# Global Liquidity, House Prices, and the Macroeconomy: Evidence from Advanced and Emerging Economies

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# Disclaimer

The views expressed in this paper are solely those of the authors and should not be taken to represent those of the Bank of England.

# Motivation

- Booms and busts in the non-tradable sector, often fuelled by excessive credit expansion and overvalued exchange rates
- Surges and sudden reversals in cross-border capital flows

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- Surges and sudden reversals in cross-border capital flows
- Housing and global liquidity
  - **Housing**: quintessential non-tradable asset/durable good
  - **Global liquidity**: key determinant of international capital flows

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- New quarterly house price data set for 33 emerging markets from 1990 to 2012
- New set of house price stylized facts
- Identify the impact of a "global liquidity shock" on house prices, and trace its impact on the macro-economy in both AEs and EMs using a panel VAR
  - Consumption, house prices and exchange rates ($\uparrow$), current account ($\downarrow$)
  - House prices and exchange rates play a significant amplification role

# Literature review

- Global house price cycle
  - [Andre (2010); Hirata et al. (2012); Igan and Loungani (2012); Claessens et al. (2012); Cesa-Bianchi (2013)]
- House prices and capital flows
  - [Laibson and Mollerstrom (2010); Favilukis et al. (2012); Adamet al. (2012); Ferrero (2012); Aizenman and Jinjarak (2009); Gete (2009); Sa et al. (2014)]
- Global liquidity
  - [Landau (2013),Rey (2013); Bruno and Shin (2014); Cerutti et al. (2014)]

# Outline

- Data & (selection of) stylized facts
- Panel VAR & Global liquidity shocks
- Inspecting the transmission mechanism

# Data

- Unbalanced panel of 57 time series with varying coverage from 1990:Q1–2012:Q4
- Source: OECD, BIS, Dallas FED international house price databases
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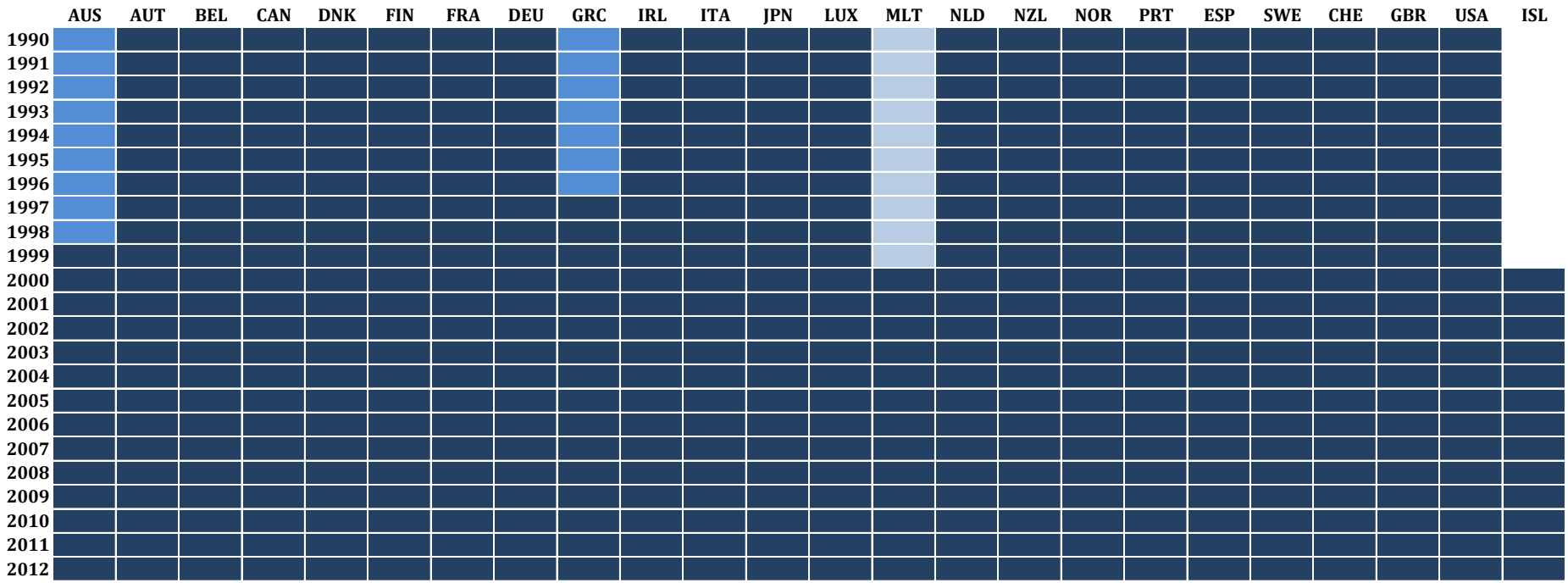
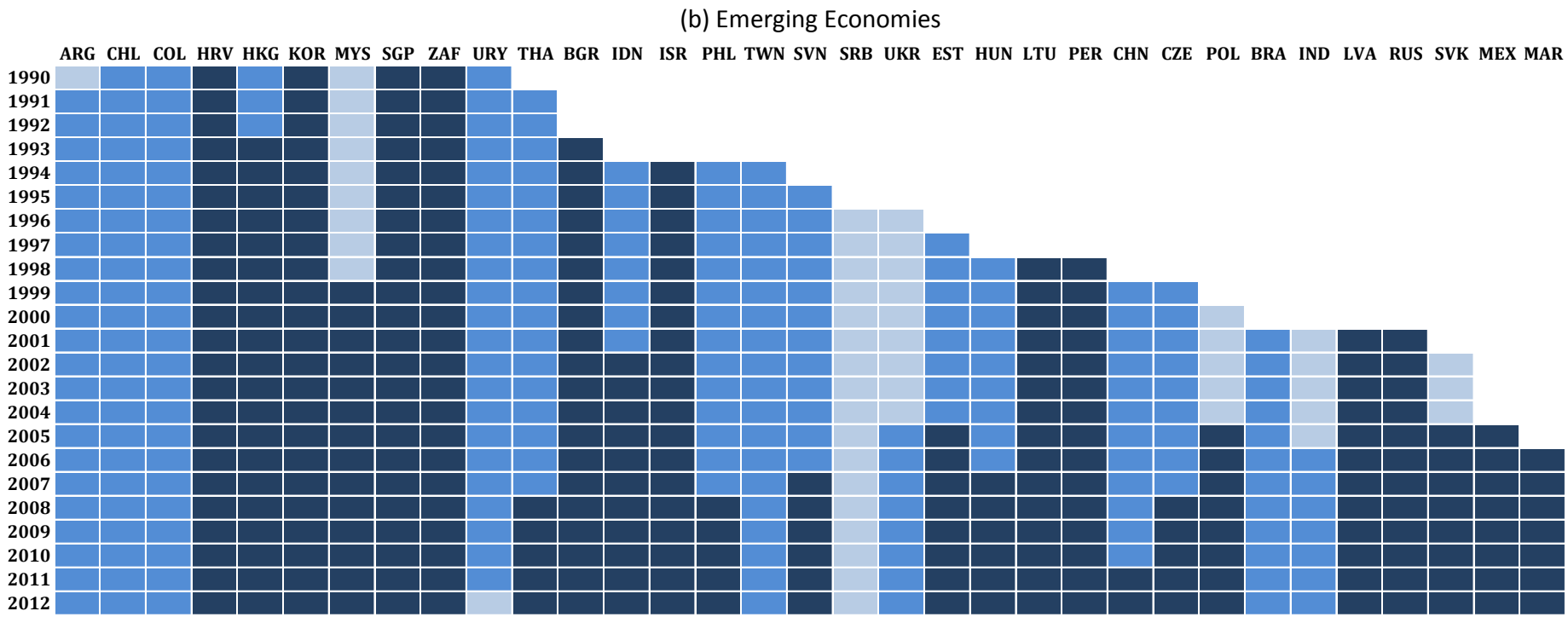
- Value added
  - **Additional countries**: Argentina, Brazil, Chile, Colombia, Czech Republic, India, Serbia, Taiwan, and Uruguay
  - **Historical data**: China, Estonia, Hong Kong, Hungary, Indonesia, Lithuania, Malaysia, Philippines, Poland, Slovakia, Slovenia, and Thailand

