	57.3	5.3
	NFA (%GDP) (1)	-22.9	14.6	2.6	34.3	-4.9

## Scenarios

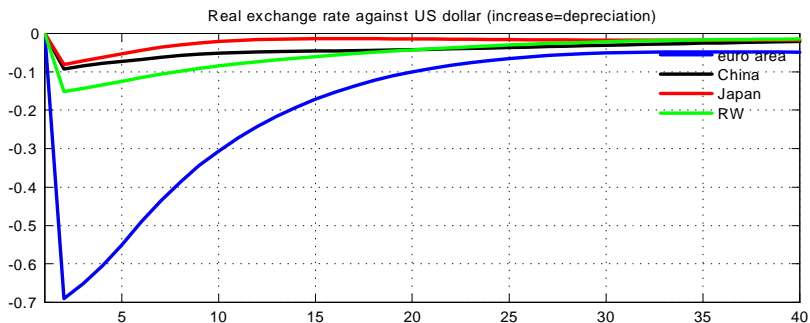
1. "So far, so good": CHN, JAP and RW *permanently* increase official reserves by 1% both in USD and EUR
2. "Rebalancing": CHN, JAP and RW reduce official reserves in USD (by 1%) and increase those in EUR so that overall reserves increase by 1%
3. Only CHN, increases official reserves by 1% both in USD and EUR
4. JAP and RW *increase* official reserves by 1% both in USD and EUR, CHN *pegs* to the USD ("Bretton Woods II")
5. CHN *reduces* official reserves by 1% both in USD and EUR, while JAP and RW *increase*

All scenarios are run under *perfect foresight from the initial steady state*.

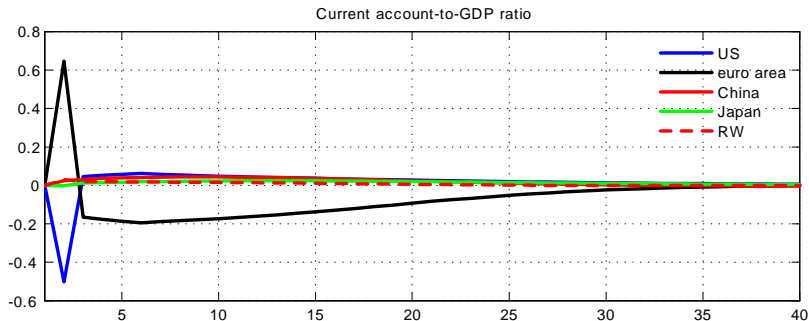


# "Rebalancing"

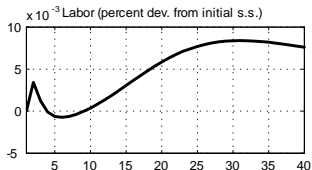
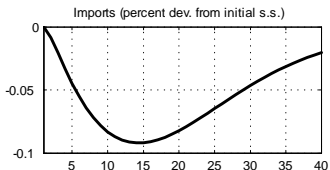
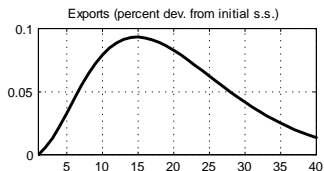
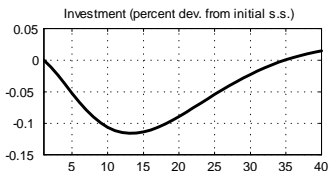
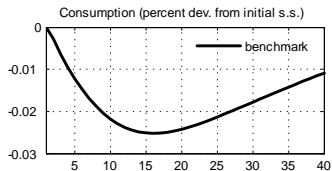
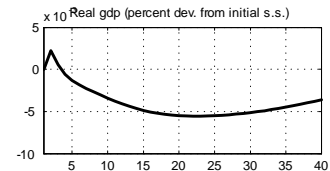
All currencies appreciate against the USD, especially the euro.



