Collateral Advantage: Exchange Rates, Capital Flows, and Global Cycles

Michael B. Devereux*, Charles Engel†, Steve Pak Yeung Wu‡

*UBC, †Wisconsin, ‡UC San Diego

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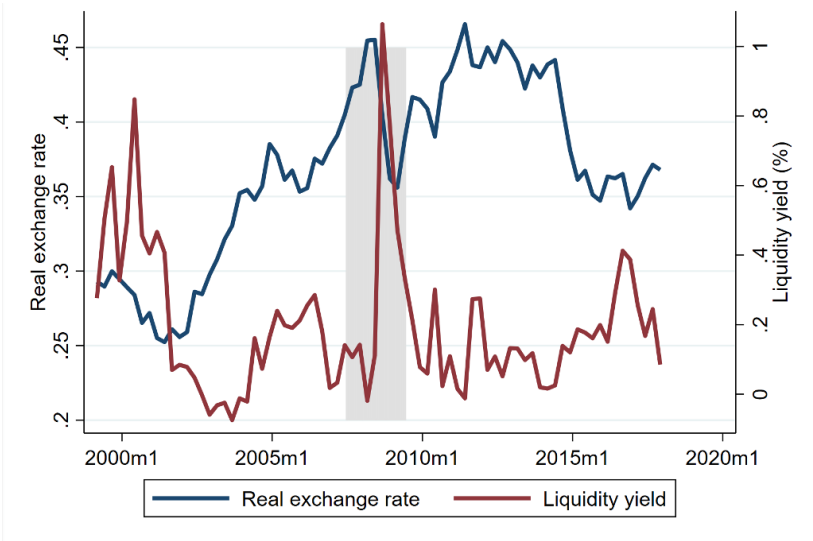
  - Widens in crisis times
  - Cannot easily be explained by differential risk
- Convenience yield shown to be a driver of the real exchange rate (Engel Wu, 2023)
- This paper constructs an endogenous convenience yield and shows it can explain a large number of stylized facts about the US dollar and US financial assets

Some ‘stylized facts’

1. US dollar appreciates in financial crisis here

Exchange rates and Liquidity yield

- Link between US dollar and liquidity (convenience) yield of Treasury securities
  Engel and Wu 2022, Jiang, Krishnamurthy, Lustig 2021



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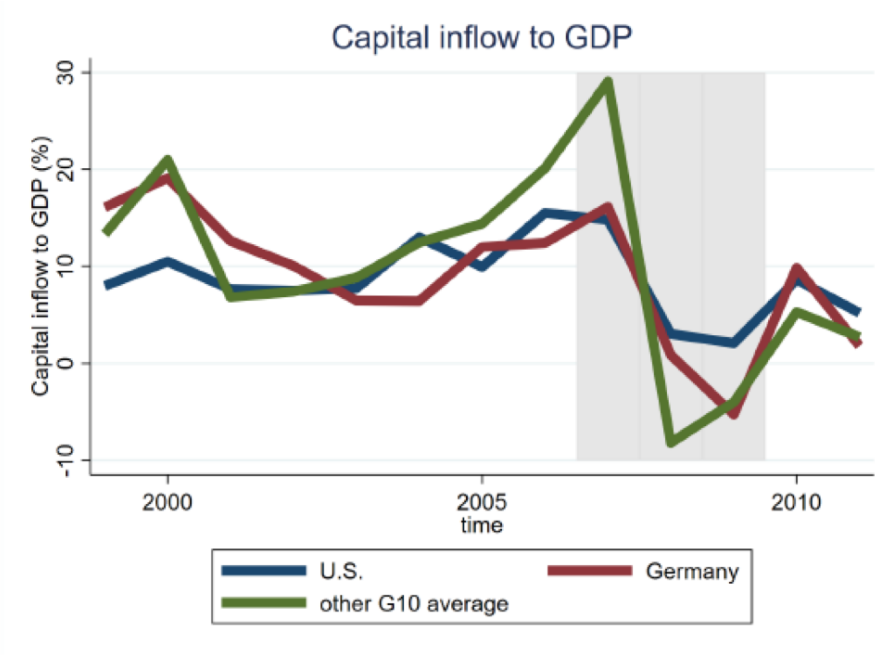
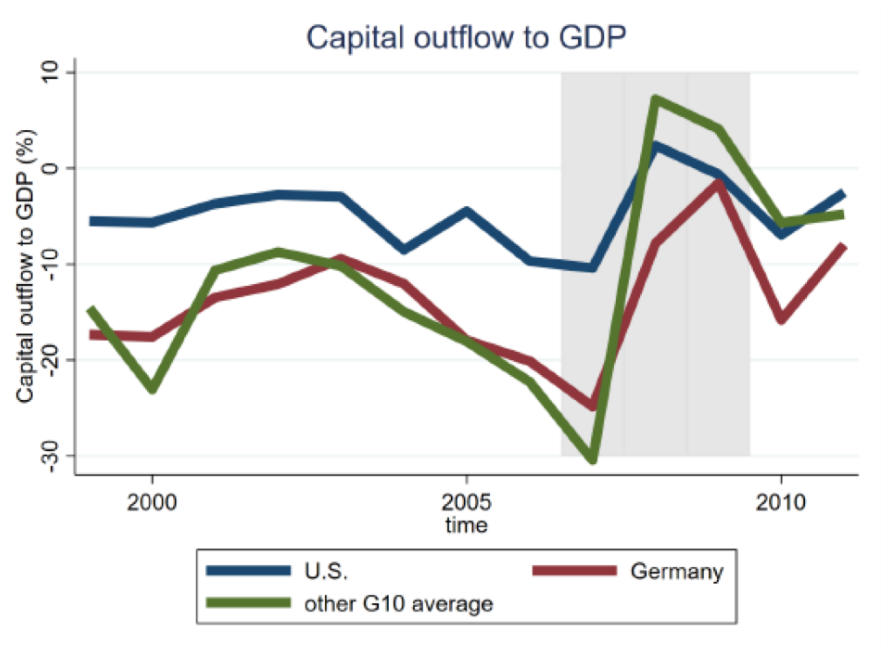
4. Capital flow retrenchment during global crises here