# Data Map: Advanced Economies

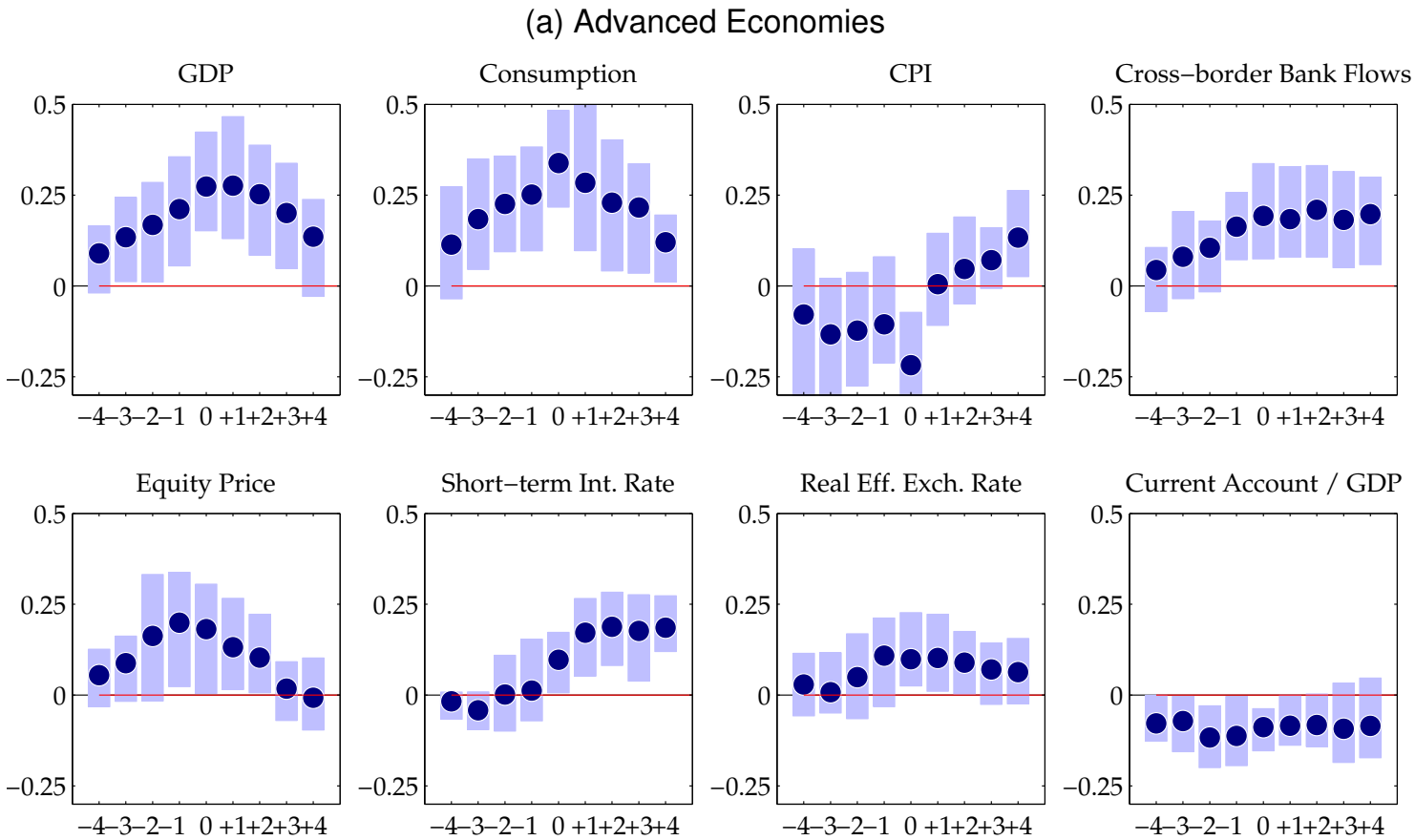
(a) Advanced Economies



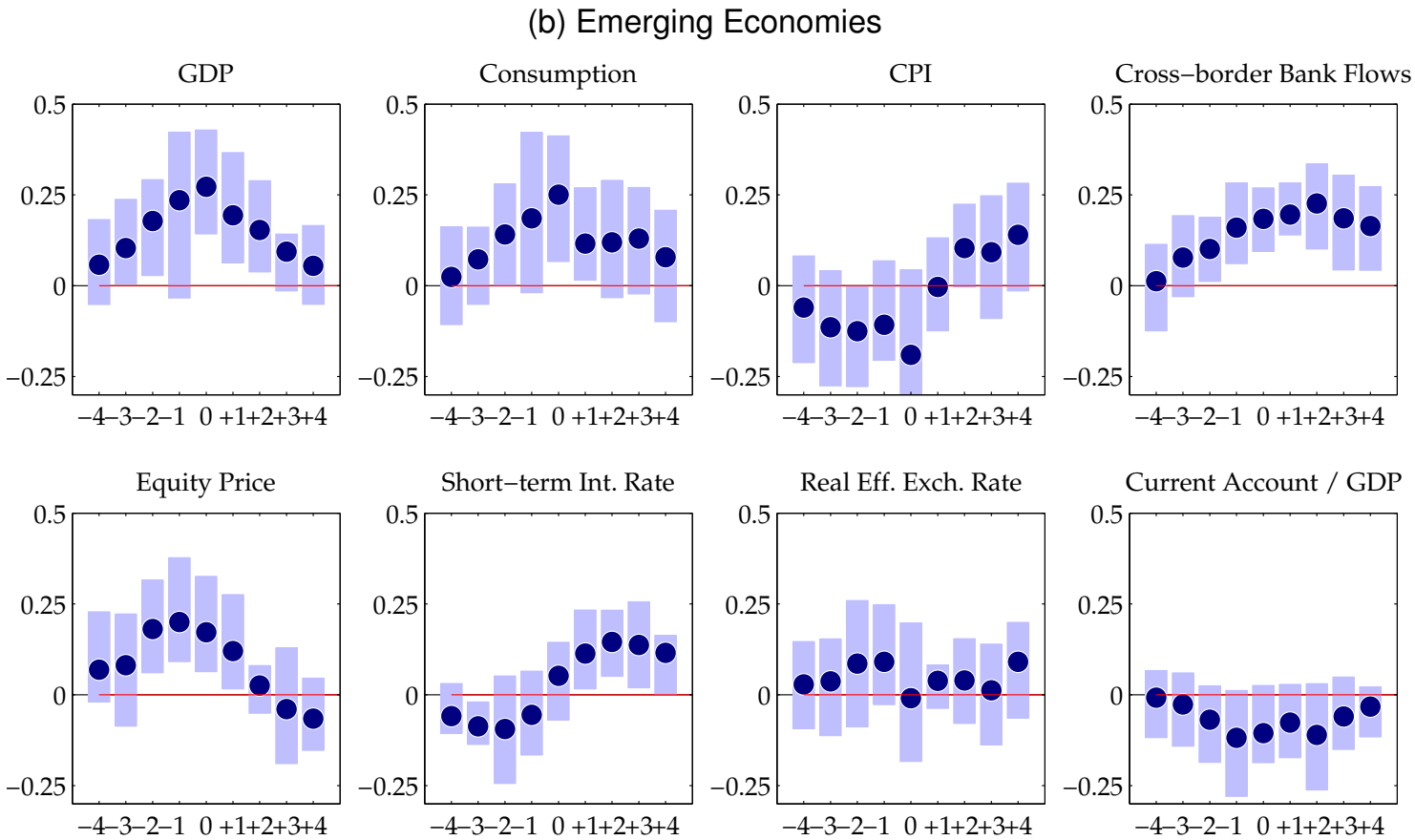
# Data Map: Emerging Economies



# House price inflation strongly pro-cyclical, leads the monetary policy cycle, some (weak) association with CA and RER in AEs



