



BANK FOR INTERNATIONAL SETTLEMENTS

# *Understanding Global Liquidity*

***Boris Hofmann***

*Bank for International Settlements*

*Seminar presentation at the National Bank of Poland*

*13 May 2014*



*The opinions are those of the author only and do not necessarily reflect those of the Bank for International Settlements*



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## Outline

- Global liquidity: Concept and measurement
  - CGFS (2011): Global liquidity – concept, measurement and policy implications
  - Domanski, Fender and McGuire (2011): Assessing global liquidity
  - BIS (2013): Global liquidity indicators
  - Bruno and Shin (2012): Capital flows, cross-border banking and global liquidity
- Understanding global liquidity: What are the underlying drivers?
  - Eickmeier, Gambacorta and Hofmann (2013): Understanding global liquidity



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## Global liquidity: Concepts and measurement

- Global liquidity has become a popular term in the policy debate.
  - Already referred to in the context of the Asian crisis
  - “Ample global liquidity” suggested as a key factor in the run-up to the global crisis
  - Recently used in the context of spillovers of loose monetary conditions in AEs to EMEs
- ...but is a vague concept
  - “ease of financing” (CGFS 2011)



## Measuring global liquidity

- Traditional approach: broad money aggregates for major economies
  - But banks' leveraging and increased reliance on non-monetary liabilities have made monetary aggregates an outdated gauge of liquidity from a financial stability perspective
  - Credit widely seen as a superior indicator of building up financial imbalances (Borio/Lowe 2004, Schularick/Taylor 2012)
- Global credit represents the end of the financial intermediation chain and the final outcome of the interaction of different sources of global liquidity (e.g. CGFS 2011)

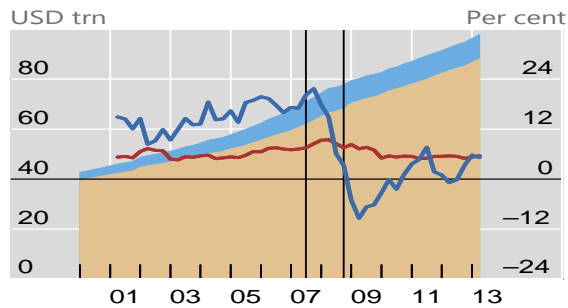


# Global credit aggregates

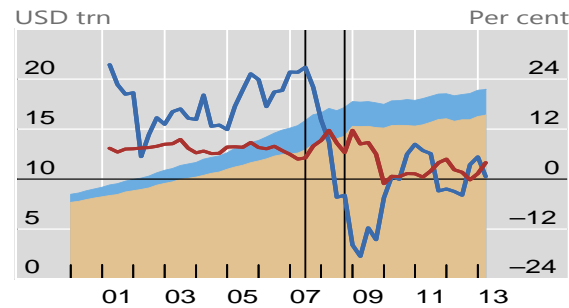
## Global bank credit aggregates, by borrower region

At constant end-Q1 2013 exchange rates

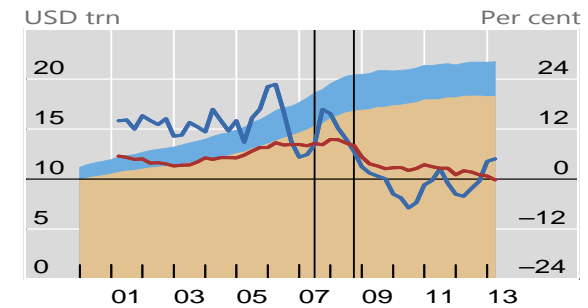
Full country sample<sup>1</sup>



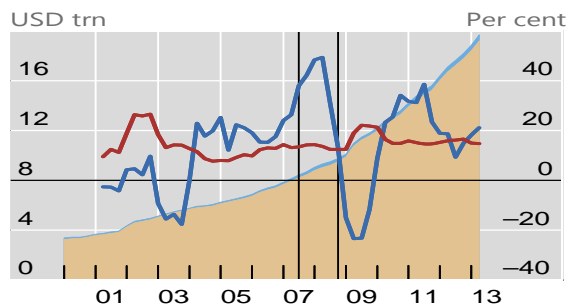
United States



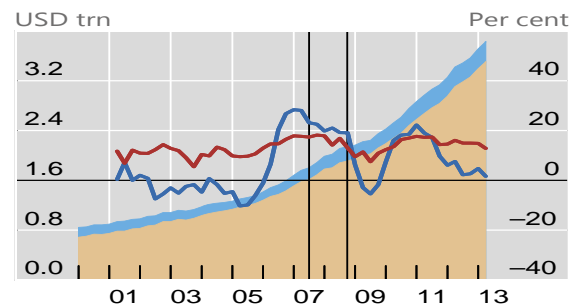
Euro area



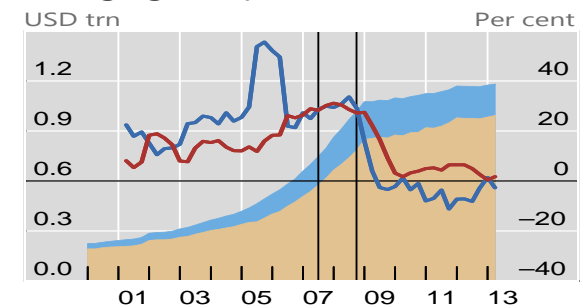
Asia-Pacific



Latin America



Emerging Europe



Levels (lhs):<sup>2</sup>

Blue: Cross-border credit  
Orange: Domestic credit

Growth (rhs):

Blue line: Cross-border credit  
Red line: Domestic credit

<sup>1</sup> Aggregate for a sample of 56 reporting countries. <sup>2</sup> Total bank credit to non-bank borrowers (including governments), adjusted using various components of the BIS banking statistics to produce a breakdown by currency for both cross-border credit and domestic credit.

Sources: IMF, *International Financial Statistics*; BIS international banking statistics; BIS calculations.