Retrenchment: crises lead to a pullback in inflows and outflows





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- Puzzle: what drives the dollar appreciation - reserve currency paradox?

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- Puzzle: what drives the dollar appreciation - reserve currency paradox?
- Can we draw all these features together in a conventional open macro model?

What this paper does

- A NK DSGE model with banks to generate endogenous convenience yield

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- Banks face collateral constraint on their asset holding
- One key assumption:
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- Rich set of implications consistent with behaviour of US dollar and US NFA around financial crises

What we find

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3. Retrenchment for both countries
4. Exchange rate response $\equiv$ endogenous convenience yield

Literature

Exorbitant Privilege and global imbalances:
Caballero, Farhi, and Gourinchas (2008, 2015), Gourinchas and Rey (2007a, 2007b, 2022)

Reserve Currency Paradox:
Maggiori (2017); Farhi and Maggiori (2018); Gourinchas, Rey and Sauzet (2019)

Global financial intermediation and exchange rates:
Gabaix and Maggiori (2015), Itskhoki and Mukhin (2021, 2022), Bruno and Shin (2015), Du, Tepper, and Verdelhan (2018), Fang and Liu (2021), Banerjee, Devereux, and Lombardo (2016), Devereux and Yu (2020), Gopinath and Stein (2020)

Convenience yields:
Krishnamurthy and Vissing-Jorgensen (2012), Nagel (2016), Du, Im and Schreger (2018) + exchange rates: Engel (2016), Valchev (2018), Jiang, Krishnamurthy, and Lustig (2021a, 2022), Engel and Wu (2021), Bianchi, Bigio, and Engel (2022)

Global imbalances: Kekre and Lenel (2023), Jiang, Krishnamurthy, and Lustig (2021)

Roadmap

1. Convenience yield and financial shocks: evidence

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Empirics: to isolate impact of financial shock on exchange rate

1. Exchange rate of US dollar against G9 currencies
2. Key feature **instrument convenience yield with financial shocks**
3. Use 4 instruments from Ottonello and Song (2022) - high frequency changes in market value of financial intermediaries around earnings announcements
4. Daily data from 2001- 2014

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Regression specification:

$$\Delta s_{j,t} = \alpha_j + \beta_1 s_{j,t-1} + \beta_2 \Delta \eta_{j,t} + \beta_3 \Delta (i - i^*)_{j,t} + \beta_4 \eta_{j,t-1} + \beta_5 (i - i^*)_{j,t-1} + u_{j,t}$$

η is convenience yield, measured as payoff on synthetic US bond minus return on treasury

Results

1 percent increase in convenience yield leads to 9 percent dollar appreciation
Consistent with model mechanics

	LHS: $\Delta s_{j,t}$
$\Delta\hat{\eta}_{j,t}$	-9.07**
	(4.53)
$\Delta i - i^*_{j,t}$	-8.58**
	(3.86)
$\eta_{j,t-1}$	-0.002
	(0.002)
$i - i^*_{j,t-1}$	-0.040
	(0.03)
$s_{j,t-1}$	-0.003
	(0.002)
N	1746