# Similar patterns in EMs: weaker association with monetary cycle and RER; stronger association with CA



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  - Risk appetite and uncertainty $\Longrightarrow$ VIX

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  - Risk appetite and uncertainty $\Longrightarrow$ VIX
- **Data** Sum (across all countries) of international cross-border liabilities of country $i$ vis-a-vis the rest of the world

# Model: Panel VAR

- Panel VAR: Equation for country $i$

$$x_{it} = a_i + \ b_i t + c_i t^2 + F_{1i} x_{i,t-1} + F_{2i} x_{i,t-2} + u_{it},$$

where

$$x_{it} = \left[ \ GL_t \quad C_{it} \quad HP_{it} \quad RIR_{it} \quad RER_{it} \quad (CA/Y)_{it} \ \right]$$

- Sample: 1995Q4 - 2012:Q4 (23 AEs and 27 EMEs)

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- Mean group estimator $\Longrightarrow$ Dynamic panel data models with heterogenous slope coefficients
  - Estimate country by country with OLS
  - Take average of IRFs across countries
  - Avoids potential inconsistency issues (Pesaran and Smith, 1995)

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- **Aggregation**
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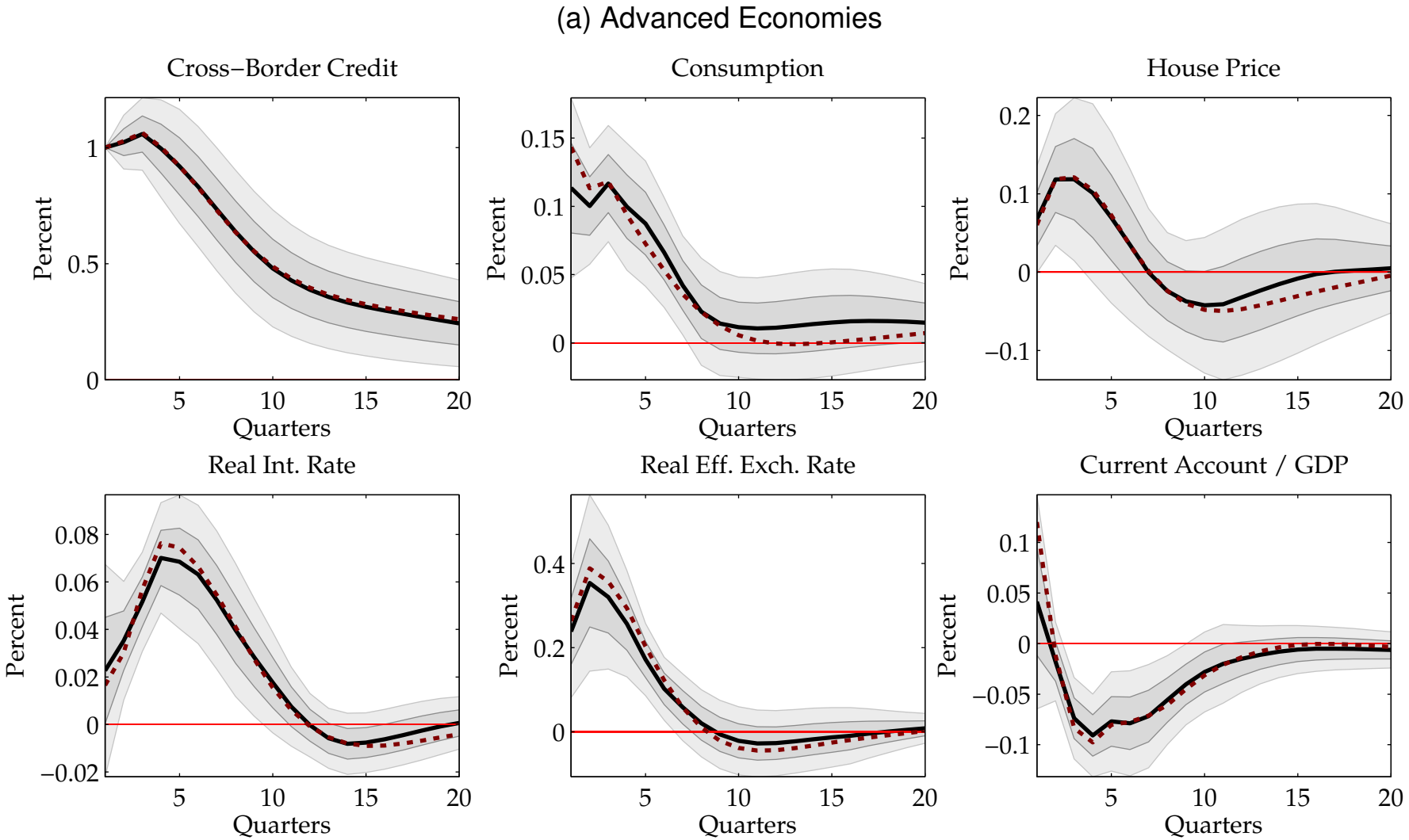
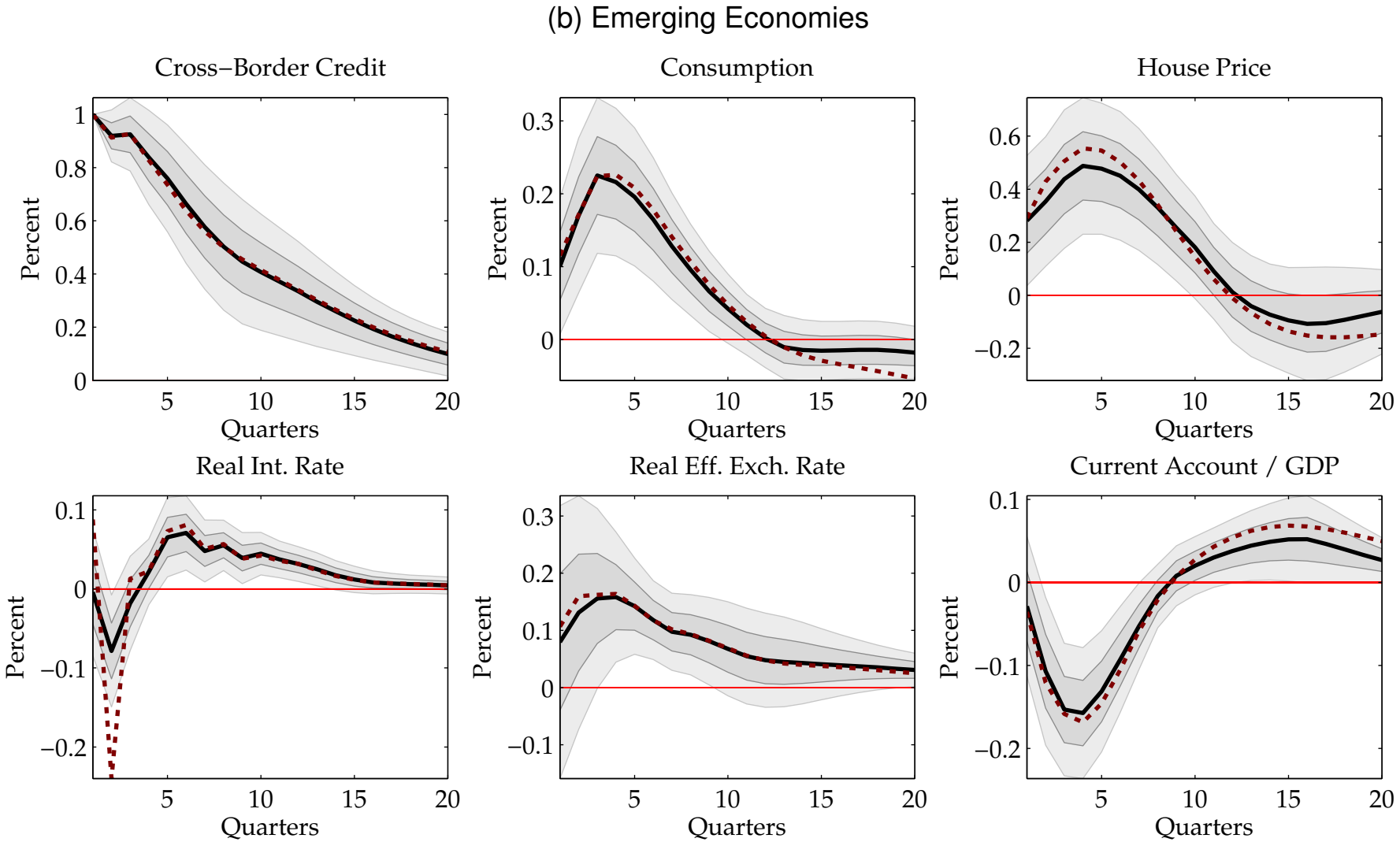
- **External instruments** [Stock and Watson, 2012; Mertens and Ravn, 2013]
  - Use the drivers of GL as instruments
  - Isolate the variation of the GL reduced-form residuals that are due only to supply "push" factors
  - As instruments are U.S. variables, drop U.S. from sample