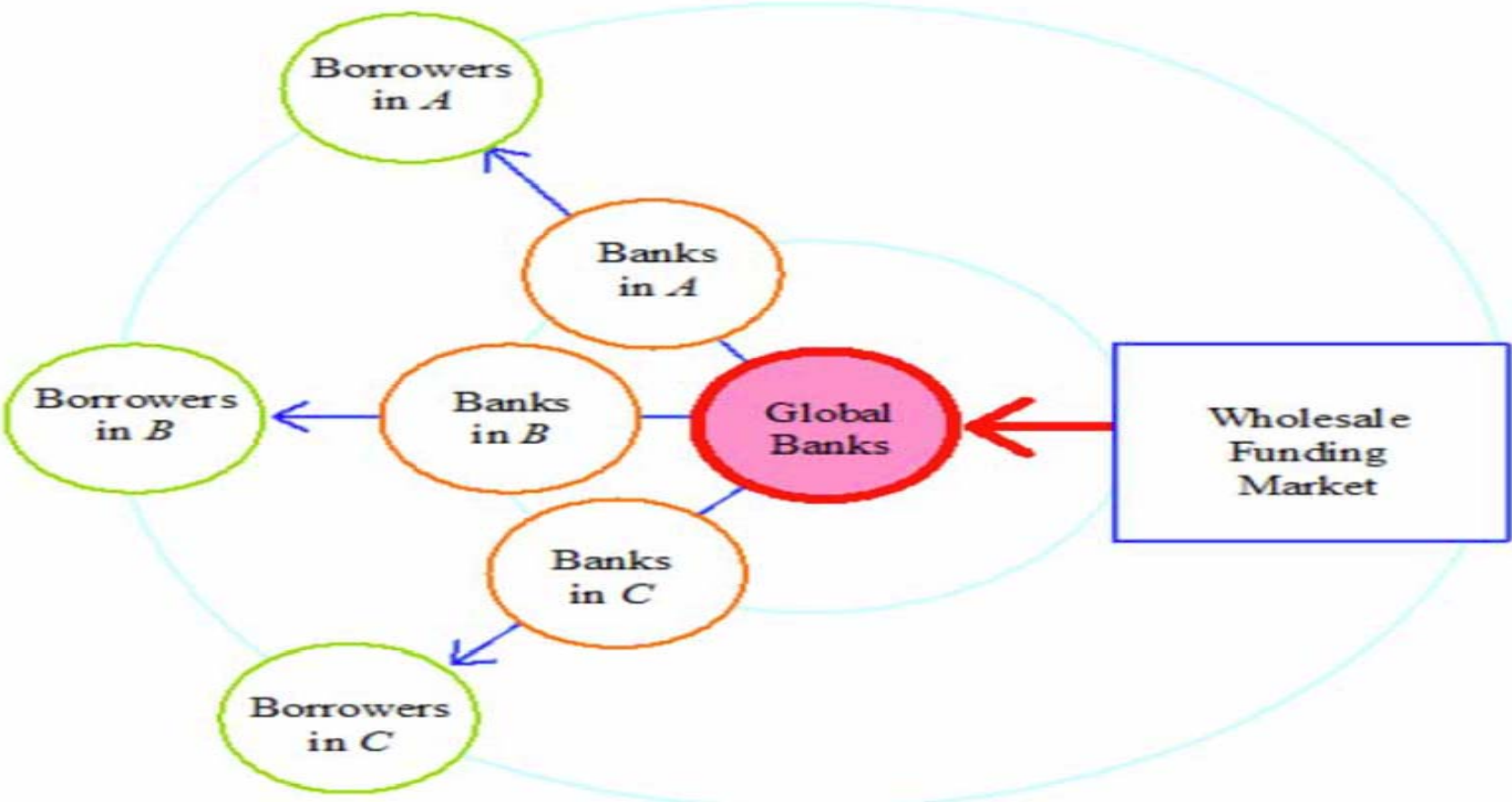
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## Cross-border credit

- The international component of credit (i.e. cross-border credit) plays an important role in the dynamics of global credit
- Global banks borrow in financial centres' money markets and distribute the liquidity globally (Bruno and Shin 2012)



# Global liquidity transmission

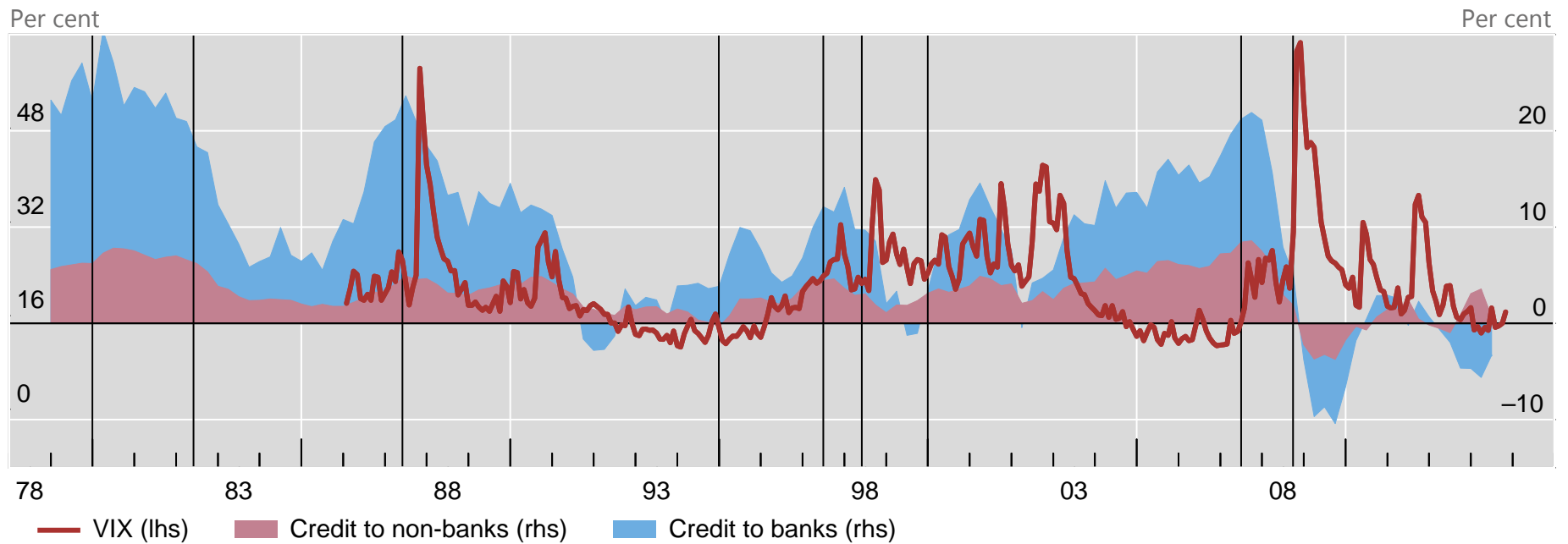


Source: Bruno and Shin (2012)



# Growth of international claims

Year-on-year rate of growth in international claims<sup>1</sup>



<sup>1</sup> Includes all BIS reporting banks' cross-border credit and local credit in foreign currency.

Sources: Bloomberg; BIS locational banking statistics by residence.