The two country NK model with treasury liquidity

- Goods market

  - Home (US) and foreign (Eurozone) goods

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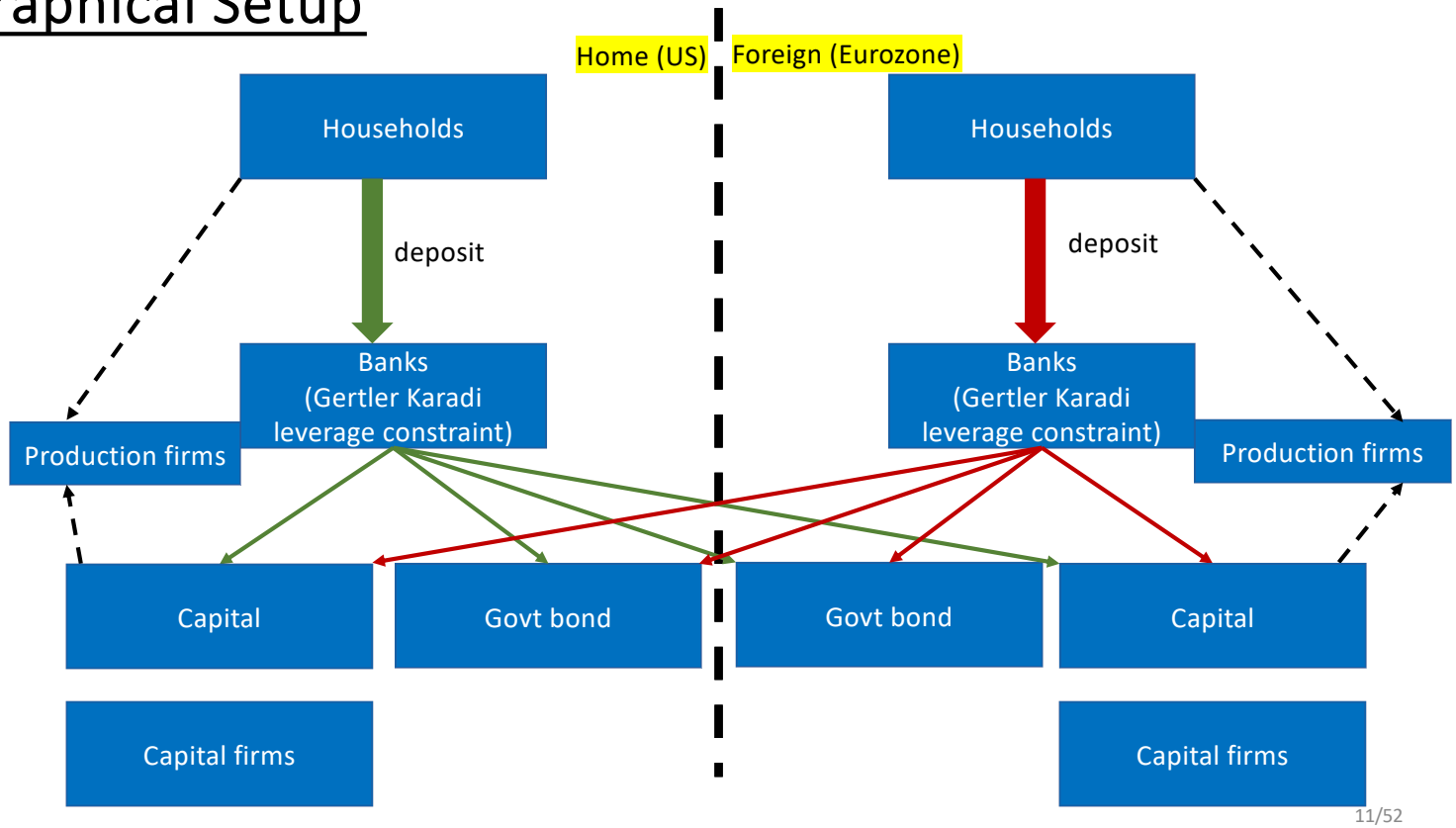
  Gertler Karadi / Gertler Kiyotaki type of Home and Foreign banks
  Moral hazard problem/Incentive constraint on asset holding
- Assets market
  Home bond, foreign bond, home capital, foreign capital
  Key is that home bond is a better collateral

Model Template

Graphical Setup



Banks

- As in Gertler et al, banks come from households and have uncertain lives
- A fraction θ of each household becomes a banker each period, and continues with probability θ, and reverts to being a consumer with probability $1-\theta$
- Balance sheet of bank

$$\underbrace{N_t + B_t}_{\text{Net Worth + Deposits}} = \underbrace{Q_t K_{h,t+1} + D_{h,t}}_{\text{Investment Home Assets}} + \underbrace{S_t[Q_t^* K_{f,t+1} + D_{f,t}]}_{\text{Investment Foreign Assets}}$$

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- Banker can abscond with some of the assets, so we need:

$$\underbrace{\text{Value of the bank}}_{\text{Value of staying in business}} \geq \underbrace{\text{Weighted value of the assets}}_{\text{Value of running away}}$$

Bank's Problem

- The gain to running away is a weighted linear function of the value of current investments

$$V_t \geq \vartheta \left[(\kappa_{K,h} Q_t K_{h,t+1} + \kappa_h D_{h,t}) + S_t (\kappa_{K,f} Q_t^* K_{f,t+1} + \kappa_f D_{f,t}) \right]$$

- The lower the κ parameters, the less the asset is divertable, or the more it is pledgeable

- Key assumption:

  Home bond is the best collateral $\kappa_h < \kappa_f \leq \kappa_{K,h} \leq \kappa_{K,f}$

  The same for the foreign banks $\kappa_h^* < \kappa_f^* \leq \kappa_{K,f}^* \leq \kappa_{K,h}^*$

  Home bond has a 'collateral advantage'

Bank's optimality conditions

- On each asset, we have a time varying spread over deposit rate
- But spreads different due to different collateral requirements

- Home bond

$$E_t \Lambda_{i,t+1} \left(R_{h,t+1} - R_{t+1} \right) = \lambda_{i,t} \vartheta_t \kappa_{h1}$$