# In AEs, GL shock increases house prices, consumption, and affects external sector. Monetary policy tightened as a response



# In EMs, effects much larger. Transmission mechanism also possibly different



# Inspecting the transmission mechanism

- How can we explain the different response of AEs and EMs?
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$$D_t \leq \theta Q_t h_t$$

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  - House prices expand borrowing capacity through increased value of collateral
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  - The larger the LTV ratio ($\theta$) the larger the effect of house prices / exch. rates movements on borrowing capacity

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  - Foreign currency borrowing
  - LTV ratios / Mortgage debt over GDP

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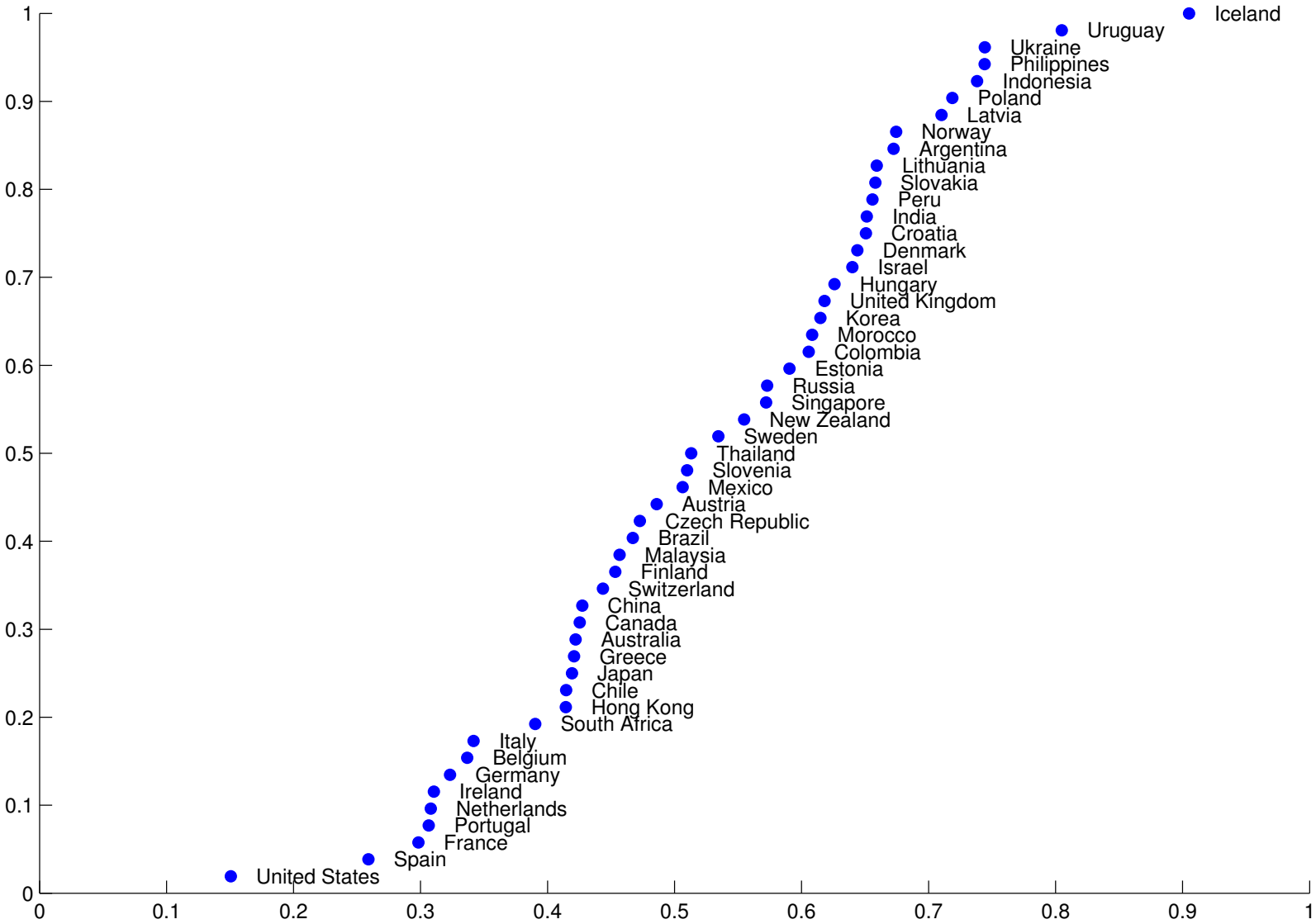
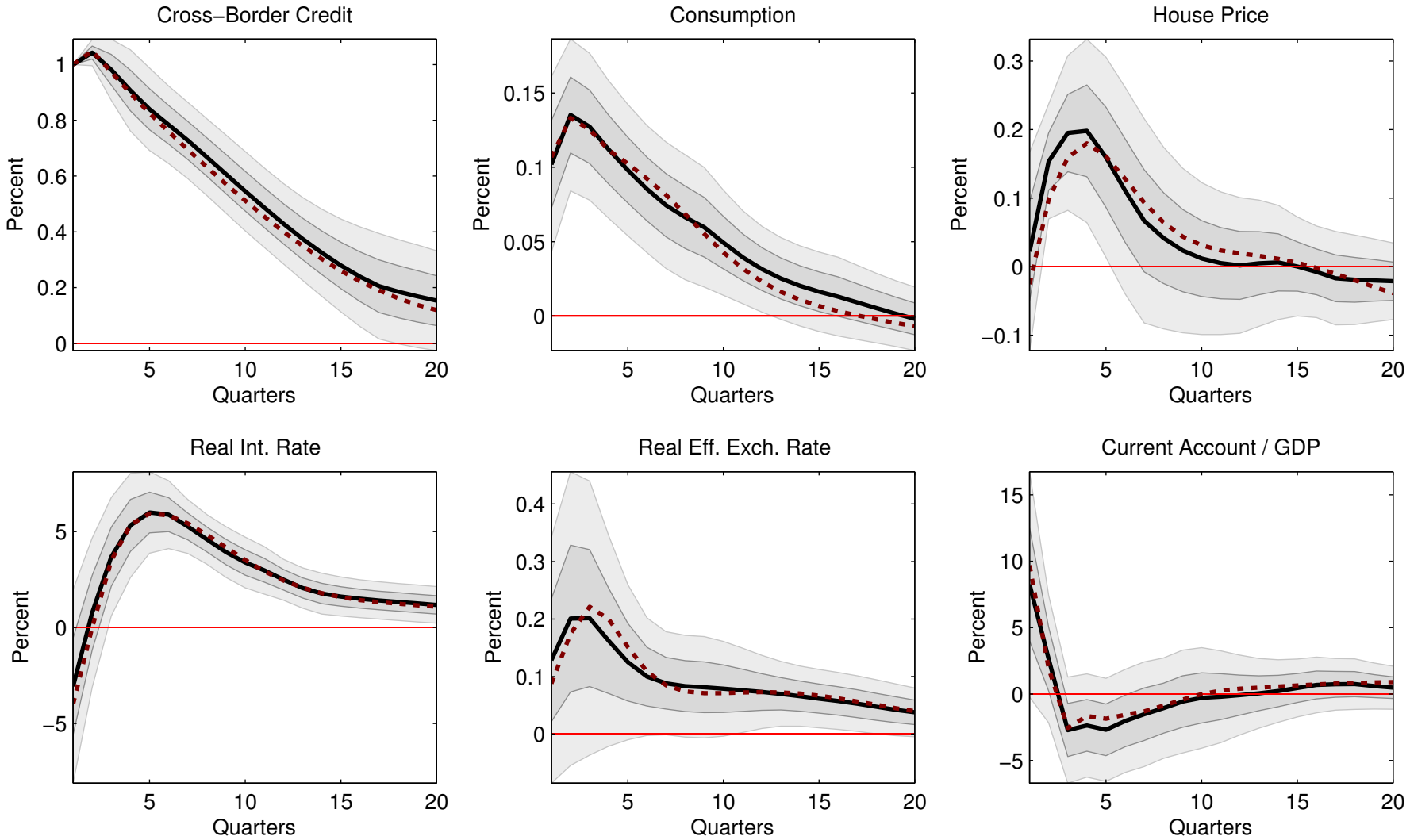
- **Model** Simple DSGE model of international borrowing and lending with financial frictions