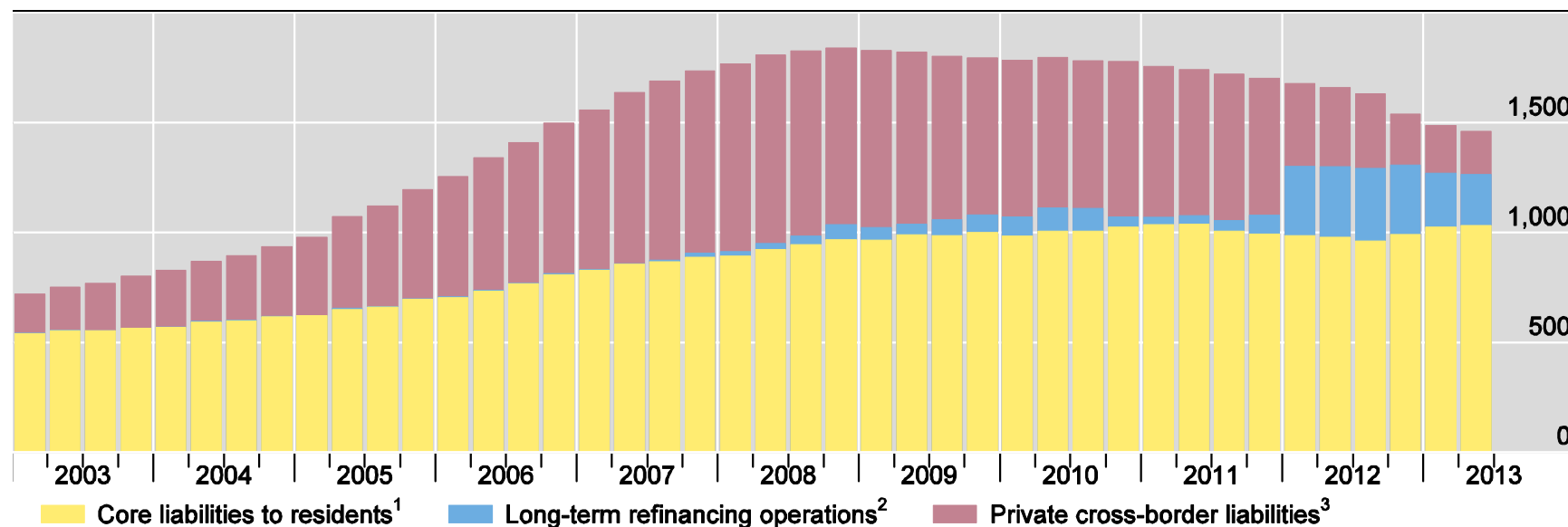




# Cross-border lending and domestic credit booms

## Funding of lending by Spanish banks

In billions of euros

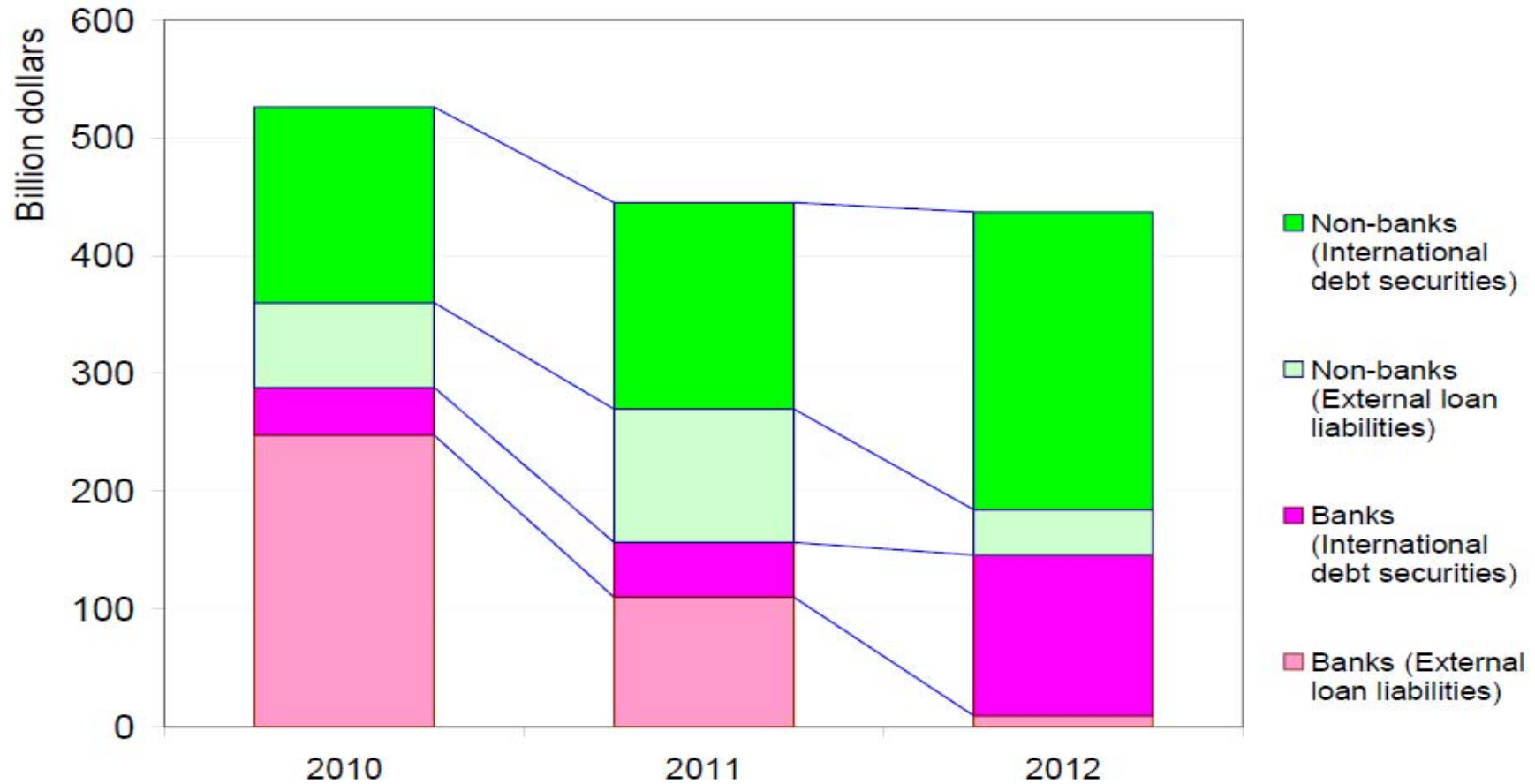


<sup>1</sup> Liabilities to the domestic households and non-financial corporations. <sup>2</sup> As part of Eurosystem's open market operations. <sup>3</sup> Defined as the difference between total bank credit and the sum of core liabilities and long-term refinancing.

Sources: Datastream; BIS.



## Second phase of global liquidity



Source: Shin (2013)



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## Global liquidity: Complementary indicators

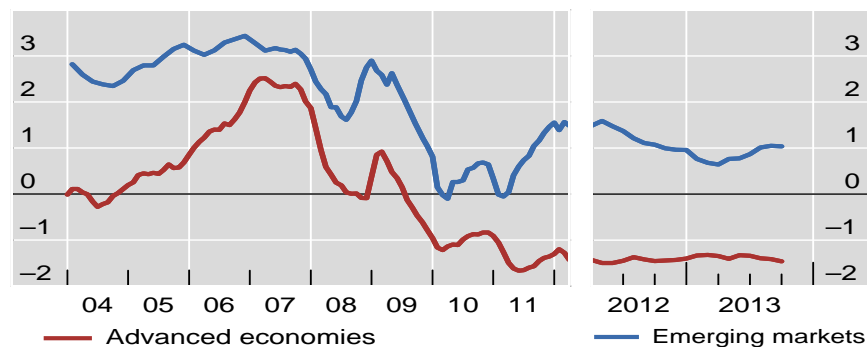
- Monetary liquidity
- Funding liquidity
- Risk appetite



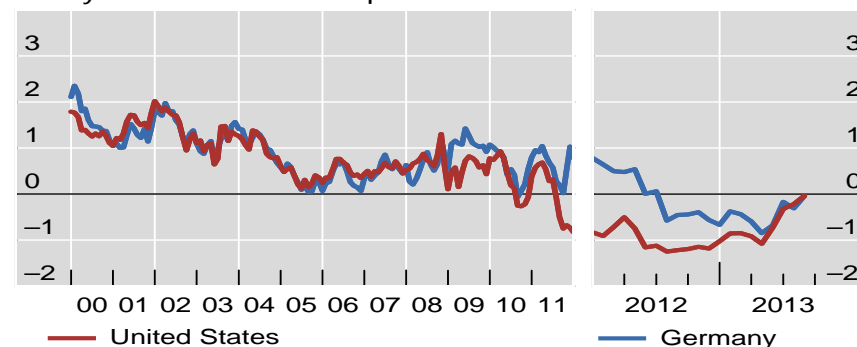
# Monetary liquidity

## Indicators of monetary liquidity

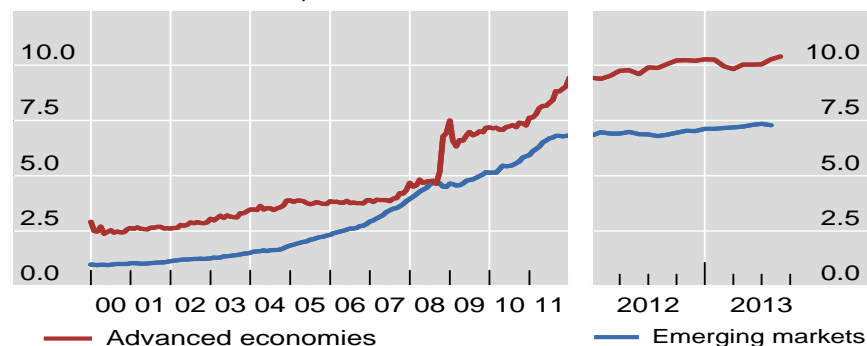
Global real short-term interest rates<sup>1</sup>