- Foreign Bond

$$E_t \Lambda_{i,t+1} \left(\frac{S_{t+1}}{S_t} R_{f,t+1} - R_{t+1} \right) = \lambda_{i,t} \vartheta_t \kappa_{f1}$$

- Home equity

$$E_t \Lambda_{i,t+1} \left(\tilde{R}_{k,t+1} - R_{t+1} \right) = \lambda_{i,t} \vartheta_t \kappa_{Kh1}$$

- Foreign equity

$$E_t \Lambda_{i,t+1} \left(\frac{S_{t+1}}{S_t} \tilde{R}^*_{k,t+1} - R_{t+1} \right) = \lambda_{i,t} \vartheta_t \kappa_{Kf1}$$

Modified UIP and exchange rates

- Combine FOC's for home and foreign bond

$$E_t \Lambda_{t+1} \left(\frac{S_{t+1}}{S_t} R_{f,t+1} - R_{h,t+1} \right) = \lambda_t \vartheta (\kappa_{f1} - \kappa_{h1})$$

Steady state excess return on foreign bond due to home collateral advantage (convenience yield)

But it is also time varying

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- Linearizing and solving forward:

$$s_t = -E_t \sum_{j=1}^{\infty} (r_{h,t+j} - r_{f,t+j} - (\overline{r_h - r_f})) - E_t \sum_{j=0}^{\infty} (\hat{\eta}_{t+j} - (\overline{\eta})) + ...$$

  - Transitory component of the exchange rate appreciates in response to expected interest rate differentials, but also to expected convenience yields.

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  - Transitory component of the exchange rate appreciates in response to expected interest rate differentials, but also to expected convenience yields.
  - However, convenience yields are endogenous in the model
  - Endogenous convenience yield depends on tightness of bank's constraint

Calibration

Calibration of collateral parameters to match convenience yield, NFA position, Foreign TB holdings, and income account of BoP

Symbol	Meaning	Value	Target
$\overline{D_h} = \overline{D_f}$	Total govt debt	2.7	Debt to GDP of 83%
θ	Bank survival prob.	0.95	Leverage of 3
κ_h	**Home constraint cost of holding home bond**	**0.025**	**Convenience yield = 1%**
κ_h^*	**Foreign constraint cost of holding home bond**	**0.05**	**Foreign holding of US Treasury of 45%**
κ_f	**Home constraint cost of holding foreign bond**	**0.40**	**-ve NFA 18.5%**
κ_f^*	**Foreign constraint cost of holding foreign bond**	**0.32**	**Net foreign income / GDP = 0.0013**
$\kappa_{Kh}^* = \kappa_{Kf}$	Constraint cost of holding external capital	0.49	Equity premium of 6%
$\kappa_{Kh} = \kappa_{Kf}^*$	Constraint cost of holding own capital	0.41	Home bias of equity of 70%

Steady State Properties

Symbol	Steady state
NFA/GDP	-18.50%
$r_f - r_h$	4.4 - 3.4% = 1%
Net income from abroad / GDP	0.13%

Exorbitant Privilege - positive income account despite negative NFA

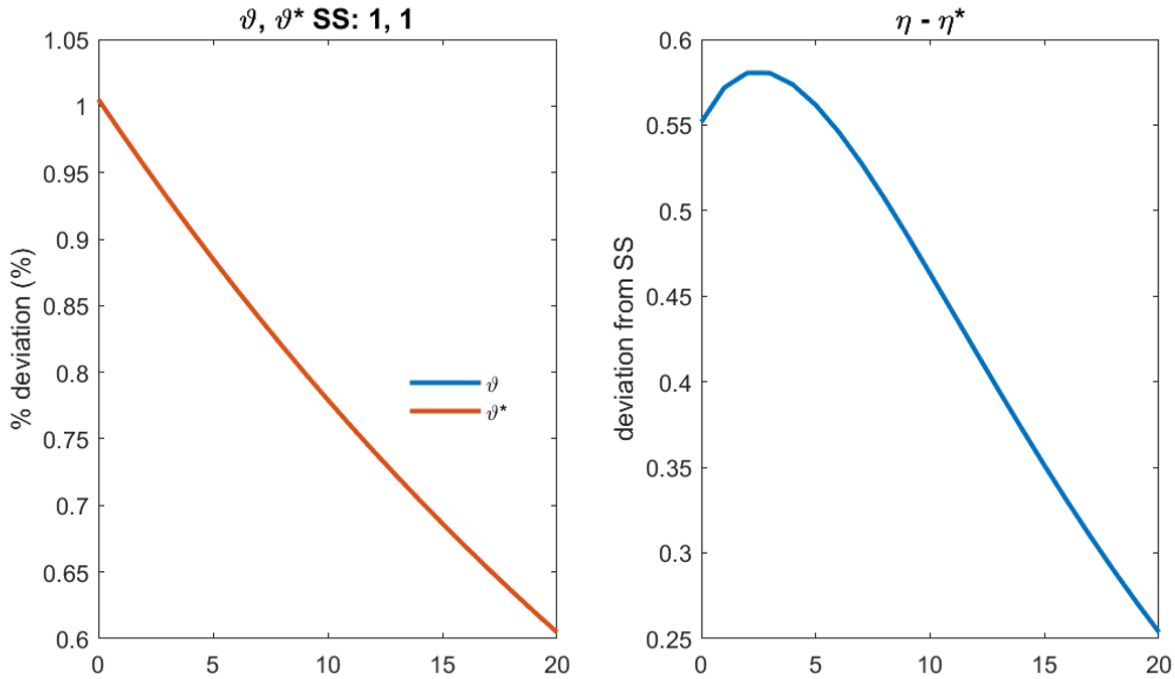
Symbol	Steady state
C, C*	0.6113 > 0.6107
L, L*	0.3314 < 0.3325
Y, Y*	0.8059 < 0.8082
Equity share of foreign claims	61% > 53%