# Share of foreign currency liabilities




**Note**. Data is from Lane and Shambaugh (2004,AER).

# GL shock: low share of foreign currency liabilities



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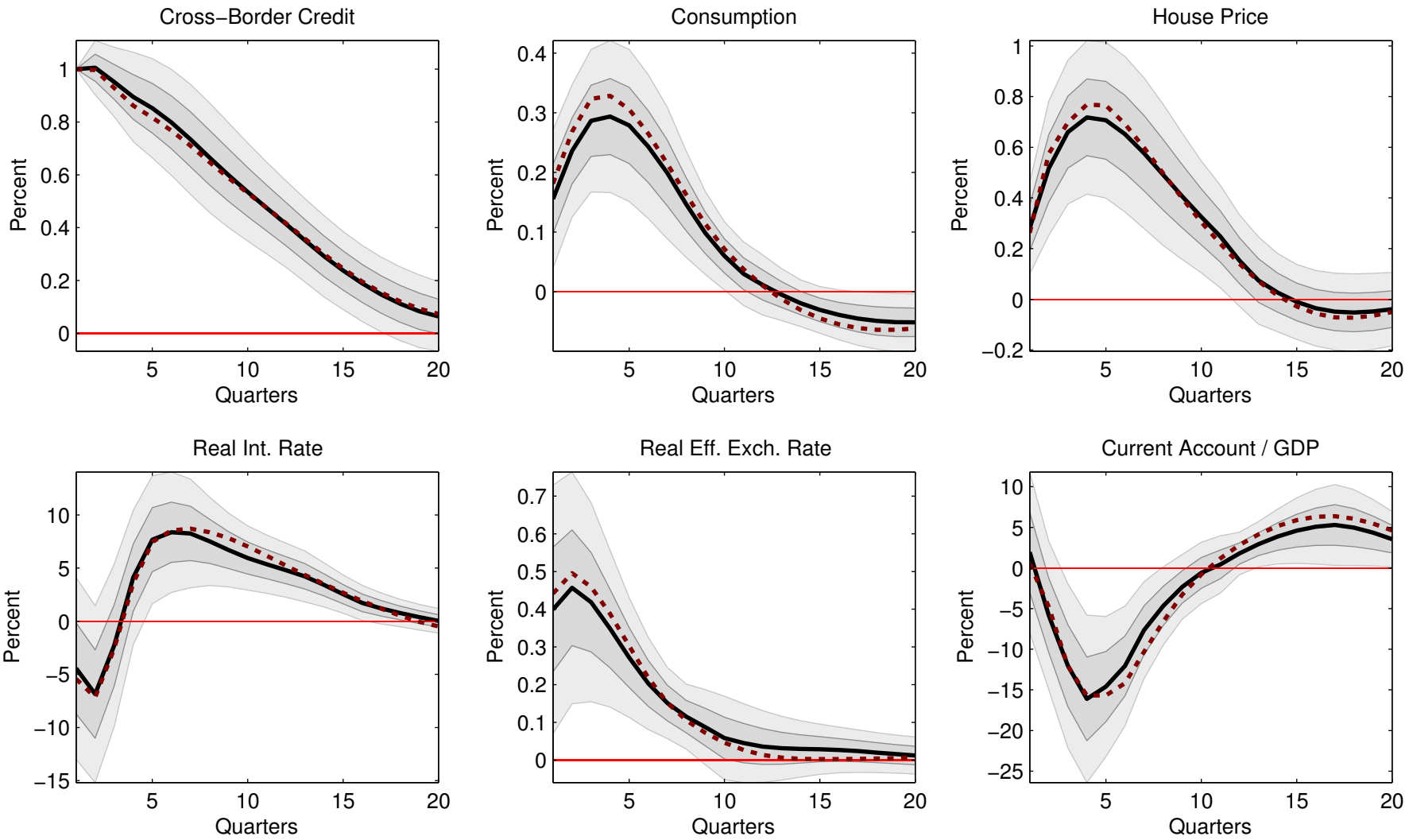

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  - More patient than Home households: $\beta^* > \beta$
  - Save via deposits and equity in financial intermediaries

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# Global Financial Intermediaries

- Balance sheet in at time $t$ (after borrowers and lenders decisions)

| Assets | | Liabilities | |
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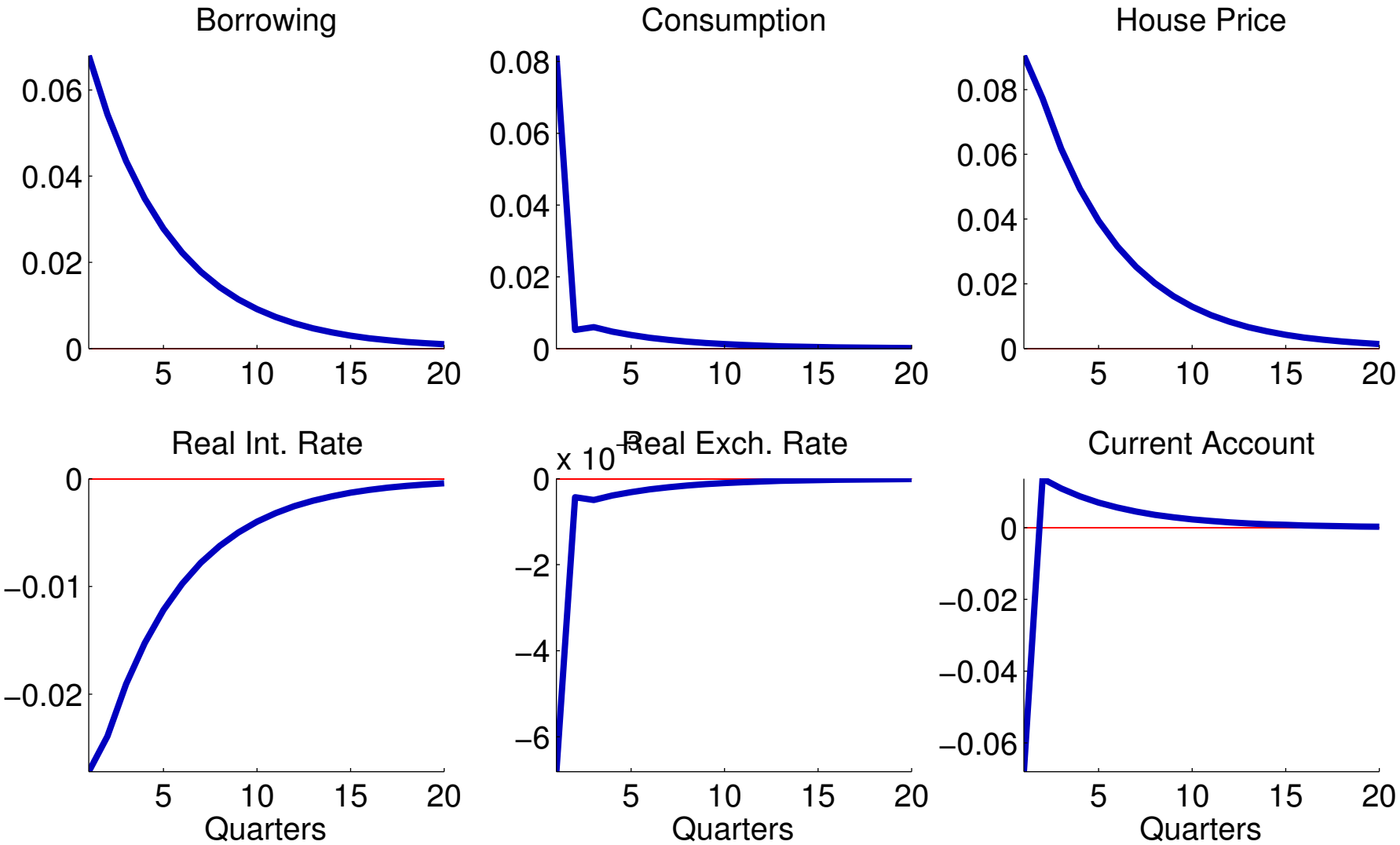
- Maximize profits subject to leverage constraint (capital requirement)