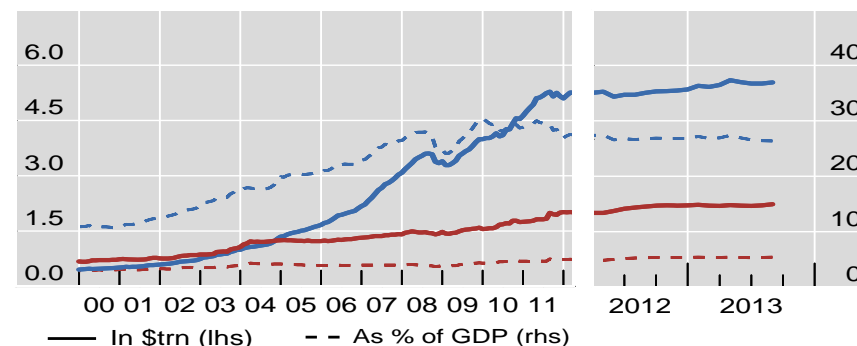
Ten-year nominal term premium<sup>2</sup>



Central bank assets, in USD trillions



Official FX reserves



<sup>1</sup> Based on the 12-months ahead average inflation expectations. <sup>2</sup> Ten-year nominal term premium (the sum of the real risk premium and the inflation risk premium) as derived from econometric term structure models.

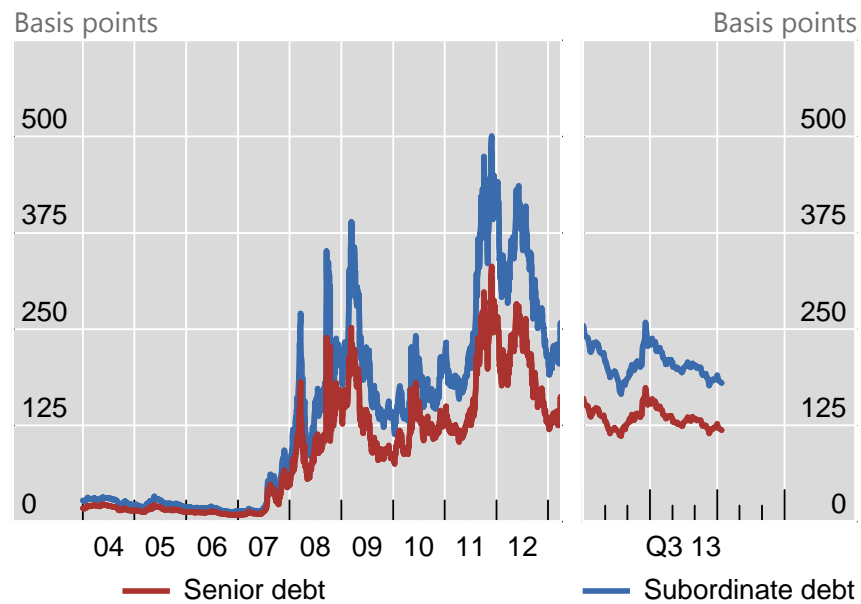
Sources: Bloomberg; Datastream; IMF, *International Financial Statistics*; OECD, *Main Economic Indicators*; Consensus Economics; Datastream; BIS calculations.



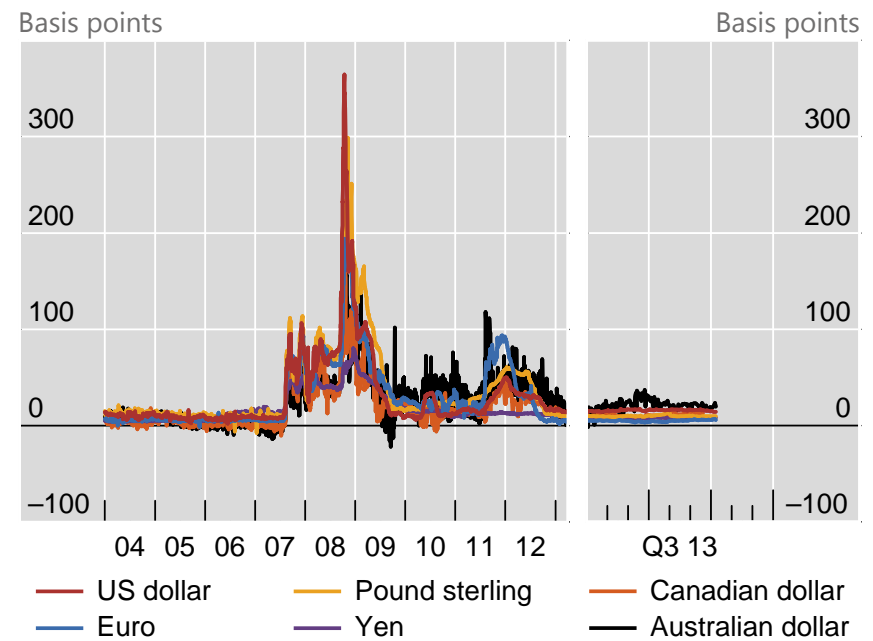
# Funding liquidity

## Bank CDS premia and short-term bank funding conditions

Bank CDS premia, five-year<sup>1</sup>



Three-month Libor-OIS spread



<sup>1</sup> 20+ major banks in the advanced economies.

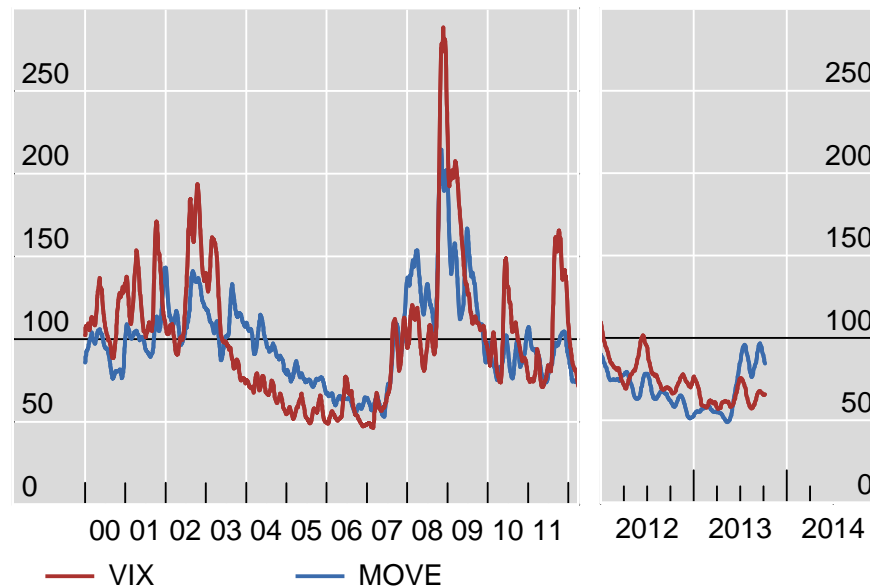
Sources: Bloomberg; Markit.