Leads to higher consumption, lower labour supply

Looking at the impact of a financial crunch

A 1 percent shock to ϑ_t the common parameter on the collateral constraint

Hits all countries equally



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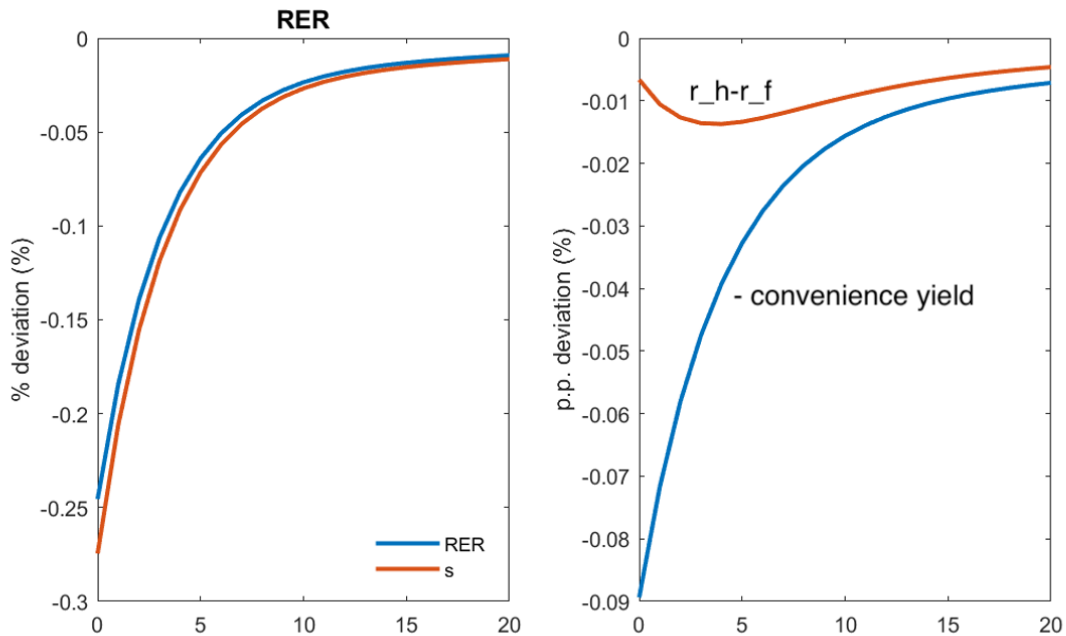
$$s_t = -E_t \sum_{j=1}^{\infty} (r_{h,t+j} - r_{f,t+j}) - E_t \sum_{j=0}^{\infty} \hat{\eta}_{t+j} + ...$$