$$nd_t \leq \chi(1-n)e_t$$

- Foreign credit supply shock

$$\chi_t = \chi(1-\rho) + \rho\chi_{t-1} + \varepsilon^{\chi}$$

# A foreign credit supply shock



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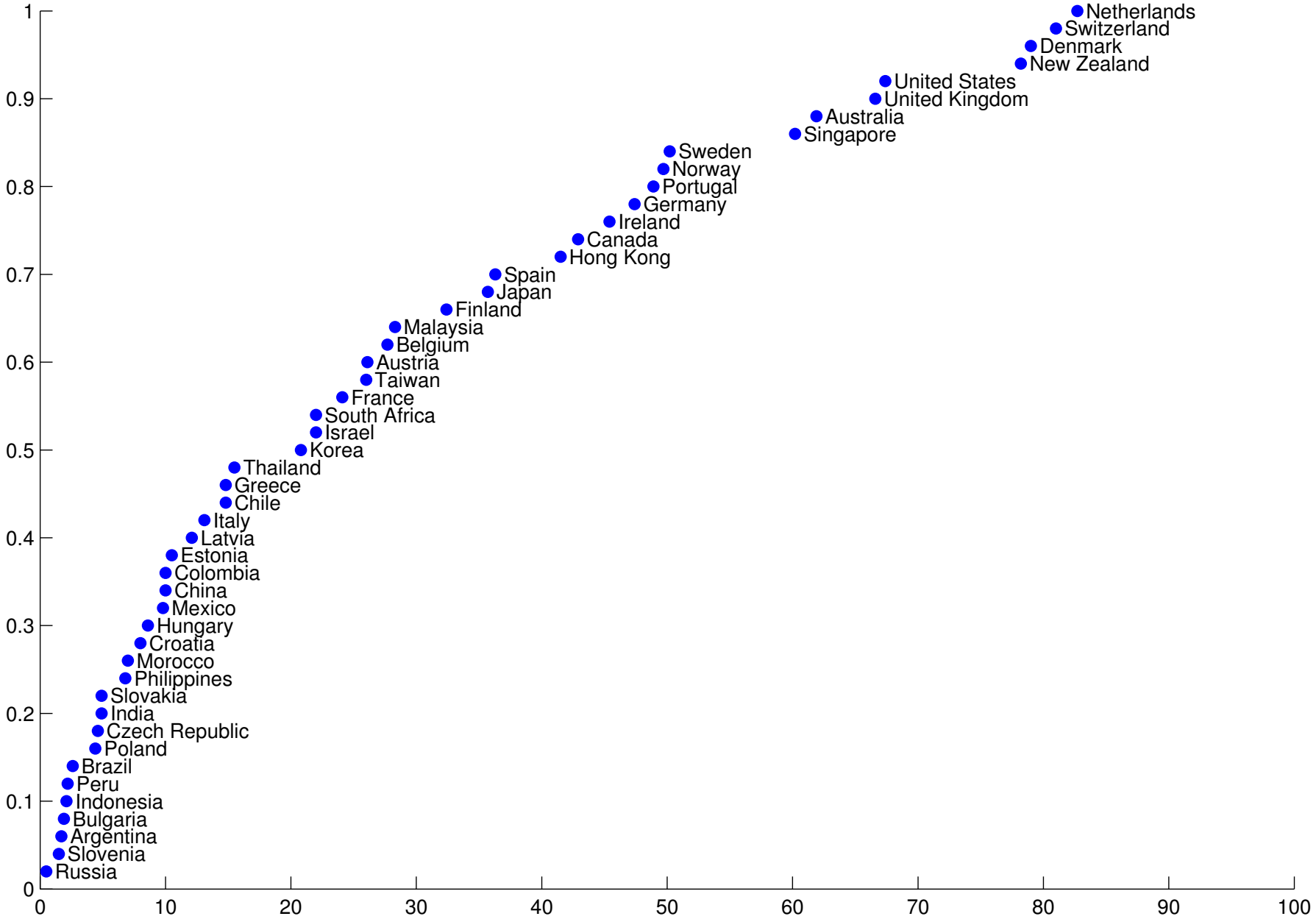
- Next steps
  - Counterfactuals using the DSGE
  - Estimation (IRF matching)

# Appendix

# LTV ratio


Netherlands
Switzerland
Denmark
New Zealand
United States
United Kingdom
Australia
Singapore
Sweden
Norway
Portugal
Germany
Ireland
Canada
Hong Kong
Spain
Japan
Finland
Malaysia
Belgium
Austria
Taiwan
France
South Africa
Israel
Korea
Thailand
Greece
Chile
Italy
Latvia
Estonia
Colombia
China
Mexico
Hungary
Croatia
Morocco
Philippines
Slovakia
India
Czech Republic
Poland
Brazil
Peru
Indonesia
Bulgaria
Argentina
Slovenia
Russia
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
10
20
30
40
50
60
70
80
90
100