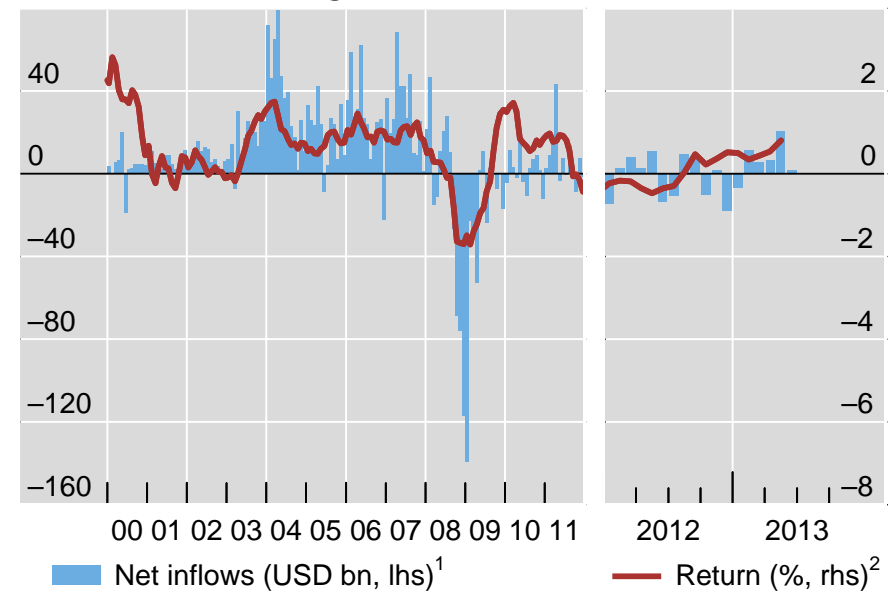
# Risk appetite

## Risk appetite and market positioning

VIX and MOVE indices, 1 Jan 1991 = 100



Net inflows into hedge funds



<sup>1</sup> Information based on active funds reporting to HFR database. Most recent data are subject to incomplete reporting. <sup>2</sup> HFRI Monthly Performance Indices calculated by Hedge Fund Research; 12-month moving average

Sources: Bloomberg; HFR; BIS calculations.

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## Summing up

- Global credit is a key indicator of global liquidity, in particular its international component
- Larger range of price- and quantity-based indicators need to be considered when assessing global liquidity conditions



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## Understanding global liquidity: What are the drivers?

- Considering the plethora of liquidity indicators is also helpful to understand the underlying drivers of global liquidity dynamics
- Price- and quantity-based indicators can together help to identify underlying supply and demand factors





## A factor approach to global liquidity analysis

- Global liquidity interpreted as common global factor(s) in credit market dynamics (similar to previous studies exploring the global business cycle and global inflation using factor analysis)
- Analysis proceeds in two steps
  - To which extent are dynamics in credit markets (and of other indicators of liquidity conditions) global in the sense of being shared by many countries?
  - What are the underlying (structural) driving forces of observable global liquidity conditions?
    - Relevant for tailoring appropriate policy responses

## Scope of the analysis

- Factors estimated from a large dataset comprising interest rates, stock market volatility, money and credit aggregates from 27 economies over 1995-2011.
- Illustration of internat. comovement of interest rates, money/credit growth
  - Adds to the literature on global economic comovements, which has so far focused on macro variables (Ciccarelli/Mojon 2010, Kose et al. 2003)
- Identification of a global monetary policy factor, a global credit supply factor and a global credit demand factor.
- Assessment of the temporal evolution of these structural factors, their importance at the global level and at the country/regional level

## Data (1)

- Country coverage: 27 advanced and emerging economies
- Sample period: 1995Q1-2011Q4
- Large liquidity dataset ( $X_t$ )
  - interest rates (overnight rate, 3-month money market, government bond yield, business and mortgage lending rates)
  - M0, M2
  - credit aggregates (domestic and cross-border bank credit)
  - stock market volatility
  - US financial data from Hatzius et al. to capture non-bank credit and liquidity conditions in the main global financial center

## Data (2)

- Large macro dataset ( $X_t^m$ ): GDP, consumption, investment, CPI, PPI, GDP deflator
- We use quarterly data to eliminate noise.
- Panel unbalanced → Expectations Maximisation (EM) algorithm
- Data are stationary, normalized and outlier adjusted.
  - interest rates and stock market volatility enter in levels,
  - all other variables in (yoy) log differences.



## International co-movements of liquidity indicators: Factor model

- Approximate dynamic factor model (Stock/Watson 2002, Bai/Ng 2002, Chamberlain/Rothschild 1983) applied to  $X_t$  /  $X^m_t$  / variable-specific datasets

$$\mathbf{x}_{i,t} = \boldsymbol{\lambda}_i' \mathbf{F}_t + \mathbf{e}_{i,t}, \quad i = 1, \dots, N$$

- Commonality given by

$$\text{var}(\boldsymbol{\lambda}_i' \mathbf{F}_t) / \text{var}(\mathbf{x}_{i,t})$$

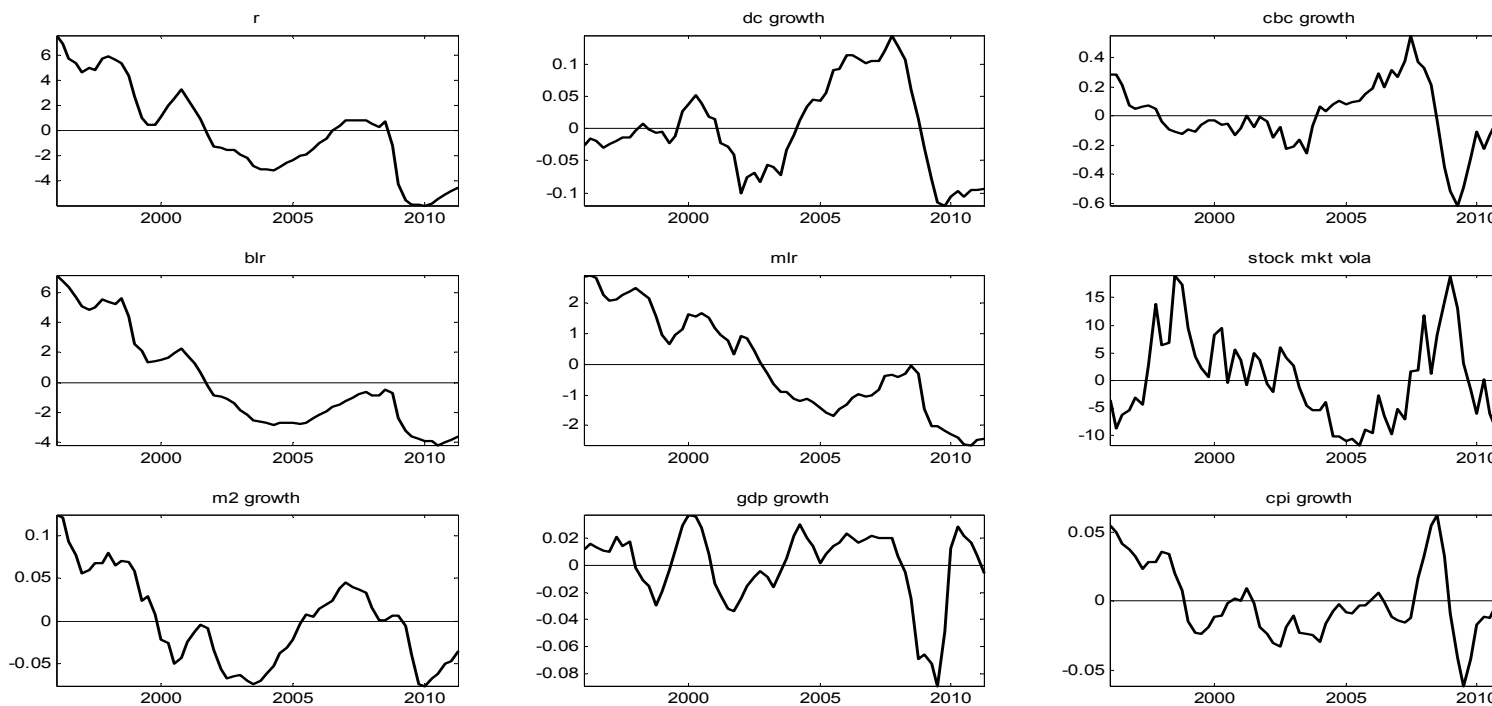
## International co-movements of liquidity indicators (1)