Portfolio rebalancing and valuation effects dominate initial CA dynamics. EA households buy US Treasuries due to higher returns and benefit from valuation gains

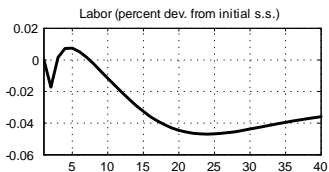
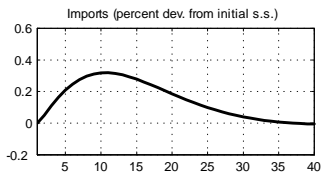
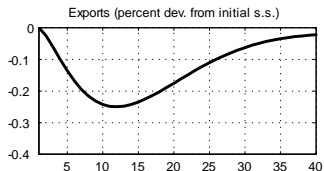
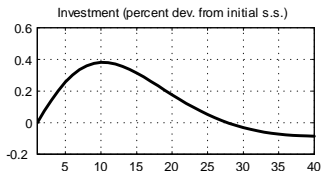
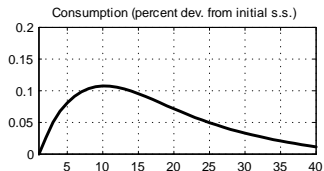
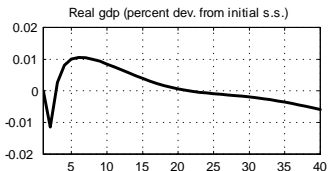


# The US lose some "exorbitant privilege" . . . .

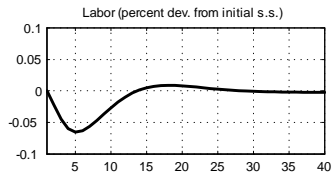
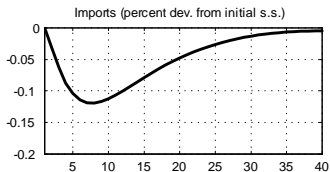
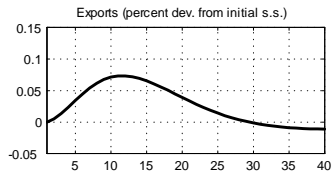
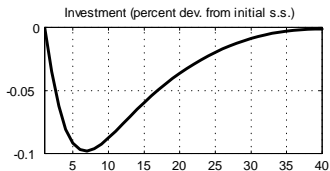
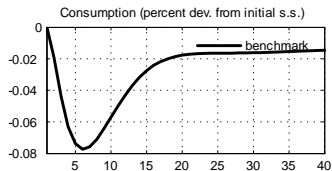
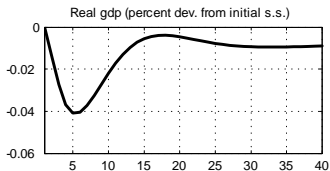




... the EA benefits from a higher "exorbitant privilege" ....



... while not much *difference* for China [sfsgCHN]



## Wrapping up ("Rebalancing")

- ▶ Portfolio rebalancing and valuation effects dominate CA dynamics in the short term.
- ▶ An increase in demand for EUR reserves lowers EA interest rates, appreciates the euro and increases domestic aggregate demand and the trade deficit in the EA.
- ▶ In the US interest rates increase and aggregate demand falls, the dollar depreciates and the trade deficit improves.
- ▶ CHN, and more generally, countries increasing their official reserves experience lower private consumption (higher savings) and increasing trade surpluses vis-à-vis the EA.



## Welfare metric

Quarterly cost as a percentage of initial steady state consumption,  $\Psi$ , for a generic country  $J$ :

$$\Psi = \left\{ 1 - \exp \left[ (1 - \beta) W_0^J + \frac{\bar{N}^{J1+\chi}}{1 + \chi} - \log \left( (1 - \xi) \bar{C}^J \right) \right] \right\} * 100$$

where  $W_0^J$  is the discounted sum of household utility in the initial steady state.



## Welfare costs

	EA	US	CHN	JAP	RW
"So far, so good"	-0.0040	-0.0078	0.0159	0.0141	0.0067
"Rebalancing"	-0.0229	0.0074	0.0156	0.0154	0.0053
CHN sells	-0.0011	-0.0016	-0.0238	0.0147	0.0063

Note: percentage points; quarterly. Consumption equivalent i.e. fraction of permanent consumption that must be given up in order to equal welfare in the new regime (negative values imply that in the new regime welfare increases)

*Putting into context:* USD official reserves increased by 10% per year in 2009-12 ca. 10 times as big as our shock on impact and 30 times cumulatively.