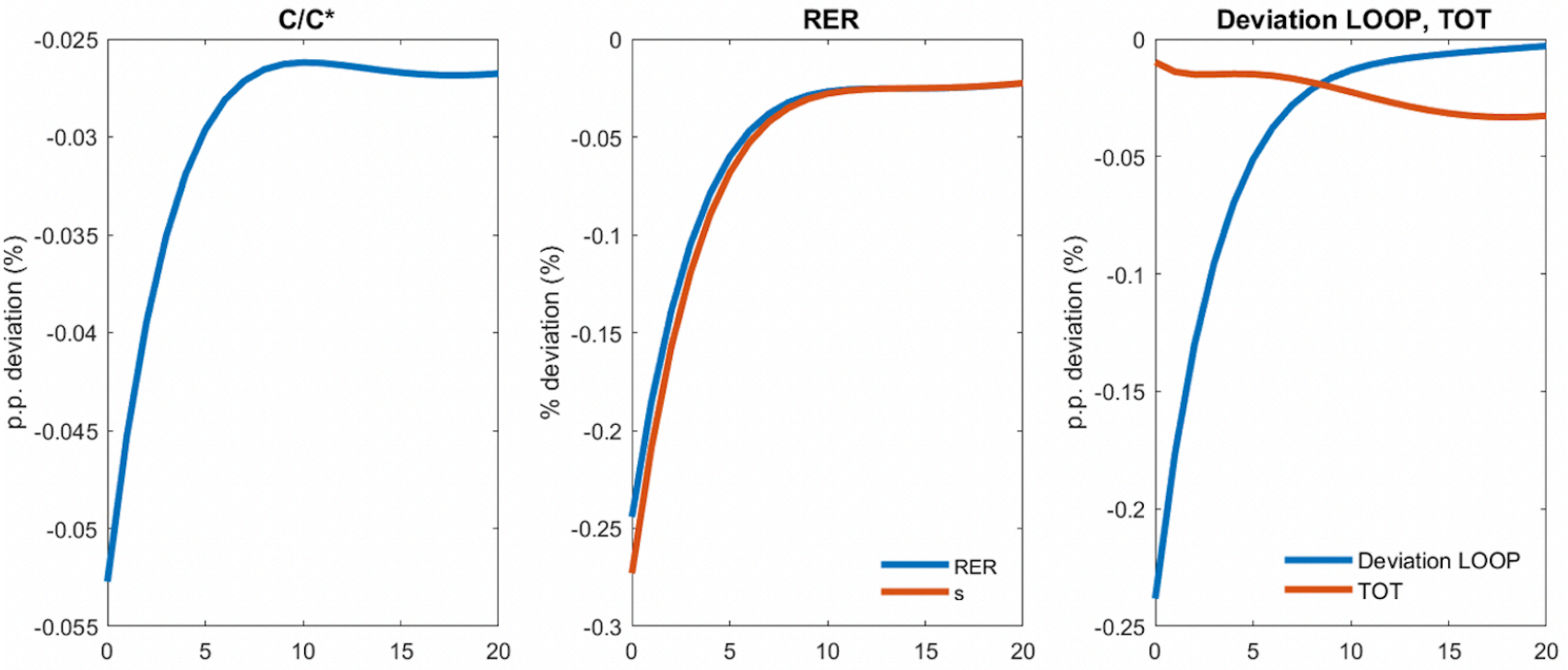
$$\hat{\eta}_t \equiv E_t s_{t+1} - s_t + r_{f,t} - r_{h,t}$$

The appreciation is mostly a persistent rise in convenience yield $\hat{\eta}_t$



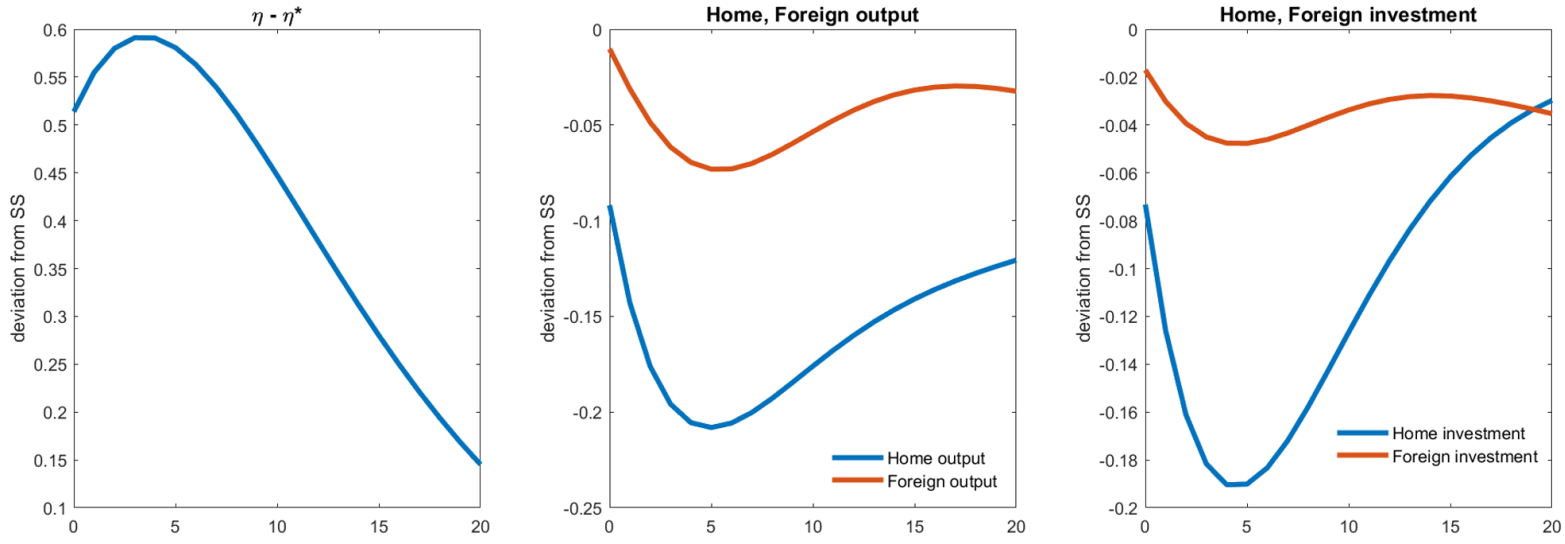
Reserve Currency Paradox

NFA falls, relative consumption falls, but RER appreciates
RER movement is all deviations from LOOP



Home economy is hit more

Larger relative fall in home investment - home banks move out of equity to a larger extent



Equity spreads different between countries

$$E_t \Lambda_{i,t+1} \left(\tilde{R}_{k,t+1} - R_{ht+1} \right) = \lambda_{i,t} \vartheta_t (\kappa_{Kh1} - \kappa_{h1})$$