- Cumulated variance shares explained by the first 10 PCs of individual liquidity and macro data groups

# factors	r	dc growth	cbc growth	blr	mlr	stock mkt vola	m2 growth	gdp growth	cpi infl
1	58	26	23	66	61	52	25	39	27
2	69	51	34	75	74	63	42	57	50
3	79	64	44	82	81	70	53	66	61
4	84	72	52	88	86	75	62	72	69
5	88	77	59	91	90	79	70	77	75
6	90	81	66	93	94	82	76	81	79
7	93	86	71	95	96	85	80	84	83
8	95	88	76	96	97	87	84	87	86
9	96	90	80	97	98	89	87	89	89
10	97	92	83	98	98	91	89	90	91

## International co-movements of liquidity indicators (2)

- First principal component extracted from individual liquidity and macro data groups



## International co-movements of liquidity indicators (3)

- Cumulated variance shares explained by the first 10 PCs of large liquidity and macro data sets

# factors	All financial variables	All macro variables	All financial variables after purging of the macro factors
1	34	23	30
2	47	37	44
3	57	48	54
4	64	56	61
5	70	62	65
6	74	67	69
7	76	71	72
8	79	74	75
9	81	77	77
10	83	79	79



## What next?

- Common factors and loadings not identified separately because

$$\lambda_i^* ' F_t^* = \lambda_i^* ' R R^{-1} F_t^* = \overline{\lambda_i^*} ' \overline{F_t^*}$$

for any invertible matrix R

- Trying to interpret the factors extracted from the full dataset is hopeless
- But we can extract interpretable factors by rotating the factors so that they satisfy theoretically motivated sign restrictions
- Extends the literature on interpretable factors (e.g. Kose et al 2003, Lengwyl/Lenz 2010) by borrowing from SVAR literature



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## Conceptual framework I: A simple supply/demand framework of the loan market (1)

$$L^D = b_1 Y - b_2 i_L$$

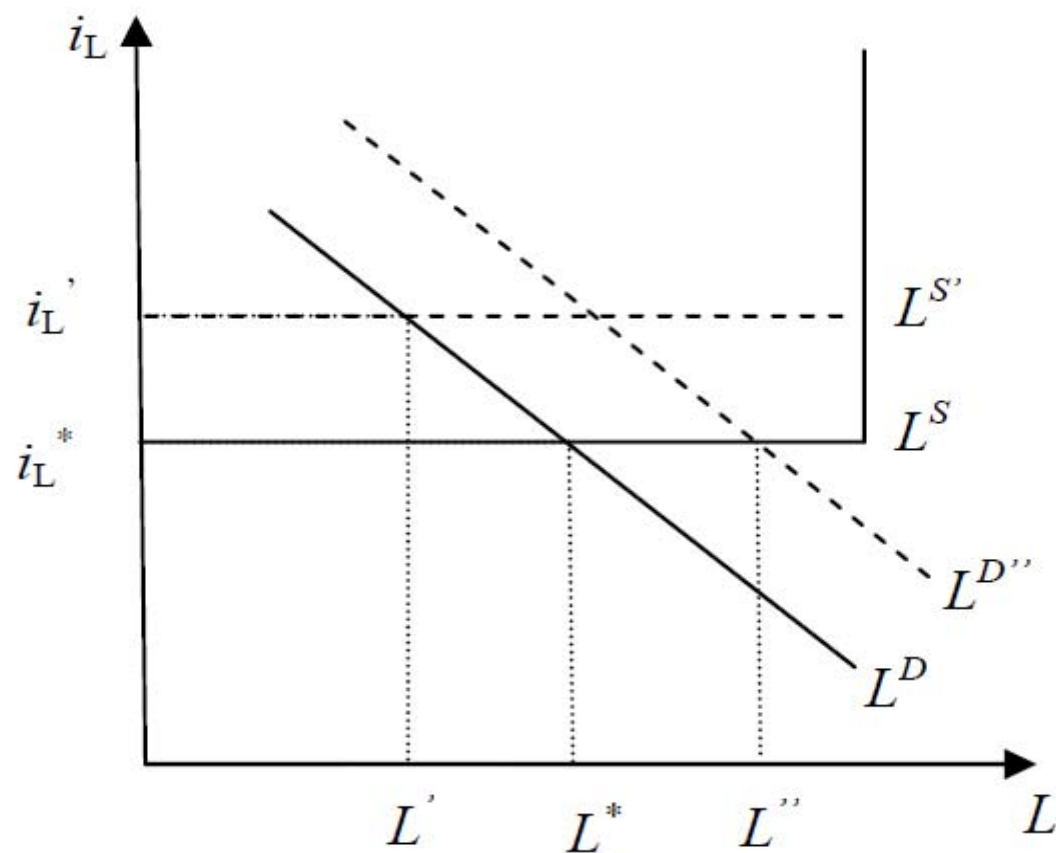
Loan demand

$$i_L = \mu + i_M$$

Loan supply



## Conceptual framework I: A simple supply/demand framework of the loan market (2)



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## Conceptual framework I: A simple supply/demand framework of the loan market (3)

- Increase in loan demand is associated with non-decreasing loan quantity and non-decreasing loan rate
- Increase in loan supply is associated with non-decreasing loan quantity and non-increasing loan rate



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## Conceptual framework II: Sticky loan rates

- Menu costs in loan rate adjustment and relationship banking lead to a delayed adjustment of loan rates to changes in policy rates
- An monetary policy loosening is associated with an increase in the spread of loan rates over policy rates
- Yields additional restriction to disentangle monetary policy from credit supply



## Sign restrictions

- **Sign restrictions** consistent with theory on loadings (on average over all countries) to identify global MP, credit supply and credit demand factors