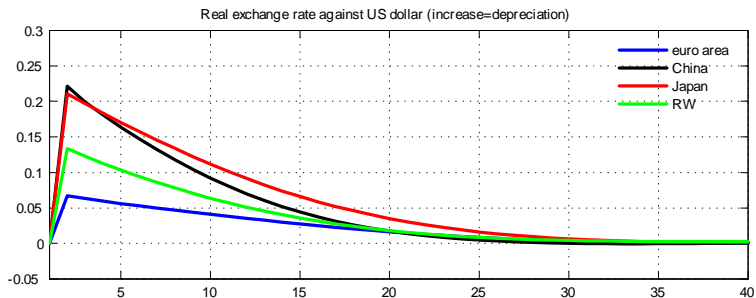


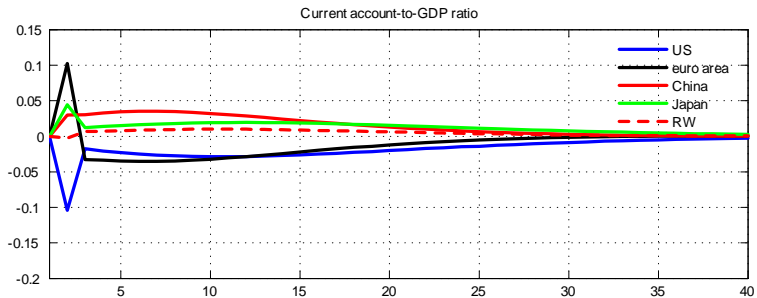
## Going forward and open issues

- ▶ (Regional) implications of renminbi going global?
- ▶ Optimal allocation of reserves
- ▶ Consolidation of a truly multilateral IMS?
  - ▶ Strategic interactions between authorities?
  - ▶ Strategic interactions between authorities and private agents?



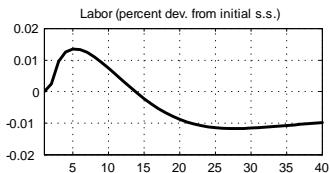
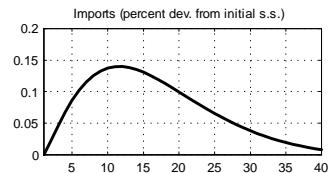
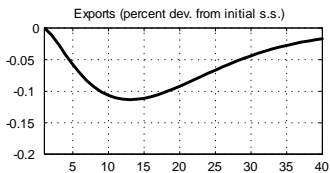
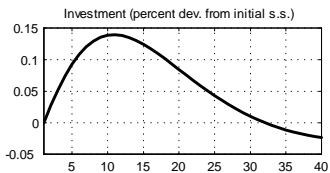
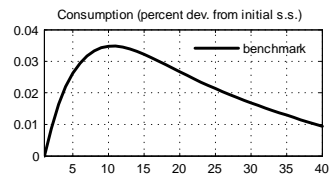
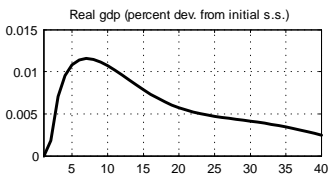
CHN,JAP,ROW increase their official reserves by 1% both in USD and EUR.





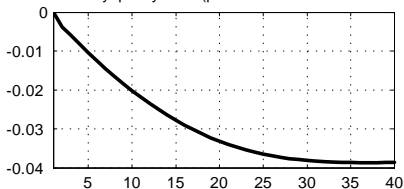


## US: real variables

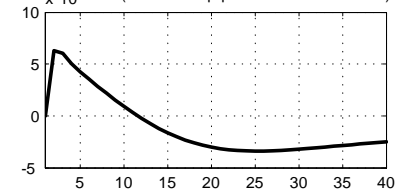


## US: financial variables

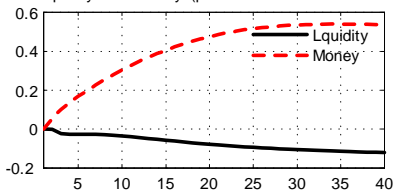
Monetary policy rate (percent dev. from initial s.s.)