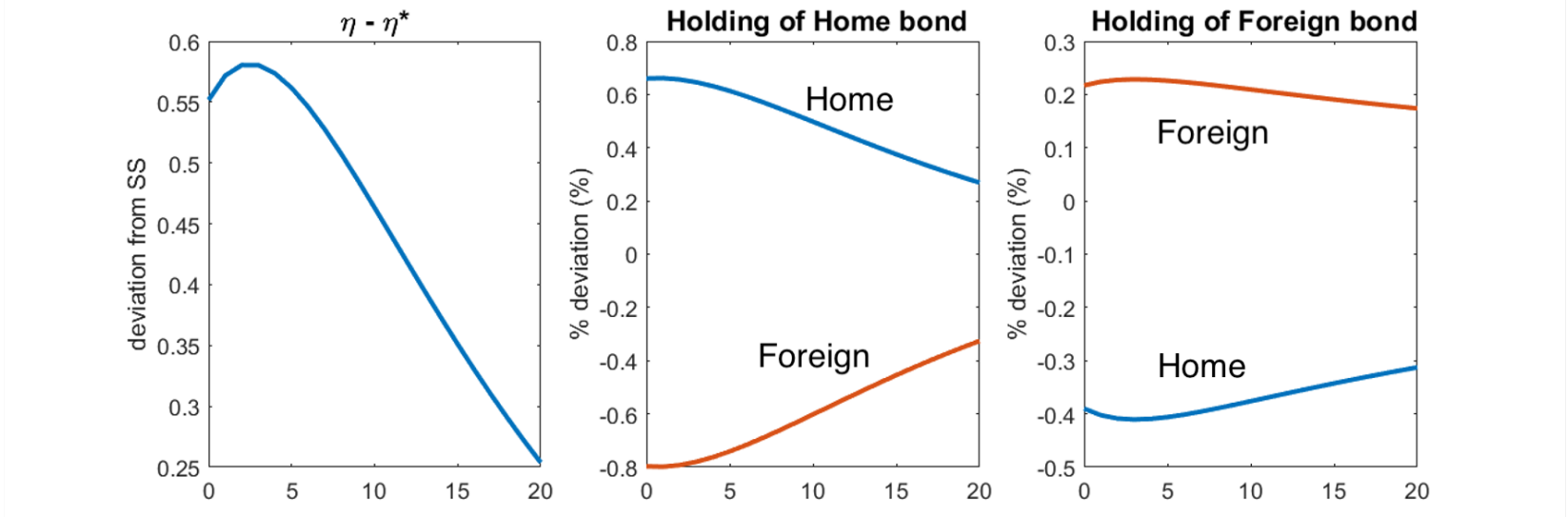
$$E_t \Lambda^*_{i,t+1} \left(\tilde{R}^*_{k,t+1} - R_{ft+1} \right) = \lambda^*_{i,t} \vartheta_t (\kappa^*_{Kh1} - \kappa^*_{f1})$$

Intuition: greater home spread over home bond means larger disinvestment

Global retrenchment

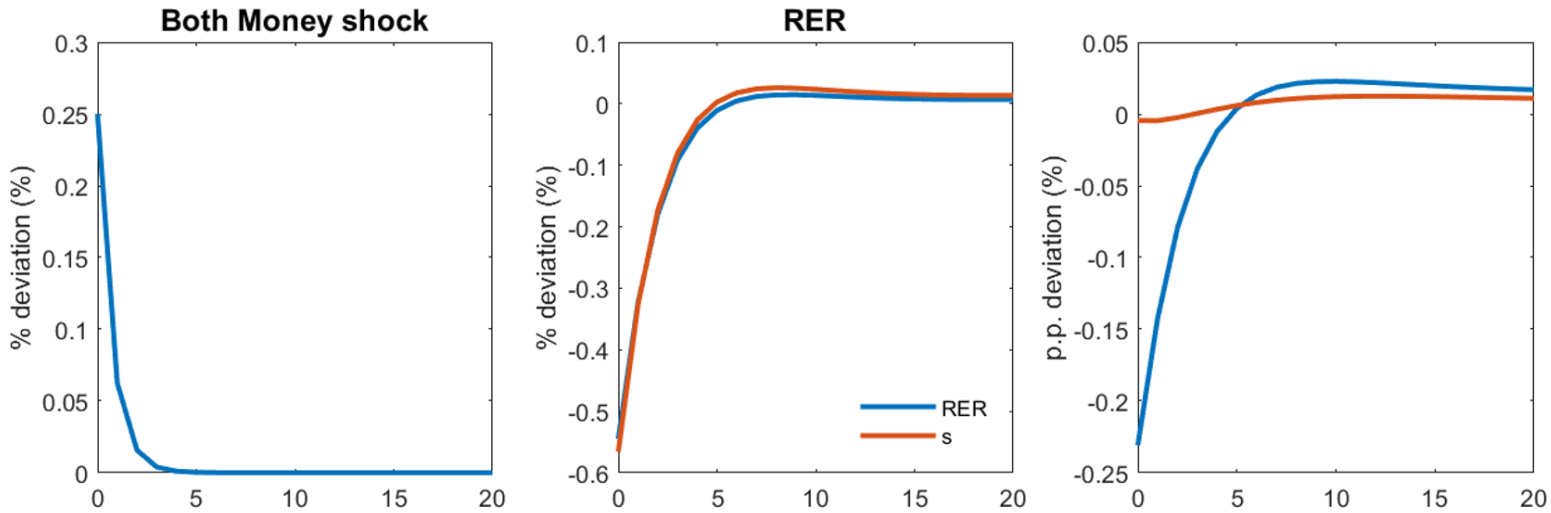
Home banks suffer more during the crisis - so demand more of the least constrained bond