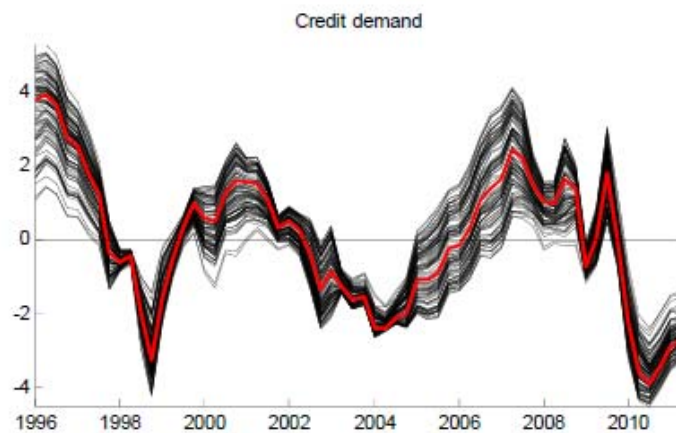
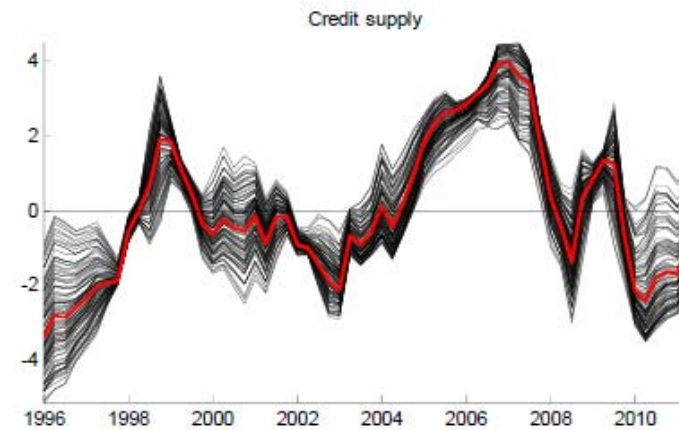
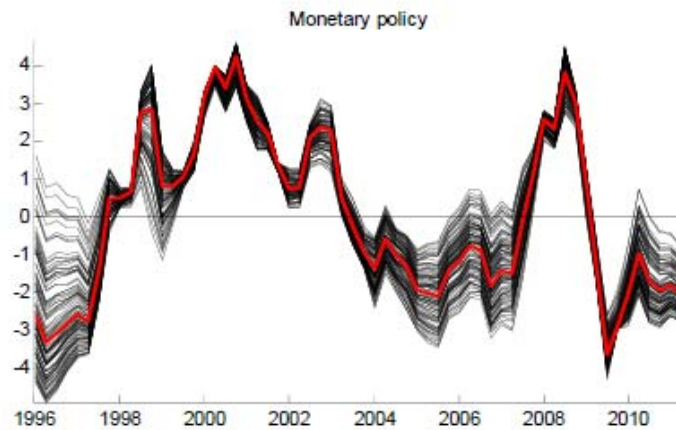
	Overnight rate	Business and mortgage lending rates	Business and mortgage lending rate spreads	Domestic and cross-border credit growth
Monetary policy factor	$\leq 0$	$\leq 0$	$\geq 0$	$\geq 0$
Credit supply factor		$\leq 0$	$\leq 0$	$\geq 0$
Credit demand factor		$\geq 0$		$\geq 0$

## Interpretable global liquidity factors: Implementation

- Purging out macro factors
  - Each liquidity variable  $x_{i,t}$  regressed on  $F_t^m$ , where  $F_t^m$  estimated as the first 3 PCs from macro dataset (other approaches to purging could be considered)
- Impose sign restrictions on factor loadings
  - Latent **liquidity factors purged of macro factors**  $F_t^*$  estimated as the first 3 PCs from the residuals
  - Draw rotation matrix  $R$  and check if corresponding factor loadings fulfill sign restrictions on average across countries (until we have 100 factors)

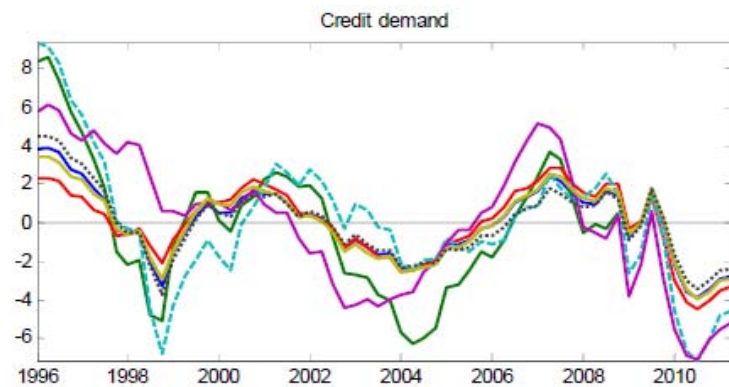
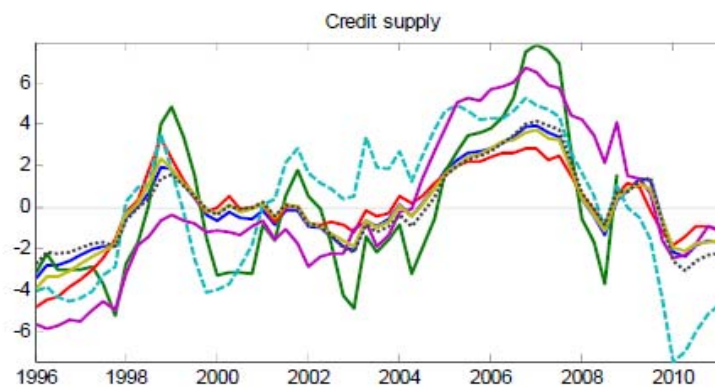
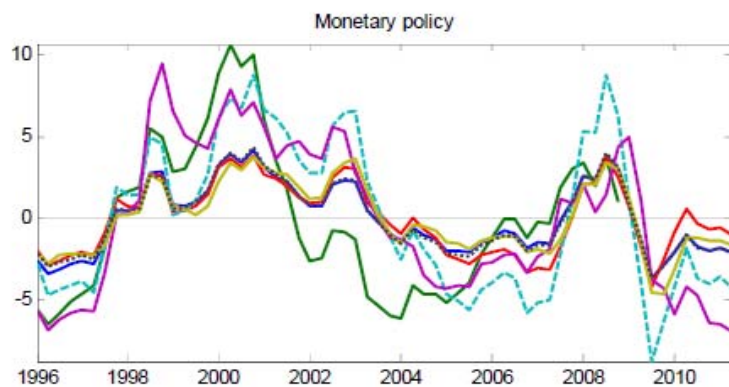