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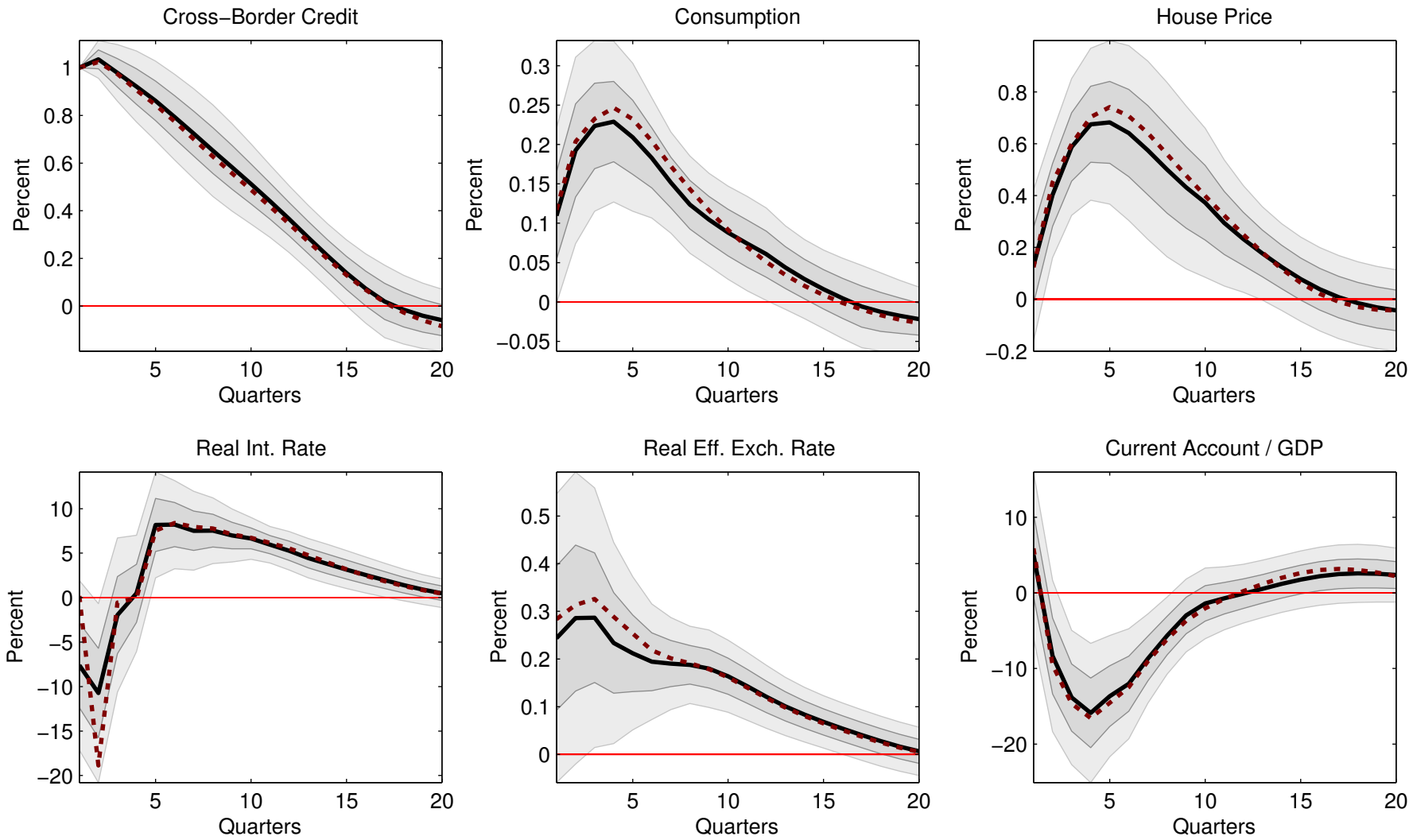

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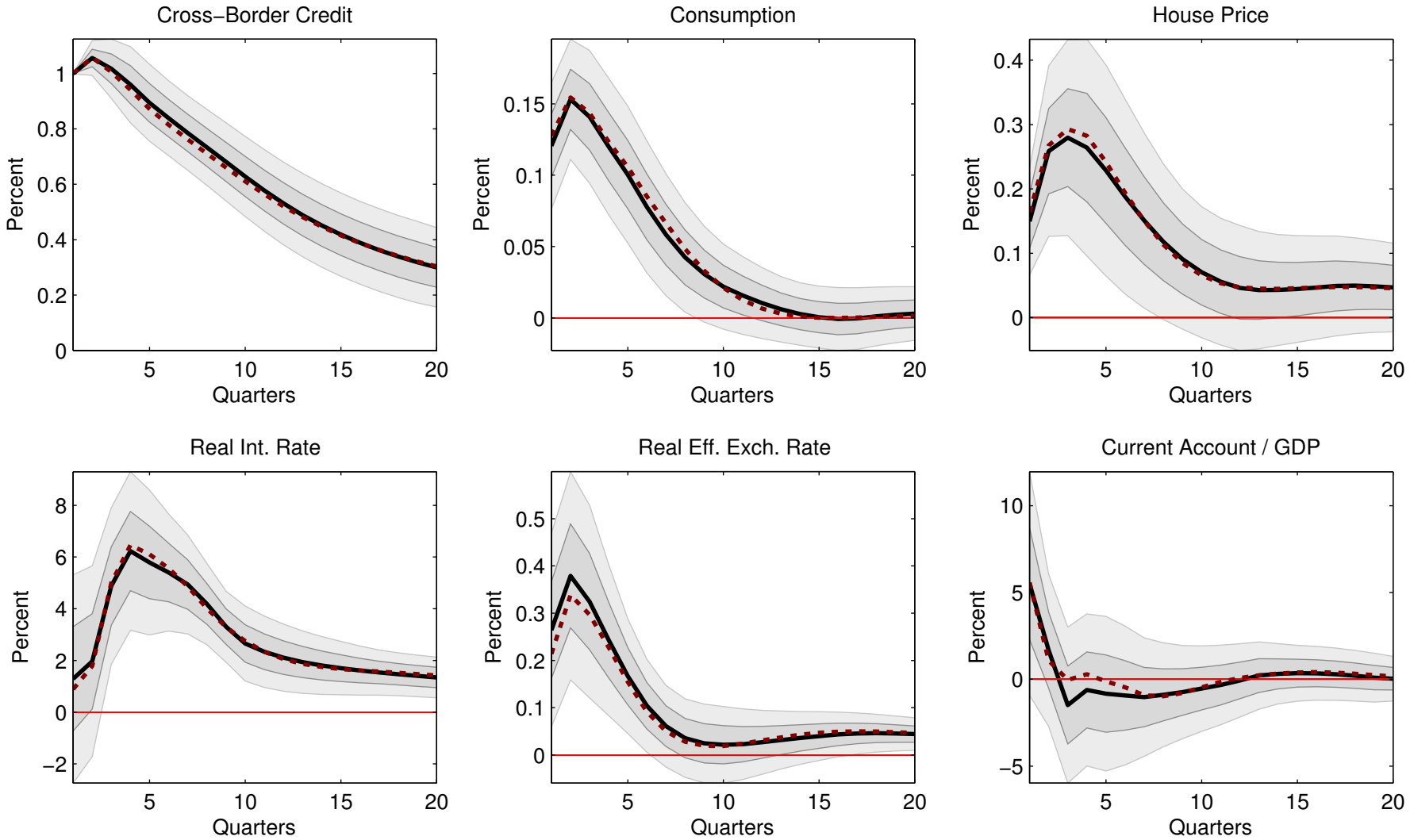
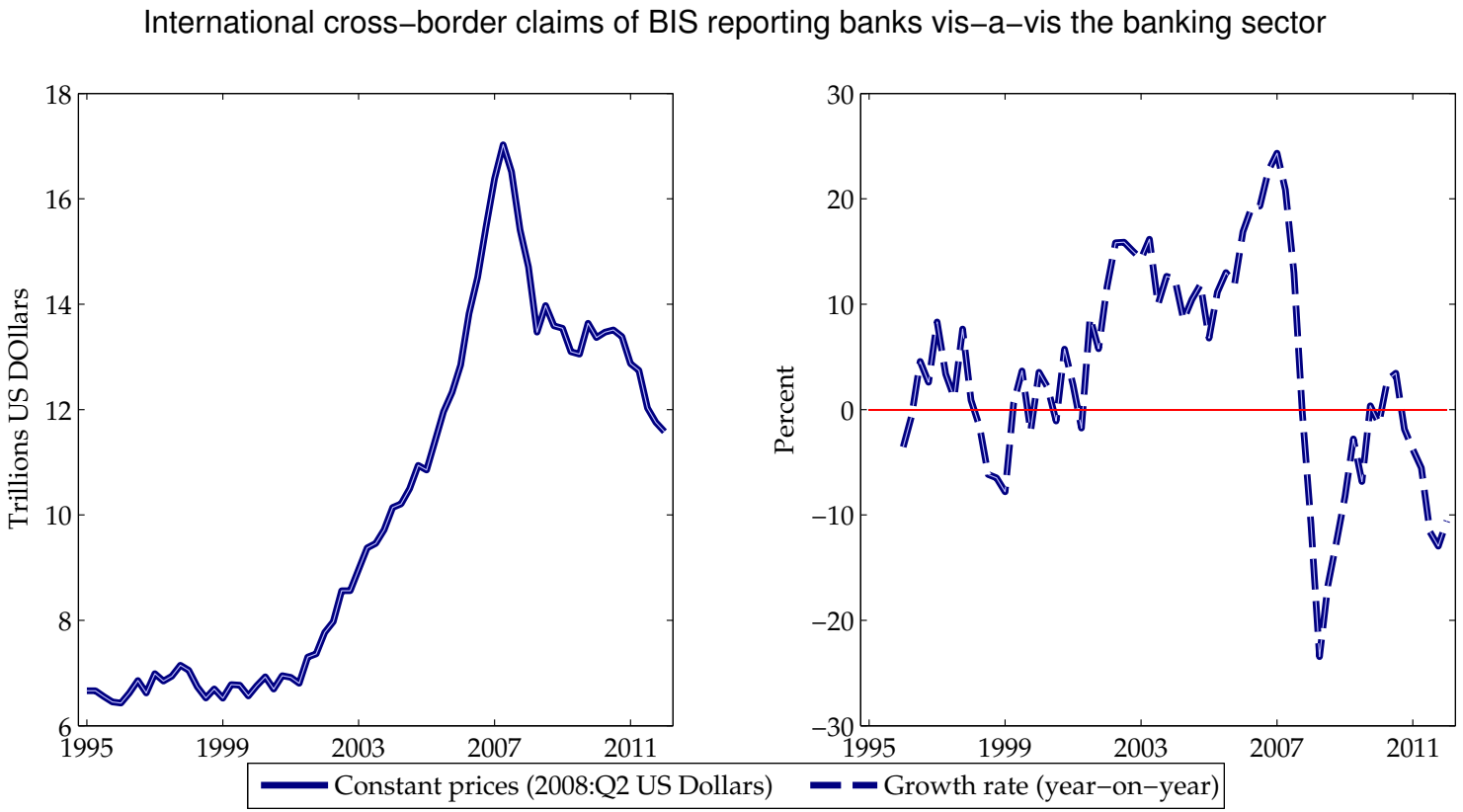