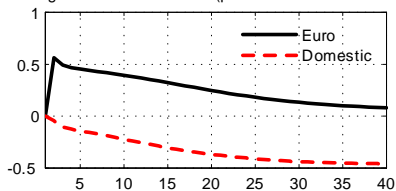
Inflation (annualized p.p dev. from initial s.s.)



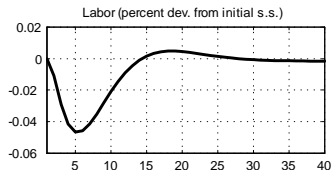
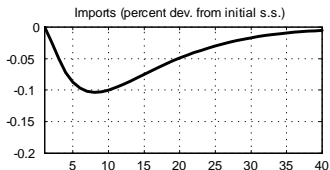
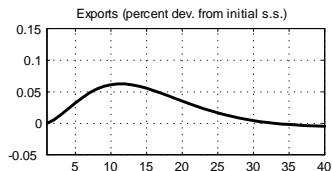
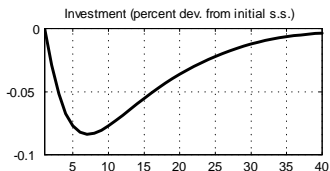
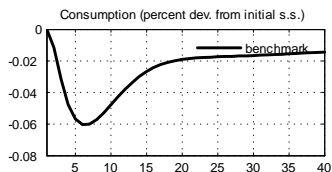
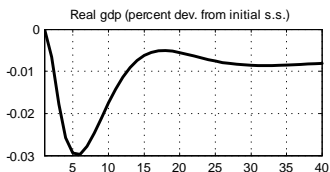
Liquidity and money (percent dev. from initial s.s.)



Foreign and domestic bond (percent dev. from initial s.s.)

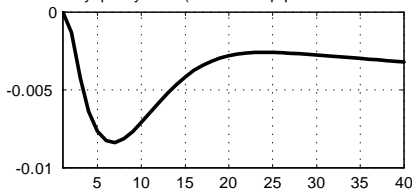


## "So far, so good" scenario. China: real variables

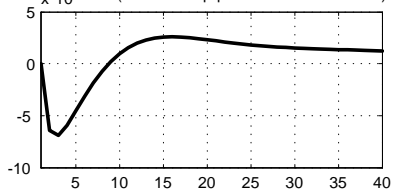


## China: financial variables

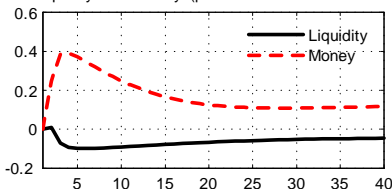
Monetary policy rate (annualized p.p. dev. from initial s.s.)



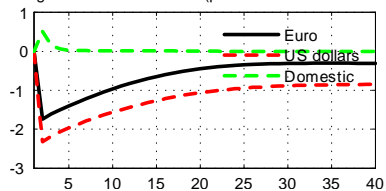
Inflation (annualized p.p. dev. from initial s.s.)



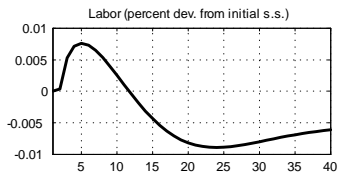
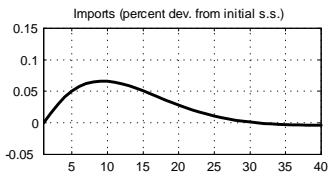
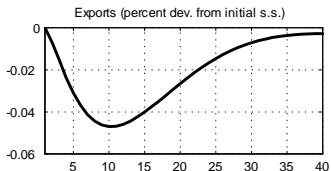
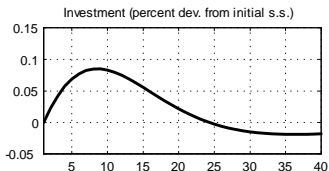
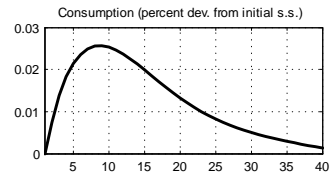
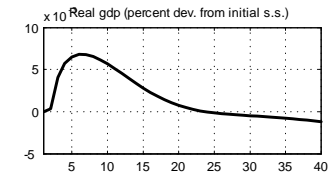
Liquidity and money (percent dev. from initial s.s.)