# Temporal evolution of identified global liquidity factors





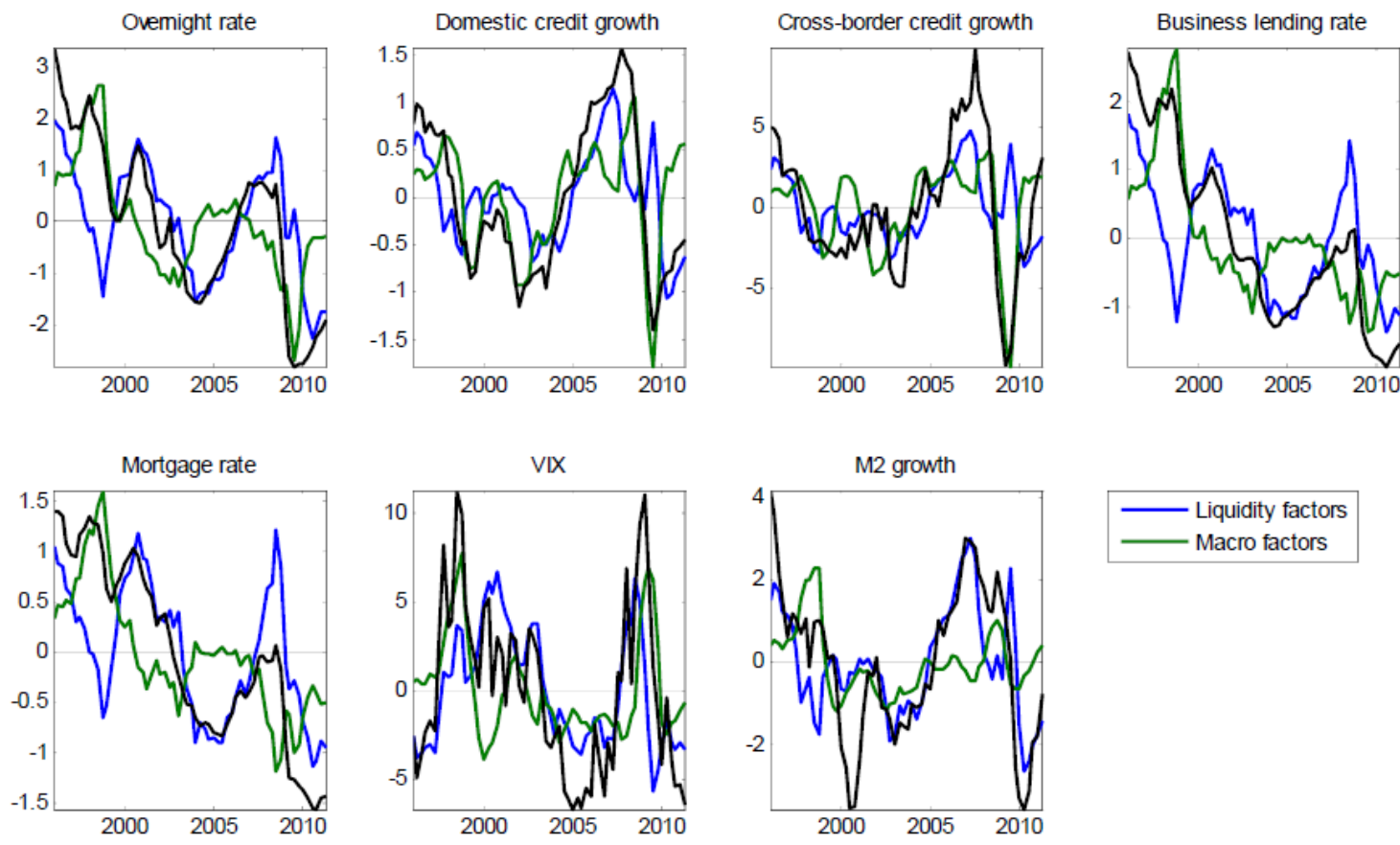
# Robustness checks



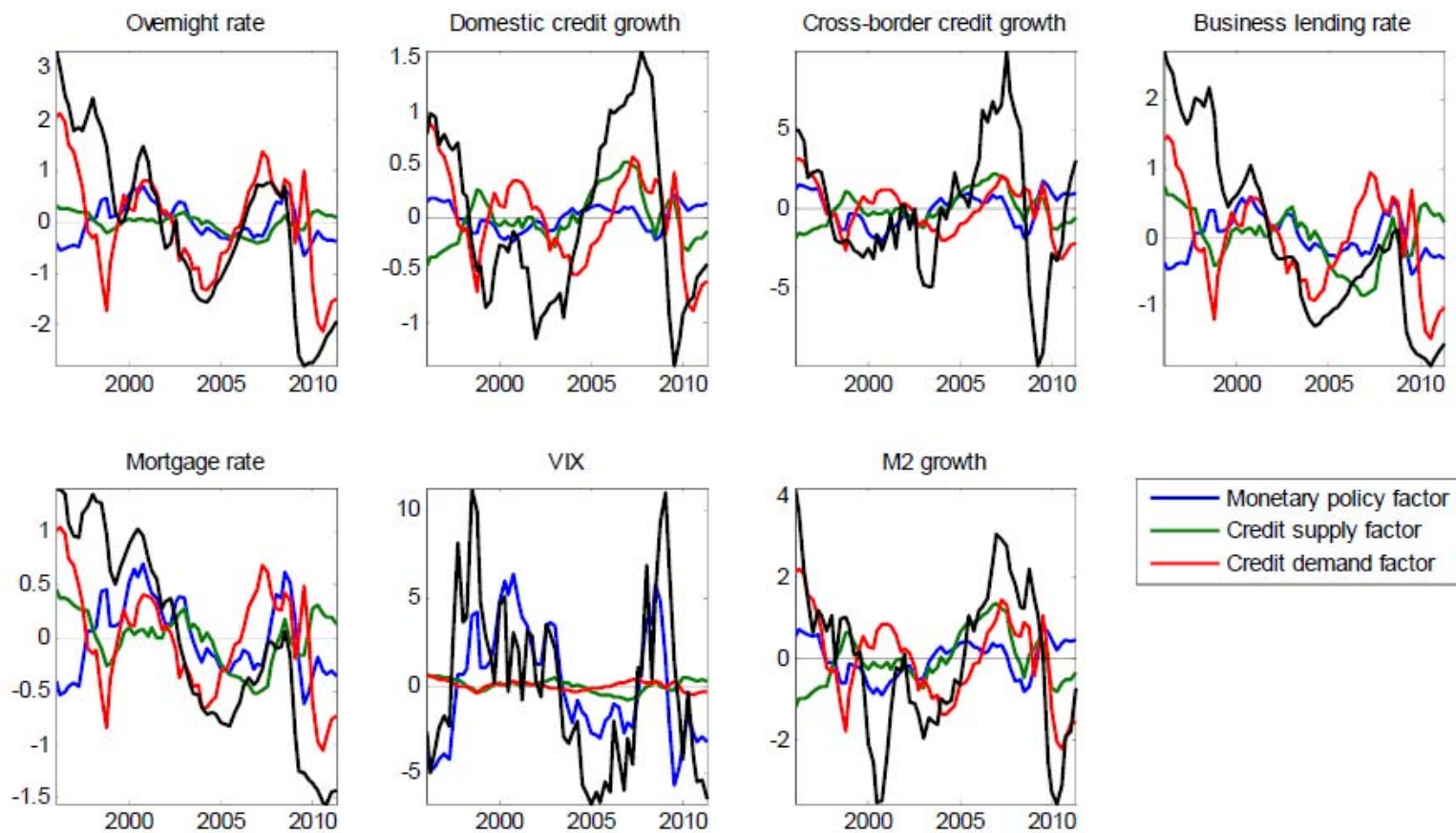
- baseline
- precrisis
- weighted av
- - - 4 liq factors
- purged of national macro influences
- including asset prices
- · · credit supply associated with restr. on the overnight rate



# Global variance decompositions I (baseline factors)



## Global variance decompositions II (baseline factors)



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## Conclusions

- High degree of international comovement in interest rates and credit growth across countries.
- Global MP, credit demand and credit supply factors identified using sign restrictions.
- Pre-crisis credit boom due to surge in credit supply and macro developments. Credit demand growth contributed at a later stage.
- At the end of the sample, weak credit demand and supply and loose monetary policy.