Foreign sells home bonds
Retrenchment of capital flows



A global monetary contraction

An equal rise in policy rates in both countries
Leads to real appreciation of US dollar and a rise in the convenience yield



Model Simulation

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4. Estimate model-implied convenience yield regressions

Model Simulation

1. Allow for financial, productivity, monetary and demand shocks
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3. Allow for Markov switching process for financial shock (switching between low and high volatility states)
4. Estimate model-implied convenience yield regressions
5. Compare moments - exchange rate disconnect ?

Convenience yield regressions

Simulation estimates close to data in sign and size

Table 3: Model implied regression and the empirical counterpart

$$\Delta s_{j,t} = \alpha_j + \beta_1 s_{j,t-1} + \beta_2 \Delta \eta_{j,t} + \beta_3 \Delta (i - i^*)_{j,t} + \beta_4 \eta_{j,t-1} + \beta_5 (i - i^*)_{j,t-1} + u_{j,t}$$

	Panel quarterly regression of G10 currenices	Model implied regression	Panal daily IV regression of G10 currenices
	(1)	(2)	(3)
$\Delta \eta_{j,t}$	-1.65**	-1.15	-9.07**
	(0.76)		(4.53)
$\Delta (i - i^*)_{j,t}$	-2.61***	-2.45	-8.58**
	(0.97)		(3.86)
$\eta_{j,t-1}$	-2.08**	-0.03	-0.002
	(0.87)		(0.002)
$(i - i^*)_{j,t-1}$	-0.44**	-0.004	-0.040
	(0.22)		(0.03)
s_{t-1}	-0.06**	-0.02	-0.003
	(0.02)		(0.002)
Observations	739	14,900	1746

Moments

Reasonably consistent with data - important distinction between high and low volatility periods

Table 4: Long-run moments

	Data moments of Eurozone vs US	Model moments conditional on the low volatility state	Model moments unconditional	Model moments conditional on the high volatility state
	(1)	(2)	(3)	(4)
Exchange rates				
$\sigma(\Delta s)/\sigma(\Delta GDP)$	3.6	1.6	2.5	4.2
$\sigma(\Delta s)/\sigma(\Delta c)$	3.3	1.1	2.0	5.3
$\sigma(i-i^*)/\sigma(\Delta s)$	0.07	0.27	0.19	0.15
Fama β	-0.18	0.48	-0.03	-0.63
$\rho(\Delta q, \Delta c - \Delta c^*)$	0.05	-0.01	0.16	0.54
$\sigma(\Delta q)/\sigma(\Delta s)$	0.99	0.91	0.93	0.93

Conclusions

- Paper is a NK DSGE model of the convenience yield
- Convenience yield linked to financial frictions and collateral advantage of US bonds
- Collateral asymmetry with uniform global shocks leads to US real appreciation
- Model consistent with many facts about behaviour of US dollar and US external balance

Exchange rates and Liquidity yield

- Link between US dollar and liquidity (convenience) yield of Treasury securities
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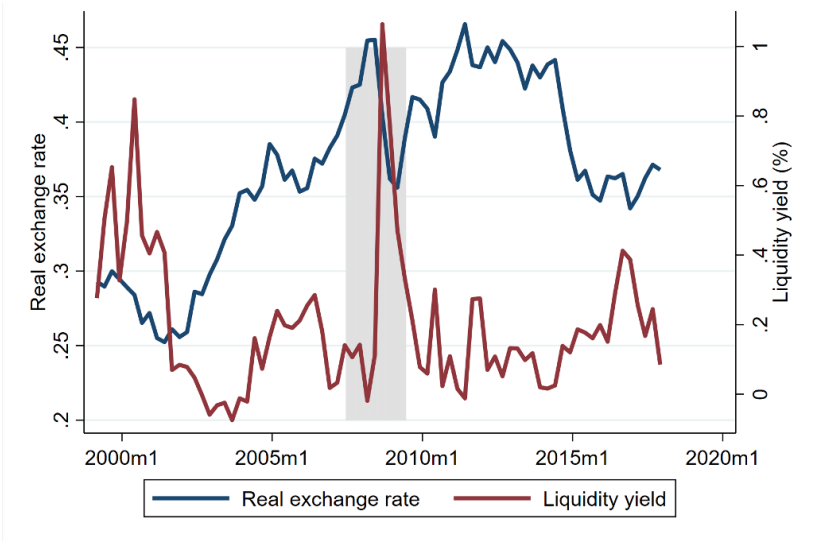

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