# GL - Data


International cross−border claims of BIS reporting banks vis−a−vis the banking sector
Trillions US DOllars
18
16
14
12
10
8
6
1995
1999
2003
2007
2011
Percent
30
20
10
0
−10
−20
−30
1995
1999
2003
2007
2011
Constant prices (2008:Q2 US Dollars)
Growth rate (year−on−year)

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# Goods Market

- Each country endowed with one good, households consume both

$$c_t \equiv \frac{(c_{Ht})^{\alpha}(c_{Ft})^{1-\alpha}}{\alpha^{\alpha}(1-\alpha)^{1-\alpha}} \qquad c_t^* \equiv \frac{(c_{Ht}^*)^{\alpha^*}(c_{Ft}^*)^{1-\alpha^*}}{\alpha^{*\alpha^*}(1-\alpha^*)^{1-\alpha^*}}$$

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- Price indexes (LOOP holds: $P_{it} = P_{it}^*$ for $i = \{H, F\}$)

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- Relative prices and real exchange rate $\propto$ terms of trade ($\tau_t \equiv P_{Ft}/P_{Ht}$)

$$p_{Ht} \equiv P_{Ht}/P_t = \tau_t^{\alpha-1} \qquad p_{Ft}^* = P_{Ft}^*/P_t^* = \tau_t^{\alpha^*} \qquad s_t \equiv P_t^*/P_t = \tau_t^{\alpha-\alpha^*}$$

# Households

## Home country

$$\max_{\{c_t,h_t,d_t\}} \mathbb{U}_t = \sum_{t=0}^{\infty} \beta^t \left[u(c_t) + v(h_t)\right]$$

$$\begin{aligned} \text{subject to} \quad & c_t + q_t h_t - s_t(d_t - R_{t-1}d_{t-1}) = p_{Ht}y_t + q_t h_{t-1} \\ \text{and} \quad & s_t d_t \leq \theta q_t h_t \end{aligned}$$

- Credit denominated in units of foreign consumption

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- Credit denominated in units of foreign consumption

## Foreign country ($\beta^* > \beta$)

$$\max_{\{c_t^*,d_t^*\}} \mathbb{U}_t^* = \sum_{t=0}^{\infty} \beta^{*t} u(c_t^*)$$

$$\text{subject to} \quad c_t^* + d_t^* + e_t = p_{Ft}^* y_t^* + R_{t-1}^d d_{lt-1}^* + R_{t-1}^e e_{t-1} + \Pi_t$$

- Foreign households own financial intermediaries

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- Next period profits for financial intermediaries

$$\Pi_{t+1} = R_t n d_t - R_t^d (1-n) d_t^* - [1 + \Psi(e_t)] R_t^e (1-n) e_t$$

where $\Psi(e_t) \equiv \eta(e_t/\bar{e})^\gamma$ ($\eta > 0$ and $\gamma > 1$) is equity adjustment cost

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- Subject to leverage constraint (capital requirement)

$$n d_t \leq \chi (1-n) e_t$$

# Global Financial Intermediaries

- Profit maximization yields solution for $R_t$

$$R_t = \frac{1}{\chi}[1 + (1+\gamma)\Psi(e_t)]R_t^e + \left(1 - \frac{1}{\chi}\right) R_t^d$$

- Assume risk-neutral foreign households ($\Rightarrow R_t^d = R_t^e = 1/\beta_l$)

$$R_t = \frac{1}{\beta^*}\left[1 + \frac{(1+\gamma)\Psi(e_t)}{\chi}\right]$$

- Equilibrium with binding credit supply constraint ($nd_t = \chi(1-n)e_t$)

$$R_t = \frac{1}{\beta^*}\left\{1 + \frac{\eta(1+\gamma)}{\chi}\left[\frac{nd_t}{\chi(1-n)\bar{e}}\right]^{\gamma}\right\}$$

- Equilibrium with non-binding credit supply constraint not interesting

$$R_t = R_t^d = 1/\beta^* \Rightarrow e_t = 0$$

# Global Credit Market Equilibrium

- Assume fixed supply of housing

$$h_t = h = 1$$

- Domestic households (also risk-neutral)

$$(1 - \theta\mu_t)q_t = mrs + \beta q_{t+1}$$
$$1 - \mu_t = \beta R_t s_{t+1}/s_t$$
$$\mu_t \geq 0 \text{ and } s_t d_t \leq \theta q_t$$

- Foreign households

$$R_t^d = R_t^e = 1/\beta^*$$

- Financial intermediaries (binding credit constraint: $nd_t = \chi(1-n)e_t$)

$$R_t = \frac{1}{\beta^*}\left\{1 + \frac{\eta(1+\gamma)}{\chi}\left[\frac{nd_t}{\chi(1-n)\bar{e}}\right]^{\gamma}\right\}$$

# Goods Market Equilibrium

- Resource constraint

$$ny_t = nc_{Ht} + (1-n)c^*_{Ht} \qquad (1-n)y^*_t = nc_{Ft} + (1-n)c^*_{Ft}$$

- Replace consumption demands

$$ny_t = \tau_t^{1-\alpha}[\alpha n c_t + s_t \alpha^* (1-n) c^*_t]$$
$$(1-n)y^*_t = \tau_t^{-\alpha}[(1-\alpha) n c_t + s_t (1-\alpha^*)(1-n) c^*_t]$$

- Borrower's budget constraint

$$c_t = \tau_t^{\alpha-1} y_t + s_t (d_t - R_{t-1} d_{t-1})$$

- Given $d_t$, three equations in $c_t$, $c^*_t$ and $\tau_t$ ($s_t = \tau_t^{\alpha - \alpha^*}$)