Foreign and domestic bond (percent dev. from initial s.s.)

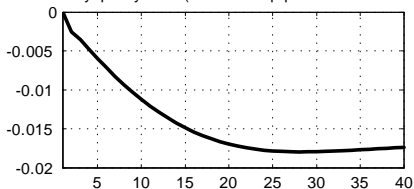


## EA: real variables

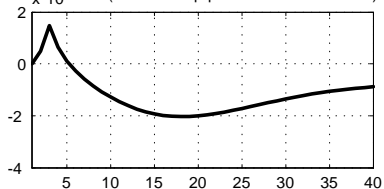


## EA: financial variables

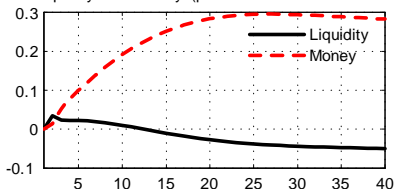
Monetary policy rate (annualized p.p. dev. from initial s.s.)



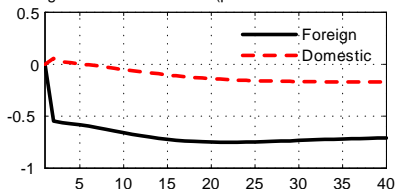
Inflation (annualized p.p. dev. from initial s.s.)



Liquidity and money (percent dev. from initial s.s.)



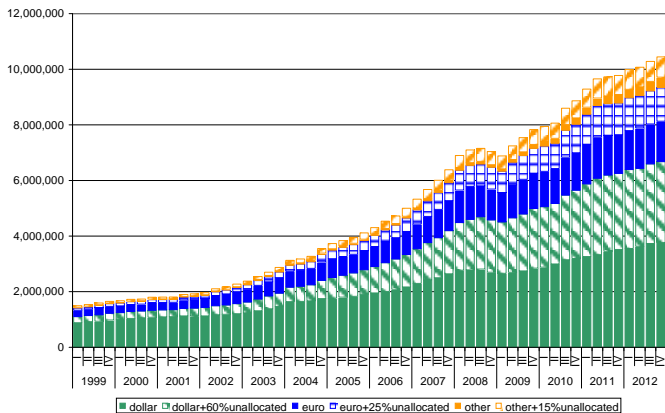
Foreign and domestic bond (percent dev. from initial s.s.)



## Related literature

- ▶ “exorbitant privilege” (Gourinchas and Rey, 2007)
- ▶ int’l currencies and asset prices (Devereux and Shi, 2009)
- ▶ imperfect substitutability and current account (Kouri, 1976; Obstfeld, 2004; Blanchard, Giavazzi and Sa, 2005)
- ▶ Note: we do not examine *optimal* asset allocation (Devereux and Sutherland, 2007)





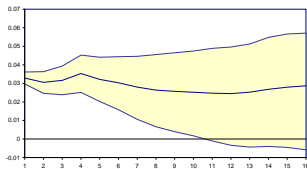


“In practice, these countries increased reserves through the expedient of issuing debt to their citizens, thereby mobilizing domestic saving, and then using the proceeds to buy U.S. Treasury securities and other assets. Effectively, *governments have acted as financial intermediaries, channeling domestic saving away from local uses and into international capital markets.*” Bernanke, 2005.

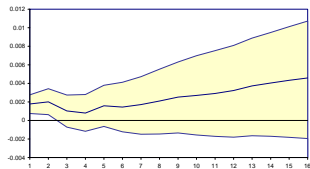
**[VAR]**



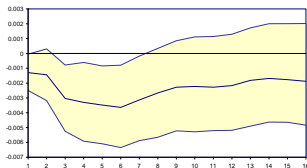
Reserves



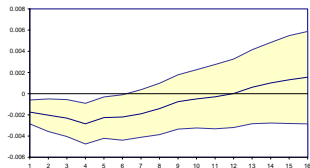
GDP



Government expenditures

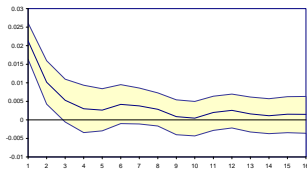


Private consumption



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Exchange rate



Trade balance

